



Motorcycle Art

F4



MV AGUSTA F4 750 ORO - S - S 1+1 - SPR- SENNA - BRUTALE ORO - S

Workshop engine manual

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Workshop engine manual

MV AGUSTA F4 750 ORO - S - S 1+1 - SPR - SENNA - BRUTALE ORO - S



F4





Statement

This manual, to be used by the MV Agusta authorised workshops has been realised with the purpose of assisting authorised personnel in maintenance and repairs operations of the motorcycle. The knowledge of technical data herein noted, determines the complete professional training of the technician.

With purpose of making the reading of this manual immediately comprehensible, the paragraphs have been aligned with detailed illustrations that highlight the argument dealt with.

Useful advice

To prevent any problems and to reach an excellent final result, MV Agusta recommends keeping to the following guidelines:

- In the case of an eventual repair, evaluate the client's impressions who states that there is an abnormal functioning of the motorcycle and to formulate the right questions to clarify the symptoms of the problem.
- Clearly diagnose the cause of the abnormality. The basic fundamental theories can be absorbed by reading this manual that must necessarily be integrated to the personal experience and the participation of training courses that are periodically organised by MV Agusta.
- Rationally plan the repair to avoid slack periods, e.g. the collection of spare parts, the preparation of tools and equipment, etc.
- To reach the part to be repaired limiting the work to the essential operations.
With regards to this, a valid help would be to consult this manual with regards to the sequences of removal demonstrated in this manual.

Informative note

MV Agusta S.p.A. is committed to a policy of continuous improvement of their products. For this reason, there could be slight differences between that which is written here and the motorcycle on which repairs and/or maintenance are about to be carried out. MV Agusta models are exported to many countries where different norms in relation to the highway code and homologation procedures are valid. Hoping that you will comprehend these problems, MV Agusta S.p.A. reserves the right to make modifications to its products and technical documentation at any moment and without prior announcement.



Respect and defend the environment

Everything that we do has repercussions on the entire planet and its resources.

MV Agusta, wanting to protect the interest of the people, would like to make the client and the technicians of the technical assistance centres aware and to adopt modalities of use of the motorcycle and the disposal of its parts in full respect of the norms in force in terms of environmental pollution, disposal and the recycling of waste.



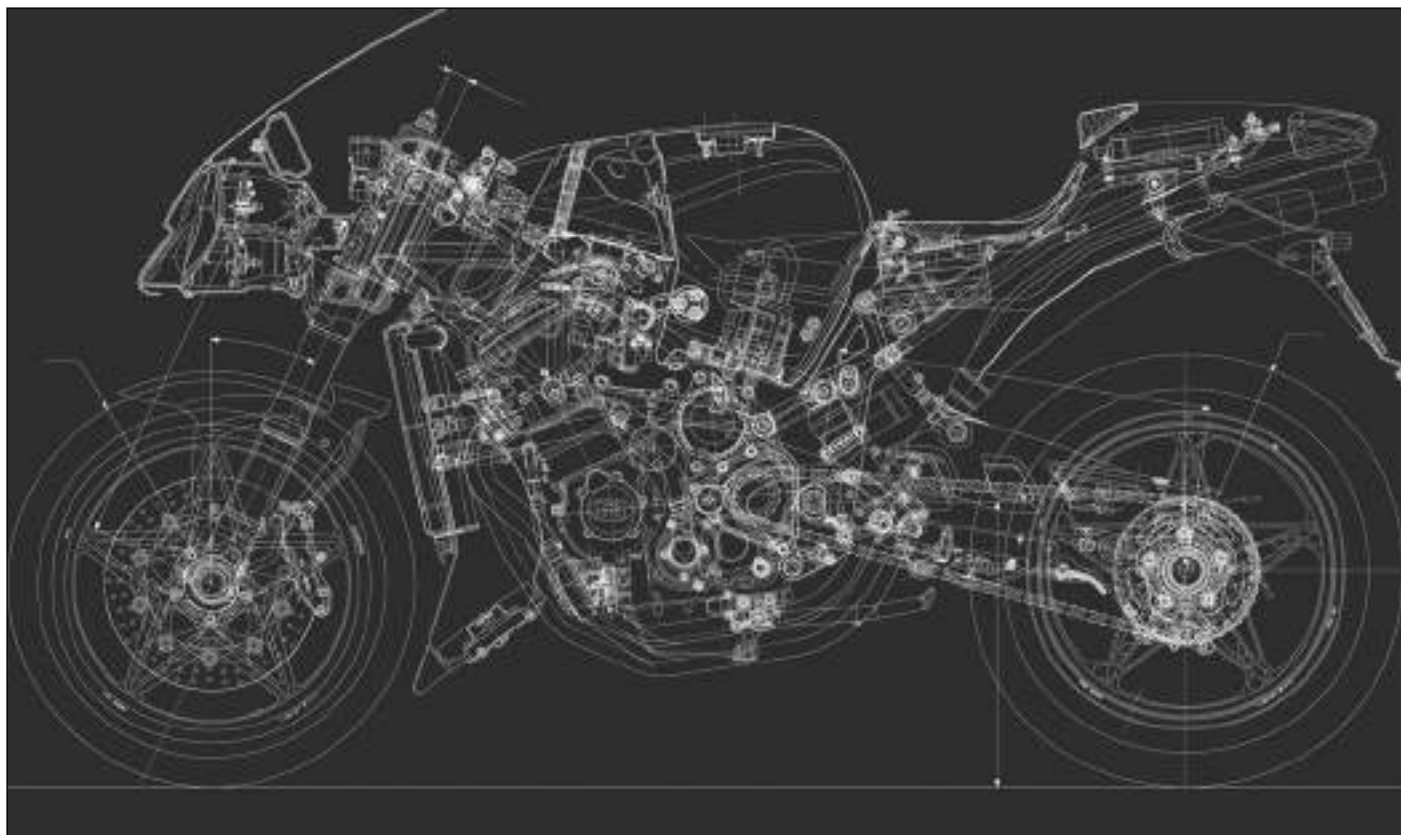
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General description

A



SECTION A
Revision 1



SUMMARY

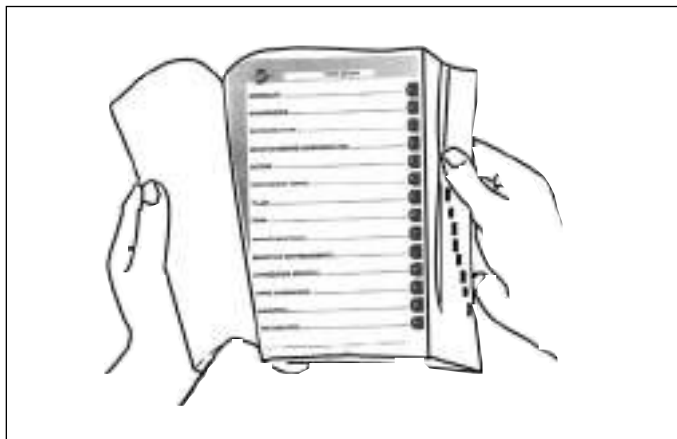
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HOW TO CONSULT THIS MANUAL

Order of the subjects

This manual is divided into chapters that deal with the sub-groups of the motorcycle.

To quickly find the chapter required, the pages of each chapter are marked with a reference mark aligned to the relative item in the general index.



Display of the operations

The operations of disassembly, assembly, removal and control are presented with the help of illustrations (designs and photographs).

The illustrations contain symbols that indicate the procedure, special tools and other information. See the symbols lists for their significance.

The procedures are described step after step.

EXAMPLE

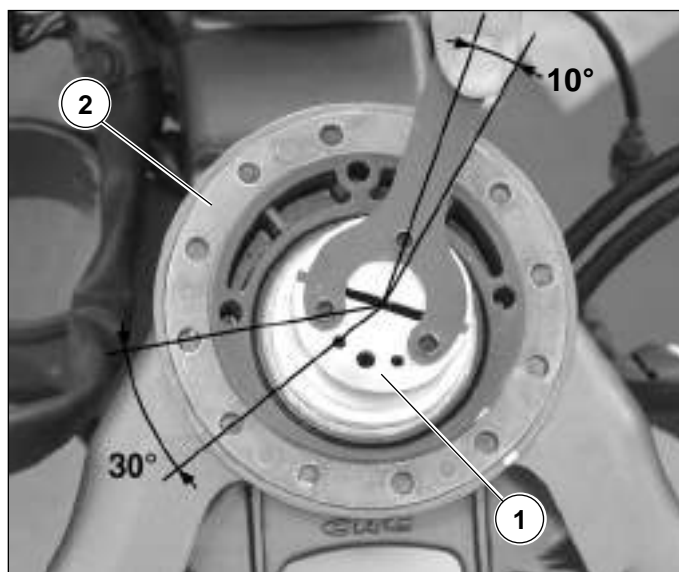
Steering pin tightening

Screw in the steering pin flange ring, without tightening.

This operation must be done manually.

Check that the steering base is at the end of its travel, to the right.

Using the special tool **N. 800091645**, tighten the ring (1) by rotating it 10° calculated approximately as one third of the movement between the two holes of the ring (2) of the steering head (see the figure).



PURPOSE OF THE MANUAL

Principally, this manual has been written for MV Agusta dealers and qualified mechanics.

It is not possible to document all the knowledge necessary for a mechanic in a manual. Those who utilise it must have a basic knowledge of mechanical concepts and the inherent procedures in the techniques of repairing motorcycles. Without this knowledge, The maintenance and repair operations can render the motorcycle unsafe for use.

Updates

MV Agusta S.p.A. is committed to a policy of continuous updating of the models produced. The modifications and significant changes to the specifications and the procedures will be communicated to the official dealers and will appear in future editions of this manual.

All information, instructions and technical data included in this manual are based upon information on the product updated at the moment of going to print. MV Agusta S.p.A. reserves the right to carry out changes at any moment without prior notice and without incurring any obligation.



General description

A GLOSSARY AND SYMBOLS



During this kind of procedure inflammable vapours might develop and metallic parts might be expelled at high velocity. Thus, it is necessary to:

- work far from exposed flames and sparks;
- wear protective clothing;
- wear protective eye-glasses.



All of the countersigns indicting right, left, superior, inferior, front and back, refer to the motor-bike in the normal direction of march.



In case it should be necessary, due to wear, to substitute a particular, relative to a cylinder, we strongly suggest that you check and if necessary, substitute the same particular in all of the cylinders for more satisfying results.

In particular, we recommend that at the same time you substitute:

- pistons with relative elastic bands and piston pins;
- valves with relative springs, semi-cones, disks and grazings;
- Valve guides with relative valves, springs, semi-cones and grazings;
- bed bearing;
- whatever else undergoes uniform wear, aside from the position of the relative cylinder.



This symbol indicates the "procedure to be carried out with the motor removed from the motor-bike".



This symbol indicates "the procedures to be carried out with an empty cooling circuit".



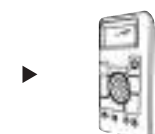
Utilise a specific tool or equipment for the correct carrying out of the operation described.



Tighten to the specified torque.



Tolerance or limit of use.



Utilise the tester.



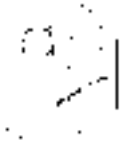











In order to allow the motor to function under the best conditions, it is necessary that all of the couplings are within the accepted tolerances established. A tight coupling, is in fact, cause for seizure as soon as the organs in motion begin to heat, while a loose coupling is cause for vibrations which accelerates wear on the particulars in motion.



General description

A

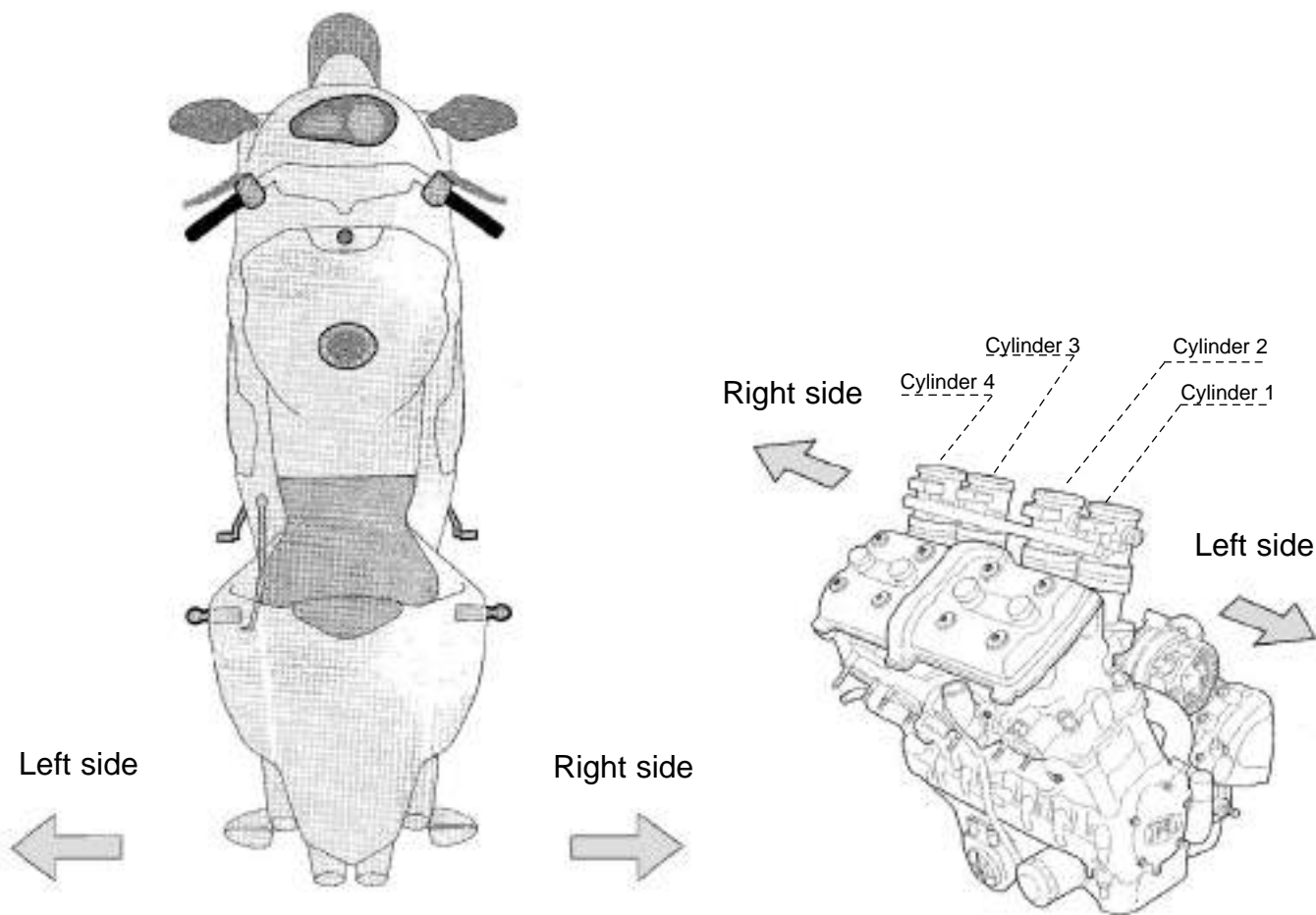
- ▶  Use the recommended oil.
- ▶  Use the recommended grease.
- ▶  Use the recommended brake fluid.
- ▶  Use the recommended suspension fluid.
- ▶  Use the recommended coolant.
- ▶  Use the recommended thread-locking fluid.
- ▶  Use the recommended sealant.
- ▶  Use the recommended adhesive.
- ▶  Carry out accurate cleaning.
- ▶  Use new components.
- ▶  Substitute the component.
- ▶  Do not leave litter about.
- ▶ ★ The information marked with this symbol refer to the F4 model series ORO.



General description

A **RIGHT HAND AND LEFT HAND STANDARD (F4)**

To clarify the right hand and left hand standard that is used in this manual, herewith below is a diagram of the motorcycle and the engine against which are indicated the right and left sides.



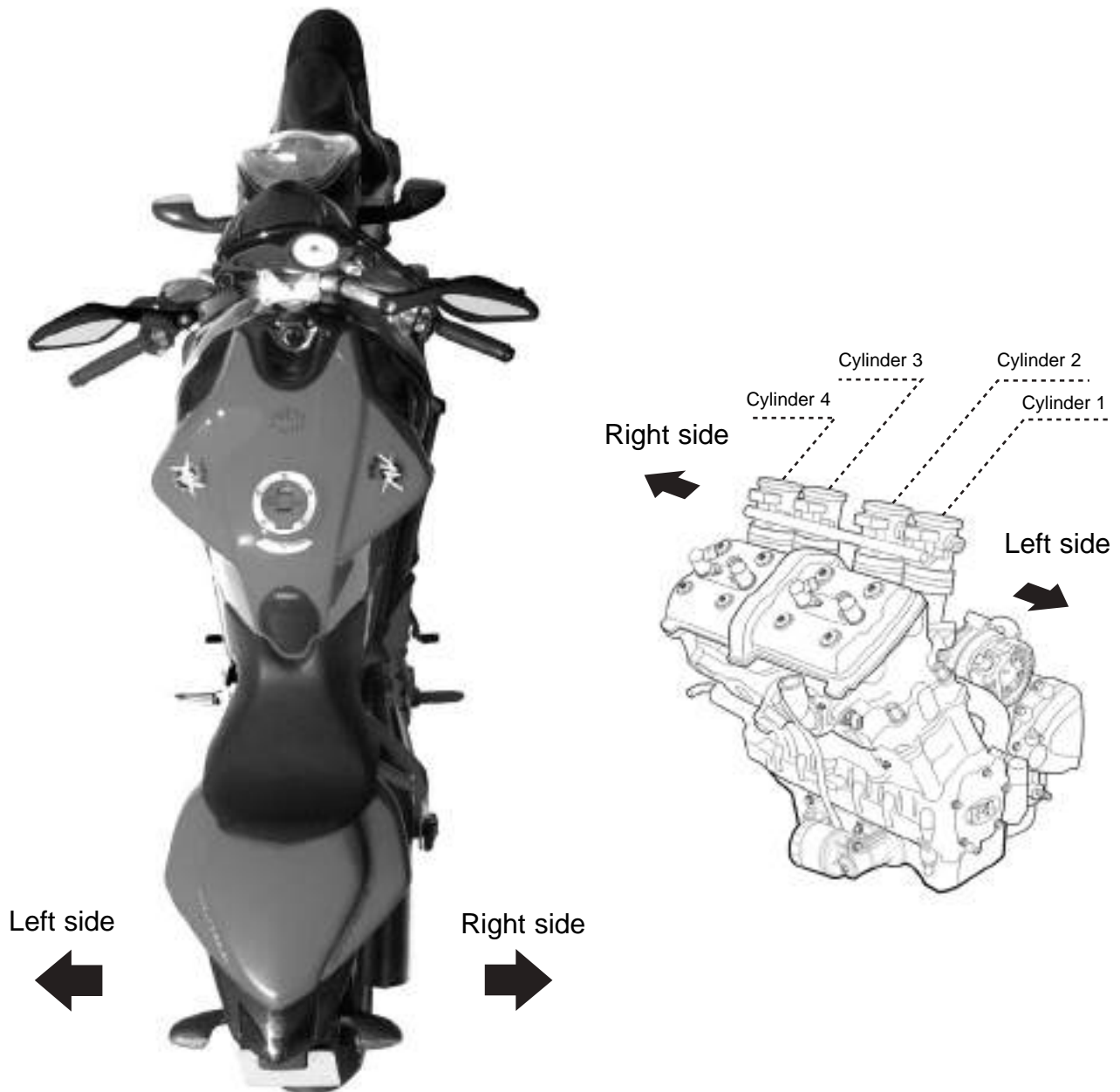


General description

RIGHT HAND AND LEFT HAND STANDARD (F4 BRUTALE)

To clarify the right hand and left hand standard that is used in this manual, herewith below is a diagram of the motorcycle and the engine against which are indicated the right and left sides.

A





General description

A SAFETY



ATTENTION

The information contained in this paragraph is fundamental so that the operations carried out on the motorcycle can be conducted with minimum risk to the mechanic.

Carbon Monoxide

- Exhaust gases contain carbon monoxide (CO) that is poisonous. Carbon monoxide can cause the loss of consciousness and death.
- If it is necessary to switch on the engine, check that the environment is well ventilated. Never switch on the engine in an enclosed environment.
- Switching on the engine can only be carried out in an enclosed environment when there are the appropriate devices for the evacuation of exhaust gases.

Petrol

- Petrol is extremely inflammable and under certain conditions can be explosive.
- Keep sources of heat, sparks and flames away from the work area.
- Always work in a well-ventilated area.
- Never use petrol as a cleaning solvent. Generally, avoid handling it unless it is absolutely necessary.
- Do not use petrol for cleaning components by using compressed air.
- Keep petrol out of reach of children.

Engine oil

- Engine oil can cause skin illnesses if in constant and long contact with the skin.
- If the skin comes into contact with engine oil, wash the parts affected as soon as possible with soap and water.
- If engine oil comes into contact with the eyes, abundantly rinse with water and consult a doctor immediately.
- If engine oil is swallowed, do not provoke vomiting to avoid the aspiration of the product into the lungs. Transport the injured person immediately to hospital.
- Used oil contains dangerous substances and poisonous for the environment. To substitute oil, it is recommended to go to an authorised MV Agusta dealer who is equipped to deal with the collection of used oil in respect of the norms in force.
- Do not dispose of used oil in the environment.
- Keep used oil out of the reach of children.

Engine coolant

- Under certain situations, the ethylene glycol contained in the engine coolant is inflammable and its flame is invisible. Ethylene glycol would cause serious burns if ignited because it is invisible.
- Avoid bringing the engine coolant into contact with hot parts. Such parts could be sufficiently hot to ignite the coolant.
- The engine coolant (ethylene glycol) can cause irritation of the skin and is poisonous if swallowed.
- If the engine coolant comes into contact with the skin, immediately remove any contaminated clothing and wash with soap and water. If it comes into contact with the eyes, abundantly rinse with clean water and immediately consult a doctor. If swallowed, do not provoke vomiting to avoid the aspiration of the product into the lungs. Administer clean water and transport the injured person immediately to hospital and show the product to the doctor.
- If exposed to high concentrations of vapour, transport the injured person to a non-poisonous atmosphere and if necessary call a doctor.
- Do not remove the radiator cap when the engine is still hot. Being under pressure, the engine coolant can be violently ejected and therefore provoke burns.
- The engine coolant contains dangerous and poisonous substances and is therefore dangerous for the environment. To substitute used engine coolant, it is advisable to go to the authorised MV Agusta dealer who is equipped to deal with the collection of used engine coolant in respect of the norms in force.
- Do not dispose of engine coolant in the environment.
- Keep engine coolant out of reach of children.



General description

A

Brake fluid

- Brake fluid is extremely corrosive.
- Avoid any contacts with the eyes, skin and the mucous membrane.
- If brake liquid comes into contact with the skin, remove all contaminated clothing and wash immediately with soap and water.
- If brake fluid comes into contact with the eyes, abundantly rinse with water and call a doctor.
- If swallowed, do not provoke vomiting to avoid aspiration of the product into the lungs. Immediately call a doctor.
- Take the injured person immediately to hospital, if he has breathed brake fluid into the lungs.
- In the case of exposure to high concentrations of vapour, move the injured person to a non-poisonous atmosphere and if necessary call a doctor.
- In the case of accidental contact, rinse abundantly with water and call a doctor.
- Keep brake fluid out of reach of children.

Thread-locking fluid

- As it is not classified as dangerous, the prolonged contact with the skin, particularly with regards to abrasions can provoke sensitiveness and dermatitis. In the case of contact with the skin, rinse abundantly with running water.
- Move the injured person into the open air and call a doctor if the injured person feels ill after having breathed in the product.
- In the case of contact with the eyes, rinse abundantly with water for at least 15 minutes.
- If the thread-locking fluid has been swallowed, drink an abundant quantity of water or milk. Do not provoke vomiting to avoid the aspiration of the product into the lungs. Immediately call a doctor.
- Keep out of reach of children.

Nitrogen - rear shock absorber

- The rear shock absorber contains nitrogen under pressure.
- Before disposing of used shock absorbers, discharge the nitrogen via the depressurising valve.
- Utilise only nitrogen to pressurise the shock absorber. The use of unstable gases can cause explosions that could cause burns.
- Do not place the shock absorber near to flames or sources of heat as this could cause explosions with consequent burns.
- Keep out of reach of children.

Battery

- The battery produces explosive gases. Keep it away from sparks, flames or cigarettes. During recharging, adequately ventilate the environment.
- The battery contains a solution of sulphuric acid (electrolyte).
- Sulphuric acid is corrosive and it destroys many materials and clothing. On contact with small quantities of water it generates a violent reaction that manifests itself by creating large quantity of heat and spurts of hot acid. Sulphuric acid attacks many metals thereby liberating hydrogen: an inflammable gas that forms an explosive mixture when mixed with air.
- Contact with sulphuric acid can cause burns. In the case of contact, remove immediately all contaminated clothing and wash the skin with abundant quantities of water. Take the injured person to hospital if necessary.
- In the case of contact with the eyes, rinse immediately with abundant water. Call a doctor and continue with the treatment until the doctor arrives.
- If the electrolyte is swallowed, rinse the mouth with water without swallowing. Take the injured person immediately to hospital and explain to the doctor there what the injured person has swallowed.
- The battery contains dangerous substances that are poisonous for the environment. It is advisable to substitute it at an MV Agusta dealer that is equipped to dispose of this product in respect of the norms in force.
- Do not dispose of used batteries in the environment.
- Keep out of reach of children.

Hot parts

- The engine and the exhaust system become very hot and maintain this temperature for some time after the engine has been switched off. Wait for these parts to cool down before handling them or working on the motorcycle near to them. Use protective gloves.



General description

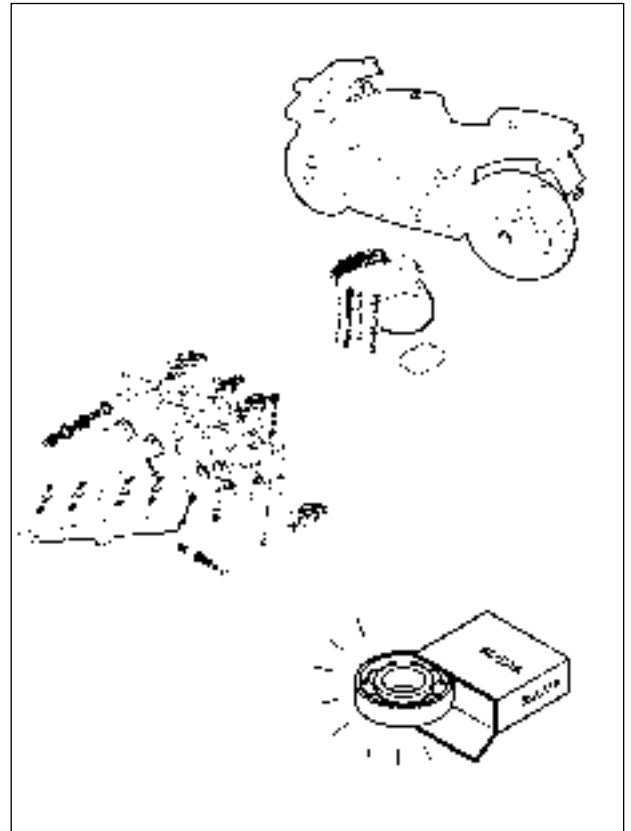
A WARNING



WARNING

The information contained in this paragraph is important so that the operations carried out on the motorcycle can be conducted without damaging the motorcycle.

- Thoroughly clean the motorcycle before disassembling it.
- During disassembly, clean all parts and place them in containers respecting exactly the order of disassembly.
- Always use the special utensils where necessary and each time where prescribed.
- Always use adhesives, sealants and lubricants where prescribed. Respect the instructions about their technical characteristics.
- Always substitute parts such as gaskets, O-rings, security washers with new parts.
- Slackening or tightening nuts or screws, always start with those of a greater dimension or from the centre. Always respect the torque values indicated.
- Utilise only MV Agusta spare parts.



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General description

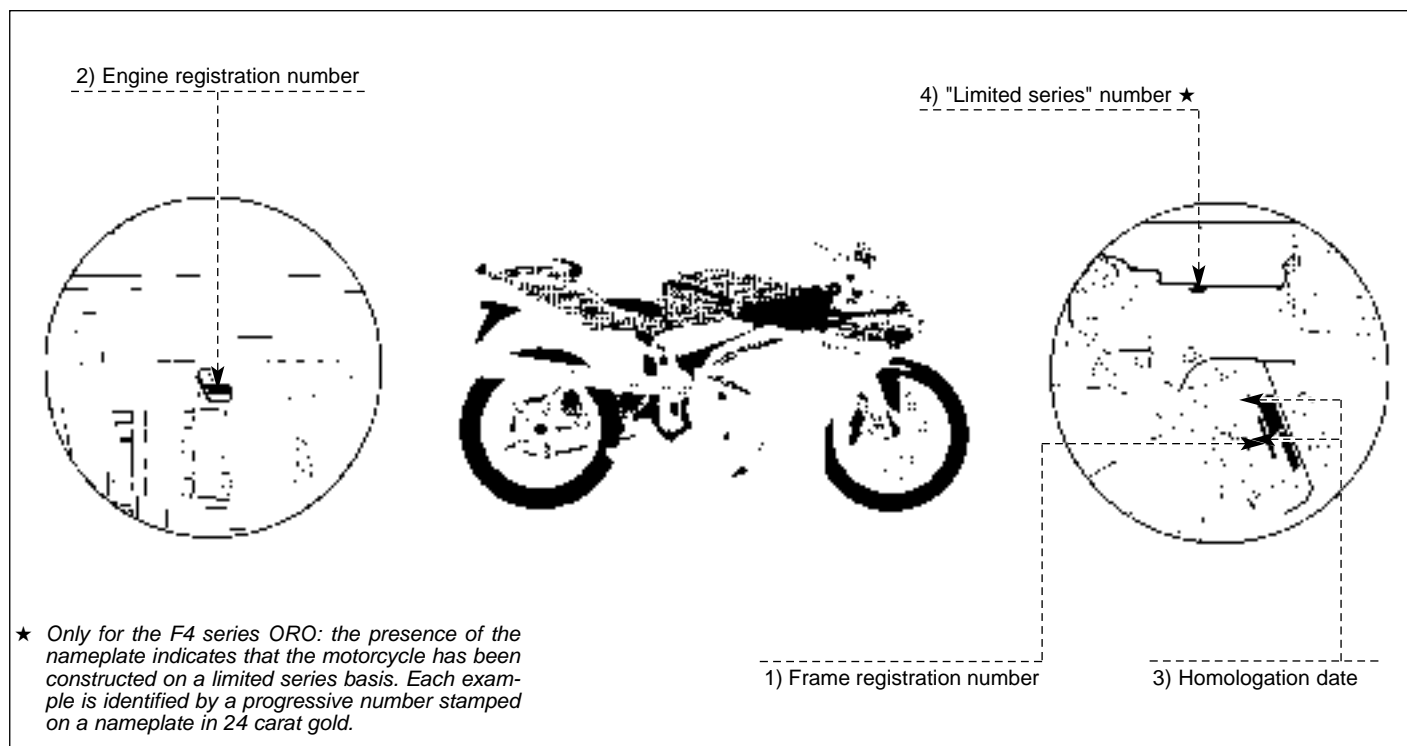
A

OPERATIVE TECHNICAL SPECIFICATIONS (F4)

MOTORCYCLE IDENTIFICATION

The registration number of the motorcycle is stamped on the right side of the steering head.

The engine registration number is stamped on the upper engine casing, near to the cylinders for the F4 series ORO and near the forks for all other versions of the F4.



Below is an example of the designation of the frame registration number:

ZCG F4 01 AA Y V 000000

Manufacturer identification —

Vehicle model —

Progressive frame number —



General description

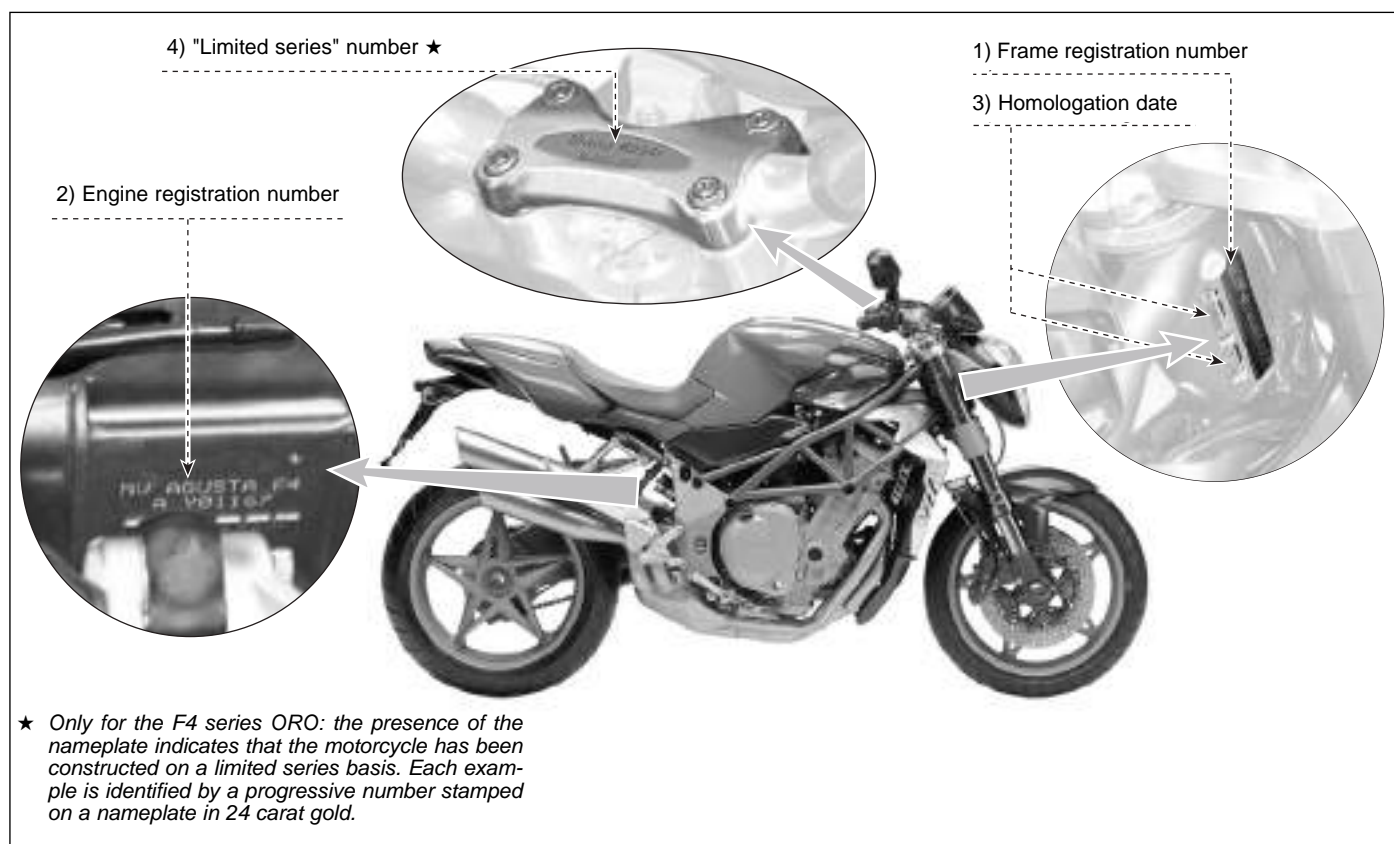
A OPERATIVE TECHNICAL SPECIFICATIONS (F4 BRUTALE)

IDENTIFICAZIONE MOTOCICLO

- 1) Frame registration number
- 2) Engine registration number
- 3) Homologation date
- 4) "Limited series" number ★

The frame serial number is stamped on the right side of the steering head.

The engine serial number is stamped on the upper half casing near the front fork,



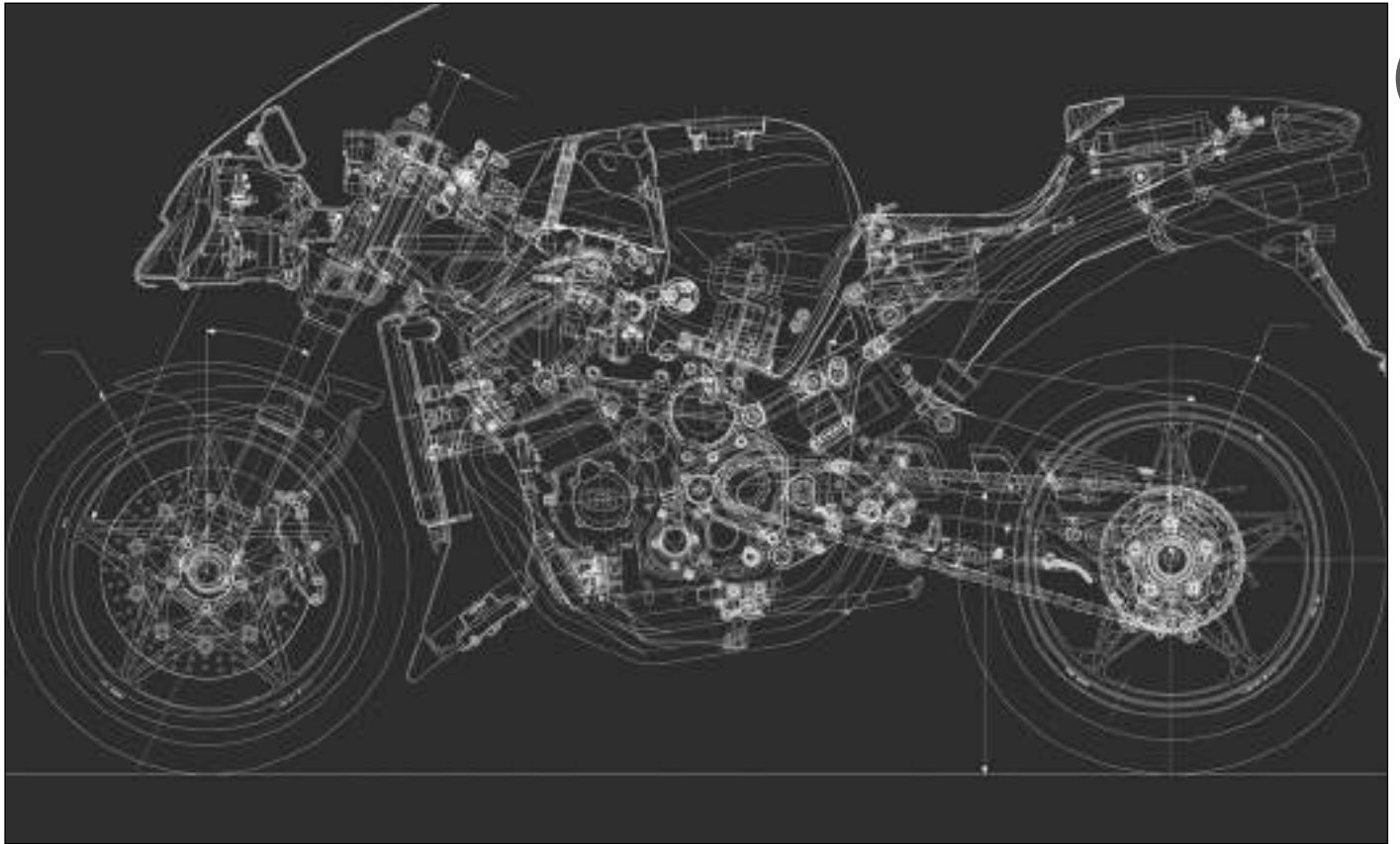
Below is an example of the designation of the frame registration number:

ZCG F4 01 AA Y V 000000

Manufacturer identification ————
Vehicle model ————
Progressive frame number ————



Engine F4 ORO



B

SECTION B

Revision 1



Engine F4 ORO

SUMMARY

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Engine F4 ORO

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	100	9.5	Strong
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	100	9.5	Strong
Gear selection drum tightening screws	12	1.2	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	



Engine F4 ORO

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws	25	2.5	
Bearing exchange screws	10	1	
Aluminium exchanger screws	14	1.4	
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate thread with Molikote HSC Plus



Engine F4 ORO

MAINTENANCE TABLE

Slip	Frequency	km	Pre-delivery	A	6000	B	12000	18000	C	24000	30000
Procedure			0	1000	6000	12000	18000	24000	30000		
Cooling liquid level	C		•	•	•	•	•	•	•	•	•
Cooling liquid substitution	S			Substitute every 2 years					•		
Motor oil level	C		•	Check every 1000 km							
Motor oil	S	6000 km or 12 months		•	•	•	•	•	•	•	•
Motor oil filter	S			•	•	•	•	•	•	•	•
Valve play	C			•	Check every 12000 km						
Distribution chain	S										•
Mobile distribution block	C/S					•			•		
Chain tightening block	C/S					•			•		
Spark plugs				Substitute every 12000 km							
	S					•					
Minimum synchronizing regime	C			•	•		•				•
Fluttering body: synchronization, minimum, CO control	C/P			•	•		•				•

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions



Engine F4 ORO

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter		
Exhaust.....	$24.6^{+0.3}_0$ mm	
Inlet.....	$28.6^{+0.3}_0$ mm	
Sealing face thickness.....	$1^0_{-0.3}$ mm	
Stem-guide clearance		
Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	$4.5^{+0}_{+0.012}$ mm.....	4.55 mm
Valve stem		
Exhaust.....	4.475 ± 0.005 mm.....	4.455 mm
Inlet.....	4.485 ± 0.005 mm.....	4.465 mm
Valve spring		
Internal.....	30.5 mm.....	30 mm
External.....	32.6 mm.....	32.1 mm
Valve-cam clearance		
Exhaust.....	0.20 ÷ 0.29	
Inlet.....	0.15 ÷ 0.24	



Engine F4 ORO

ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.025 ÷ 0.045 mm	0.10 mm
Piston-pin play.....	0.004 ÷ 0.012 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	0.8 ^{-0.01} _{-0.03} mm.....	0.75 mm
2 nd	1 ^{-0.01} _{-0.025} mm.....	0.96 mm
Oil scraper.....	2 ⁰ _{-0.1} mm.....	1.88 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	38.8 mm

B



Engine F4 ORO

ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Cleaning the parts

All of the parts must be cleaned with special biodegradable solvents and dried with compressed air. Proceed with the cleaning process of all the parts before disassembling them as well as after the particular parts have been disassembled. Clean each part even before reassembling.

Connections

In order to allow the motor to function in the best conditions it is absolutely necessary that all of the connections meet the standards established by the manufacturer. A connection with reduced standards could cause seizing, while a connection with excessive toleration causes vibrations which accelerate the wear of the components.

General norms for assembling the parts

For reassembling invert the disassembling procedure, paying careful attention to the specified procedures. Gaskets, oil spill protector, metallic locks. Tightening rings in deformable material and self blocking nuts must always be substituted.

The bearings are dimensioned for a determined number of working hours. Substitution is therefore recommended in consideration of the difficulty in checking wear. The above mentioned is in addition suggested for dimensional controls of the single components mentioned in the relative paragraphs.

It is absolutely necessary to carefully clean all of the components; the bearings and all of the other parts subject to wear must be lubricated with motor oil before reassembling. Nuts and screws must be locked to the pre established torques.

Following are the descriptions of the disassembling, revision and reassembling procedures of the various parts and sub parts constituting the motor, in the finalized sequence of a completely disassembled motor.

Disassemble the motor from its frame as described in the relative paragraph;

Drain the oil from the oil cup;

Remove the spark plugs covering the openings with clean rags to avoid small objects (rings, etc.) from falling into the motor.



Engine F4 ORO

Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

A) Heat the motor to the usual functioning temperature (of regime);

B) Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;

C) Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

Cylinder compression control (280 rpm-min)		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

A) carbon deposits on the walls of the combustion chamber and on the piston ceiling;

B) If the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

A) The seat of one or more valves is damaged and the valves do not maintain the compression pressure;

B) One or more valves have null functioning play;

C) The piston, cylinder play is excessive;

D) The cylinder head is twisted and/or the head gasket is damaged;

E) Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.



Engine F4 ORO

CO REGULATION

Attention: CO regulation is of vital importance for the correct functioning of the motor.

Prior to carrying out the CO regulation accurately check:

- That there are no cracks or damage of the rubber tubes of the vacuum meter line
- That gas does not seep out of the exhaust pipe joints
- That the gas tube links are correctly inserted in the tank lodgings and that the tubes are neither bent nor crashed

A) Verify and if necessary regulate the butterfly valve opening to minimum using Magneti Marelli MDST software. The butterfly valve angle must be of 1.5 degrees. Fluctuation between 1.5 and 1.7 are allowed; fluctuation between 1.3 and 1.5 are not allowed.

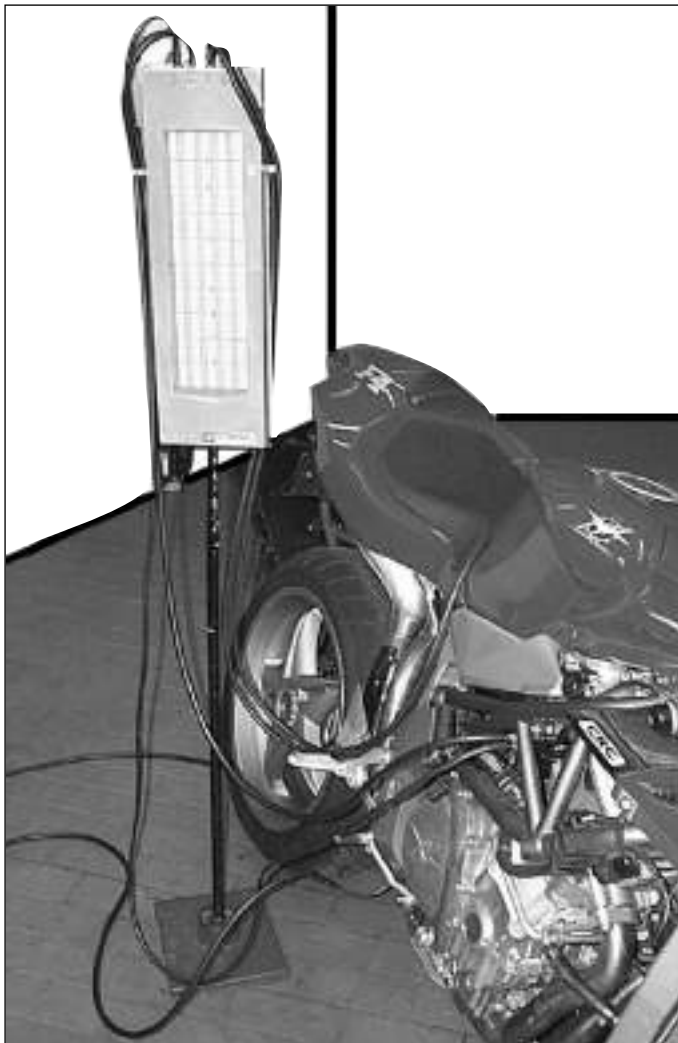
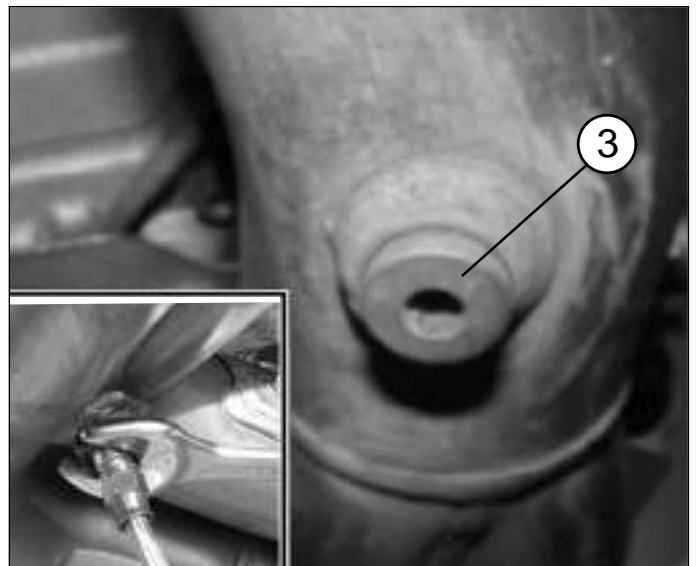
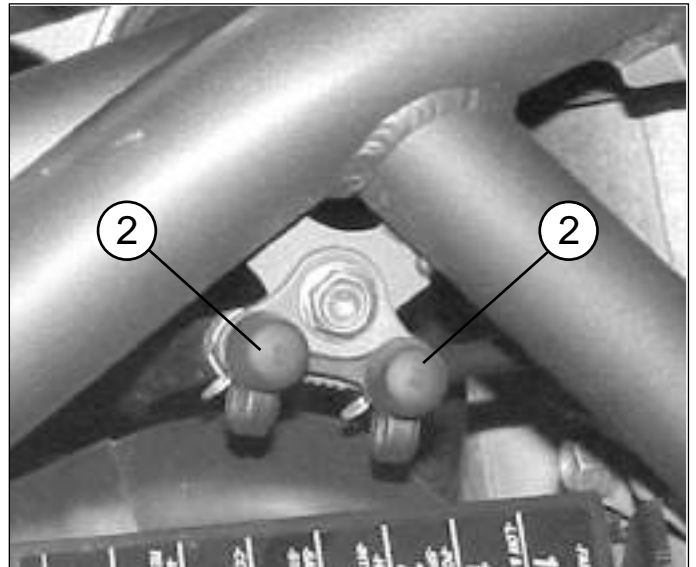
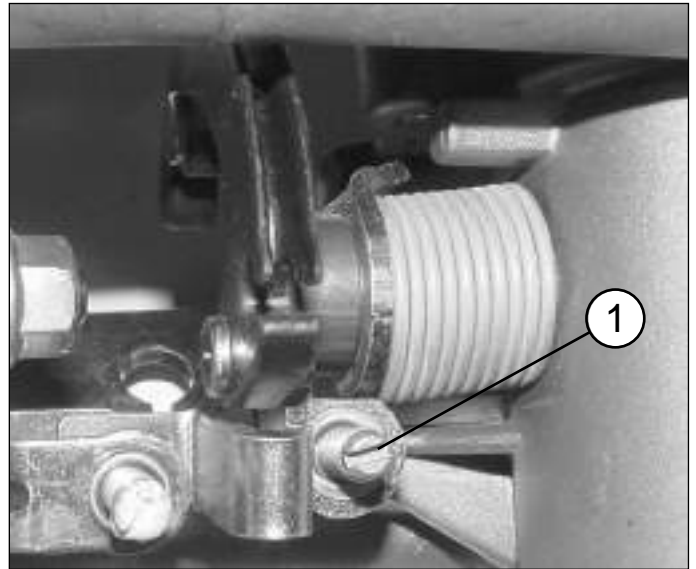
If required, You can intervene exclusively operating on the specific screw (1) placed on the opening gudgeon of the fluttering body.

NOTE Operate only on the right screw (the smaller one).

B) Verify the correct functioning of the water temperature sensors and environmental air and pressure and the battery tension using Magneti Marelli MDST software.

C) Wait with the motor at minimum speed for the culling vents to start up.

D) Connect the vacuometer to the sockets (2) and the CO tester to the socket (3) after having unscrewed the cap with a number 5 hexagonal closure.





Engine F4 ORO

E) Balance the cylinder depression by means of the bypass screws (1) Of the fluttering body trying to get close to the inserted vent at following CO levels and minimum functioning:

Bypass opening 1/2 - 1 turn

CO 4 \pm 0.5%

Minimum RPM 1050 \pm 50

F) Disconnect the vacuumeter, speed up the engine and verify the throttle goes back to the value previously defined, wait for the CO value stabilisation and verify CO and rpm values are in the given clearance.

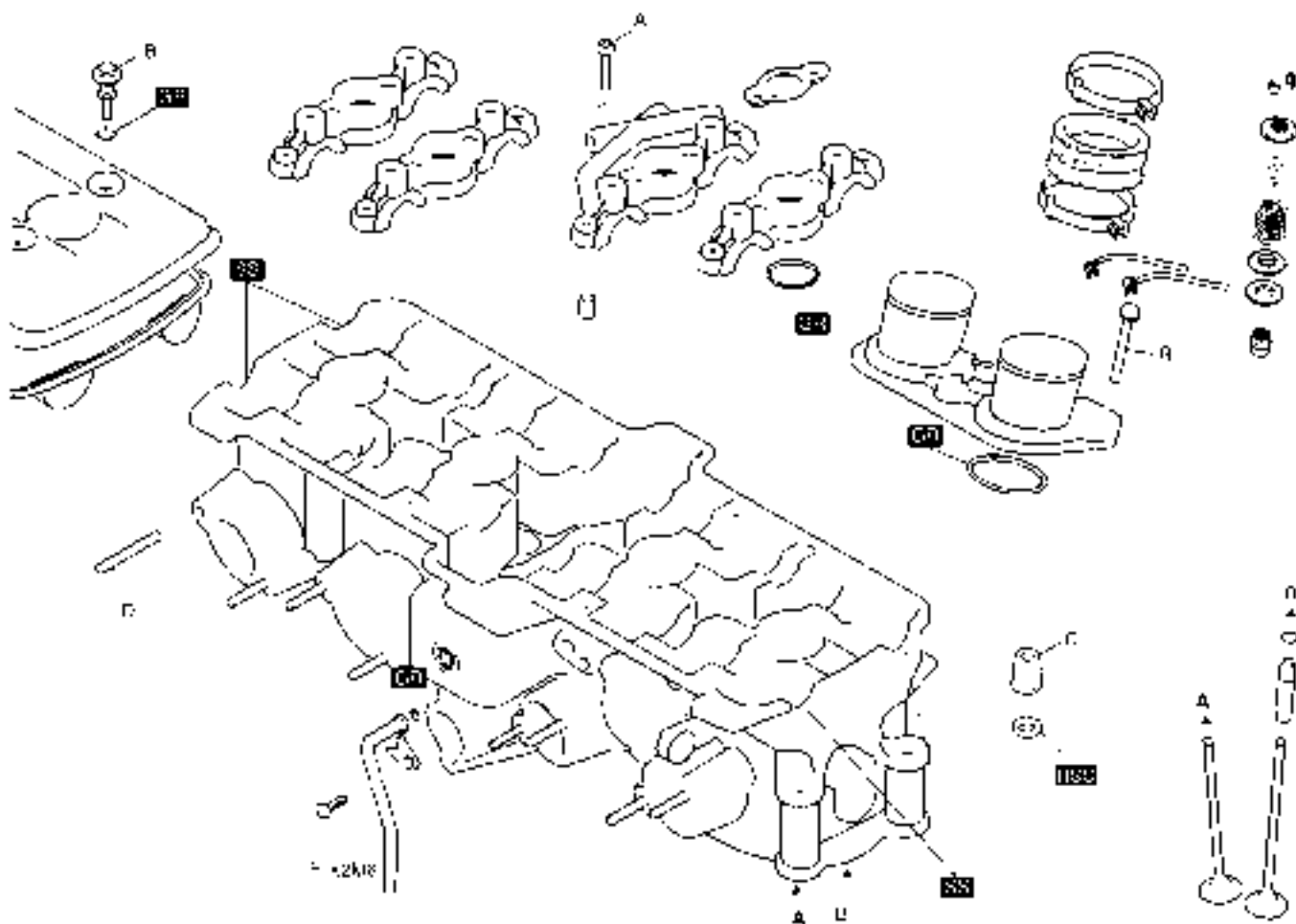
G) If the values are out of range check the vacuumeter line for air infiltration, reconnect the vacuumeter and repeat the operation starting from the E) point.





Engine F4 ORO

CYLINDER HEAD



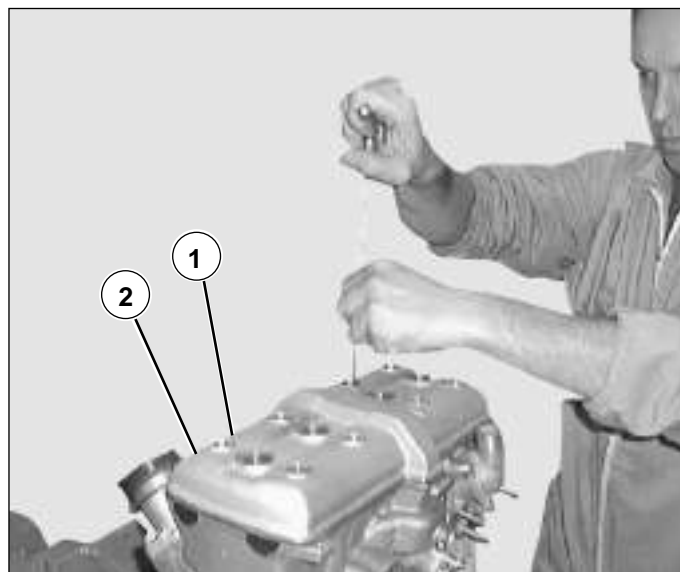
		A	B	C*	D	E	F	G	H	I	L
Tightening torque	N·m	12	8	45	24	8					
	Kg·m										
	ft·lb										
Thread blockers						Medium					

* See text.

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Removal of Head group

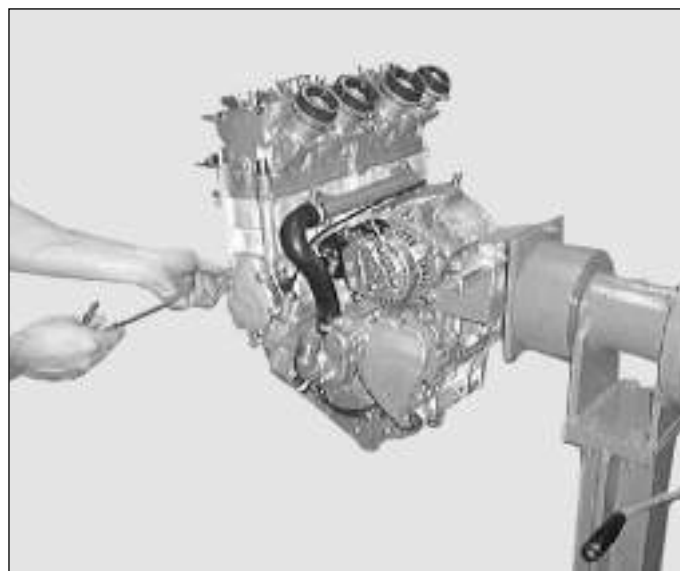
B



Remove the eight tightening nuts (1) and remove the valve cover (2) proceed carefully so as not to damage the gasket (3).



On the left side of the motor remove, together with the gasket, the phonic wheel cover by means of the five screws.

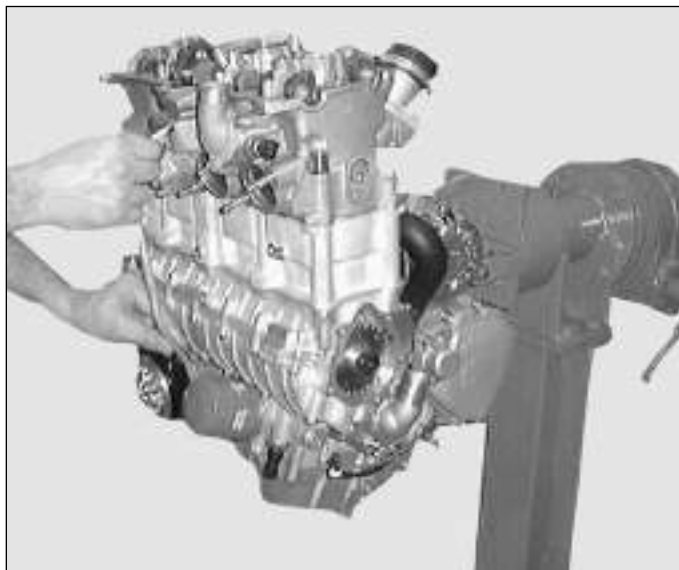




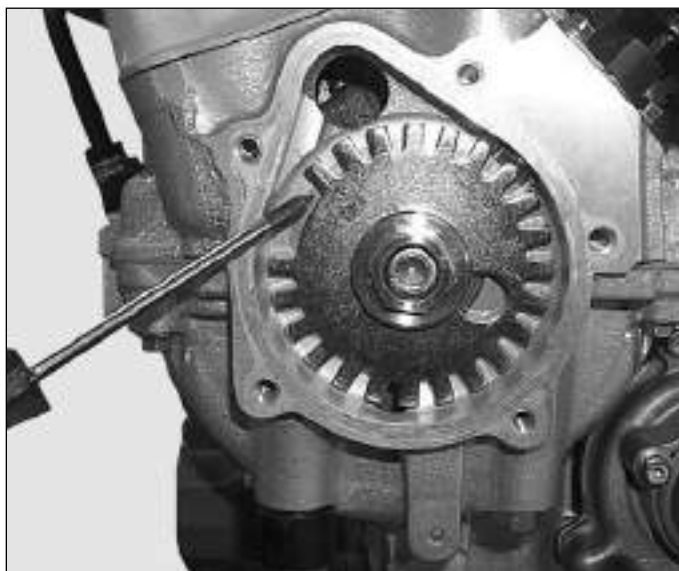
Engine F4 ORO

Remove the oil tube adduction and the head situated at the front of the motor, using the two tightening screw with a T number 8 key.

Working on the phonic wheel knot with a number 19 mm bush key rotate the drive shaft up to the point where the n° 1 piston is at MSP in burst phase.



In this position the T notch on the phonic wheel is lined up with the reference notch on the bedplate.



The cams relative to cylinder n° 1 converge upwards in the symmetrical position as indicated in the fig. Beside,, the reference notches on the control wheels of the camshafts are in horizontal position and positioned externally.





Engine F4 ORO

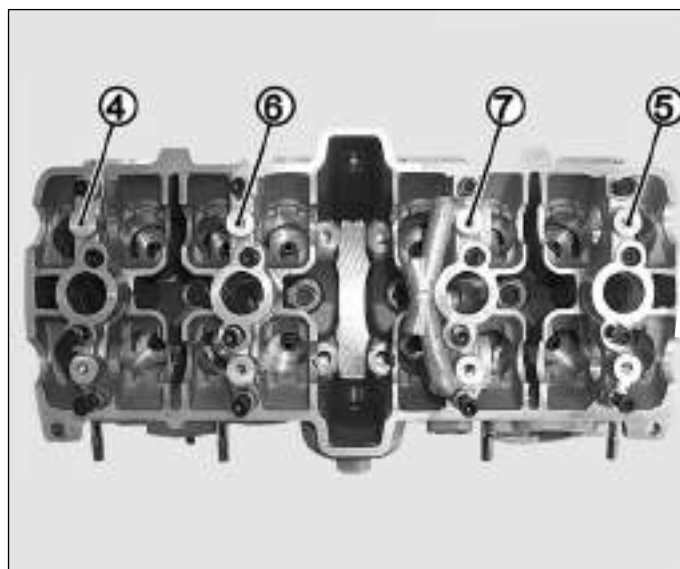
Loosen the central screws of the chain tensioner distribution system. Remove the chain tensioner by means of the two tightening screws.

B



First remove the 2 external stands (4 and 5) of the camshafts by means of the four screws each internally hexagonal.

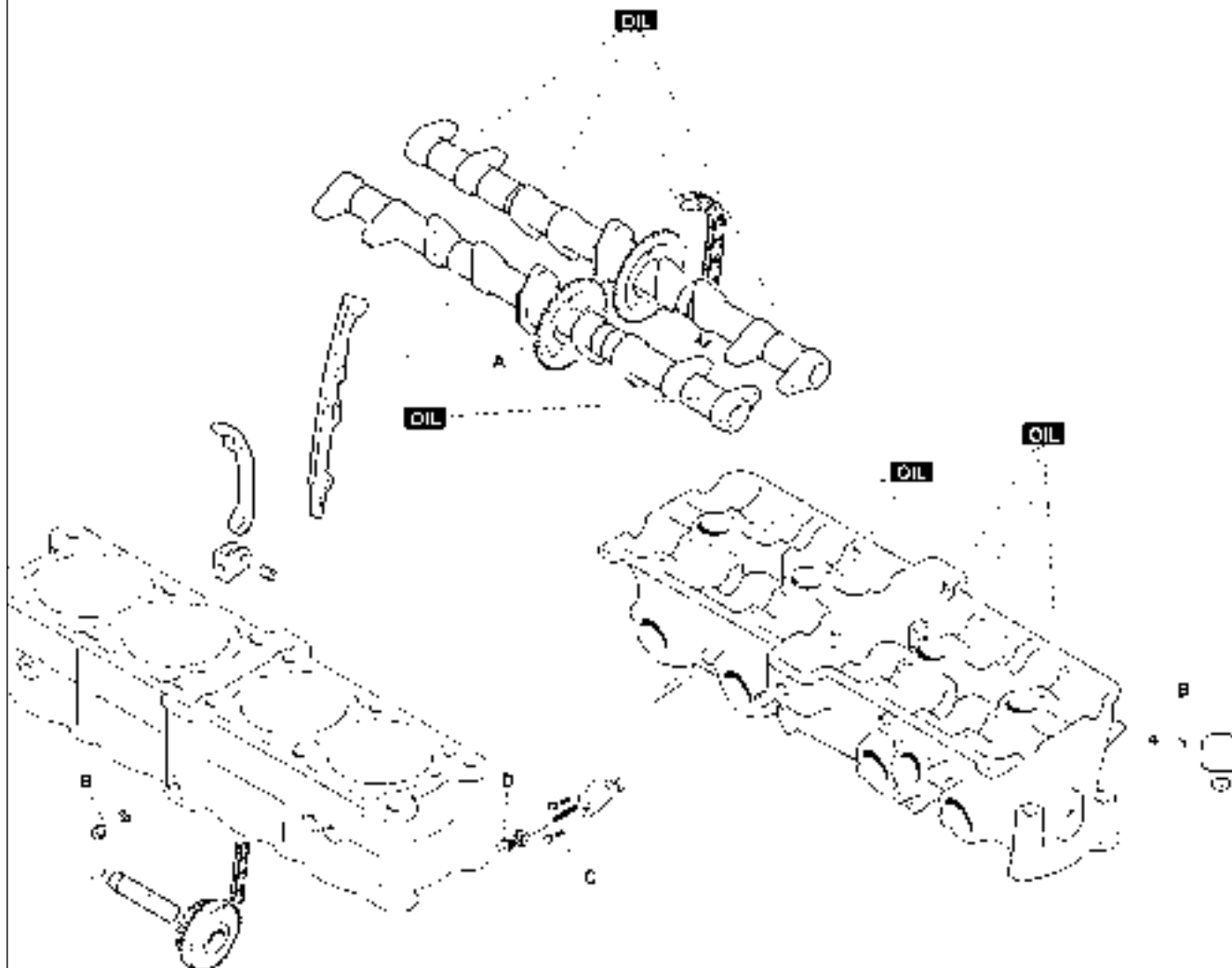
At the same time remove the 2 internal stands (6 and 7) placing attention on the thrust caused by valve springs.





Engine F4 ORO

DISTRIBUTION CONTROL UNITS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	12	8	8	12						
	Kg·m										
	ft·lb										
Thread blockers		Strong	Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



Engine F4 ORO

In order to facilitate the detachment of the stands use a rubber hammer or delicately the end part of a flat screwdriver.



Slightly rotate without force the unloaded end of the gearshaft shifting it from its slot; by doing so, the tension on the distribution chain will loosen.

Release the distribution chain.

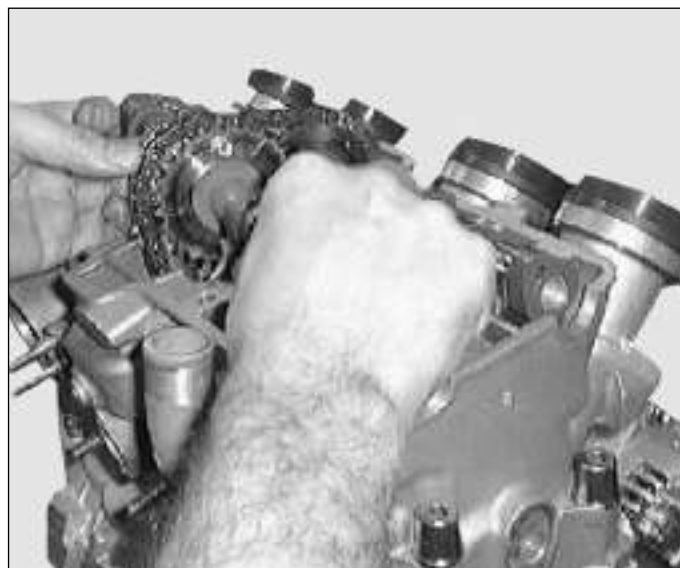
First remove the unloaded end of the gearshaft. Fasten the distribution chain with copper thread in order to retrieve it during the following procedure.

Remove the inlet end of the camshaft.

Remove the first link block for the distribution chain by using the tightening screws.

In case it should be necessary to substitute the distribution chain at the expected mileage (see the programmed maintenance chart), it is advisable also to substitute the gears on the camshaft (INLET n° 82453-EXHAUST n° 82454).

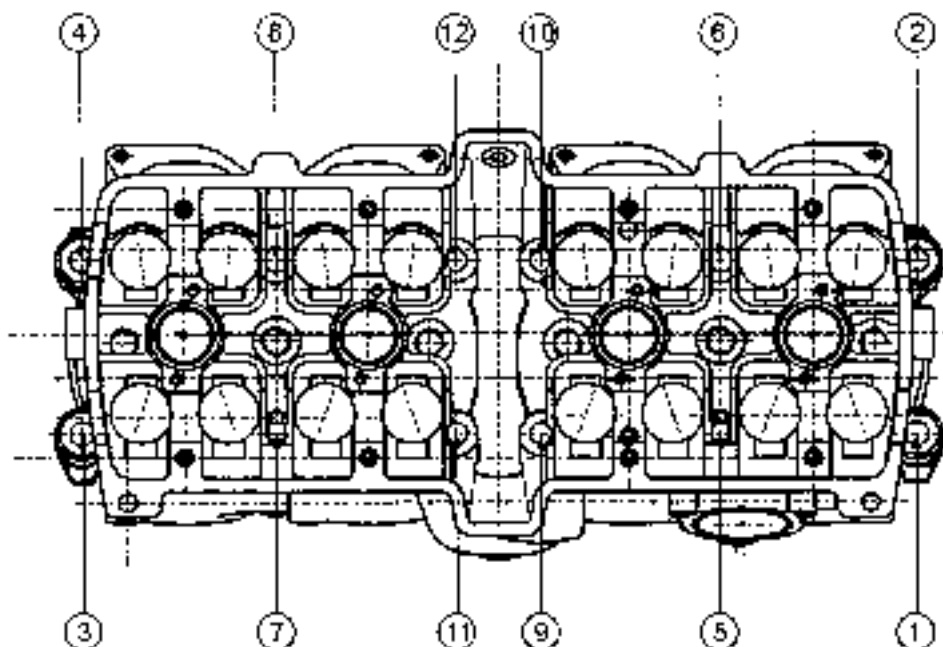
In this case carefully degrease and use LOCTITE 648 on new n°62726 screws locking them at 12Nm.



Remove the 12 tightening nuts from the head beginning from the external ones proceeding towards the internal ones, following the sequence indicated in the figure.



On each encarcement there is a washer. Be carefully no to let it fall into the motor, you may block the holes with clean rags.



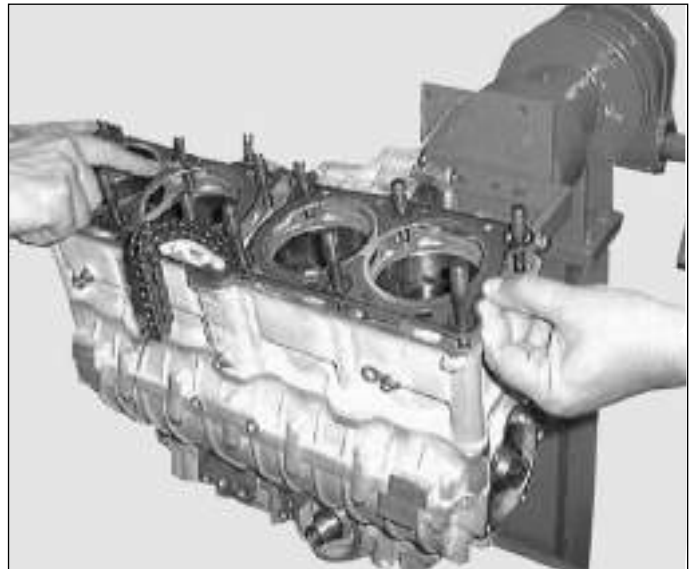
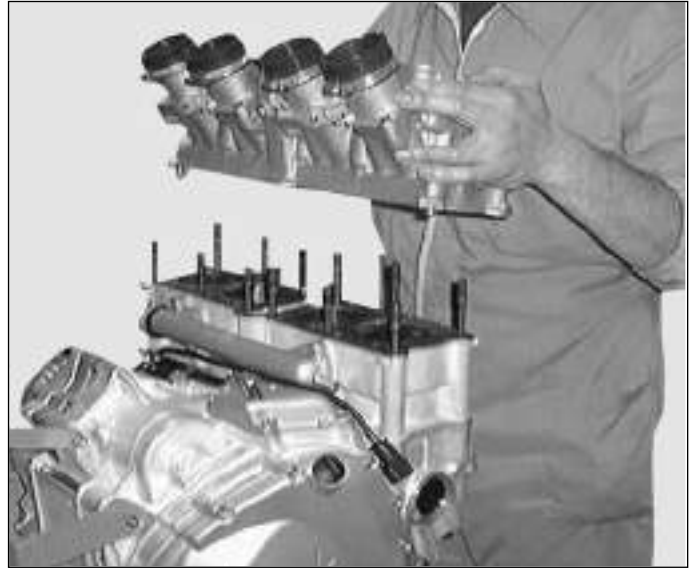


Engine F4 ORO

Remove the head and place it onto a clear place

B Remove the gasket which will be substituted during reassembly.

Avoid placing the head upside down.



Inspection of the head group

Remove carbon deposits from the combustion chambers. Clean away eventual encrustments from the canalizations of the cooling liquid. Check to be sure that there are no cracks and that the holding surfaces are free of crevices, runs or any other kind of damage.

Verify the planarity of the stroke surfaces.

Verify the perfect state of the spark plug threads



Engine F4 ORO

Head assy assembly

To execute this operation you need the following special tool:

- A) n° 94793 piston / cylinder plane distance measuring tool

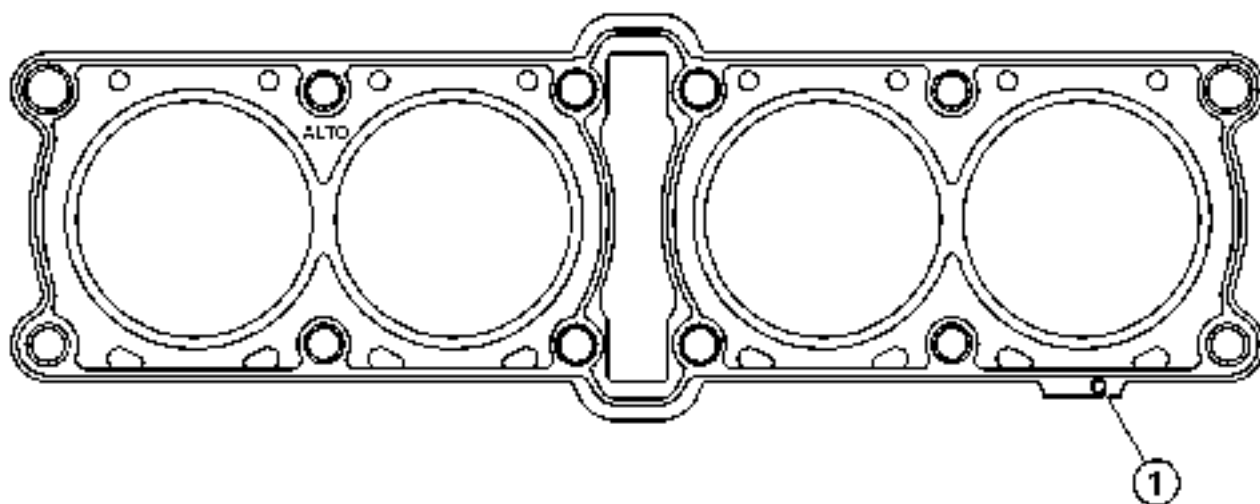
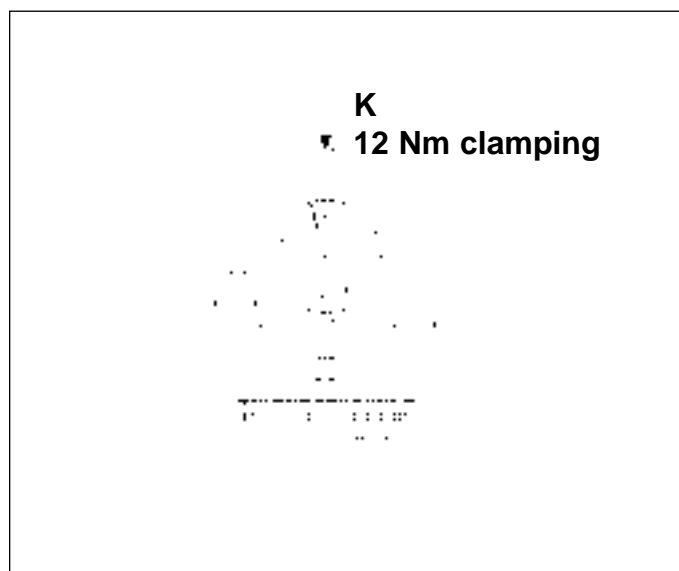
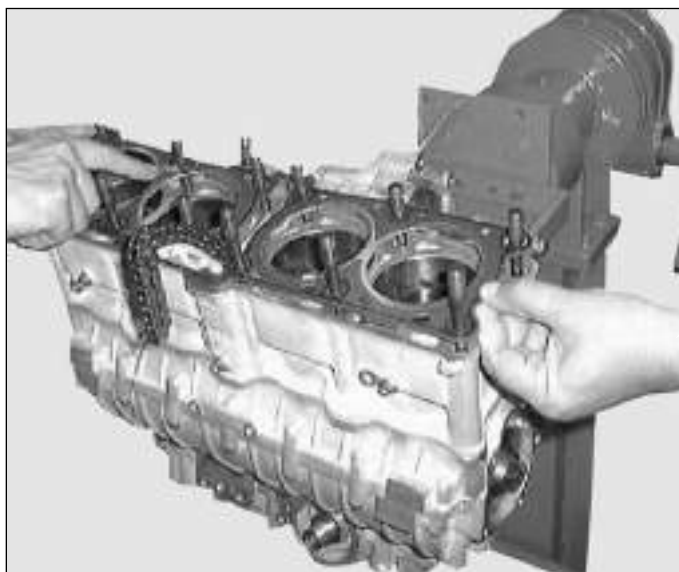
Place the new gasket on the cylinder plane.
The gasket is of the same thickness of the one installed before if no parts replacement occurred.

If replacement is necessary you'll need to measure the piston / cylinder plane distance with the n° 94793 tool, tightening the head nuts at 12 Nm. The choice is made following table below:

Piston/cylinder plane projection	Type of gasket
0.37-0.57 mm	Thick= >1.45 mm
0.17-0.37 mm	Thin= >1.30 mm

The gaskets are different for the presence of the holes (1) shown in picture.
The presence of the holes identifies the thicker gasket as shown on the chart.

Holes numers	Compressed thickness	Part N°
NONE	1.30 ± 0.05 mm	8A0087757
1	1.45 ± 0.05 mm	800087757





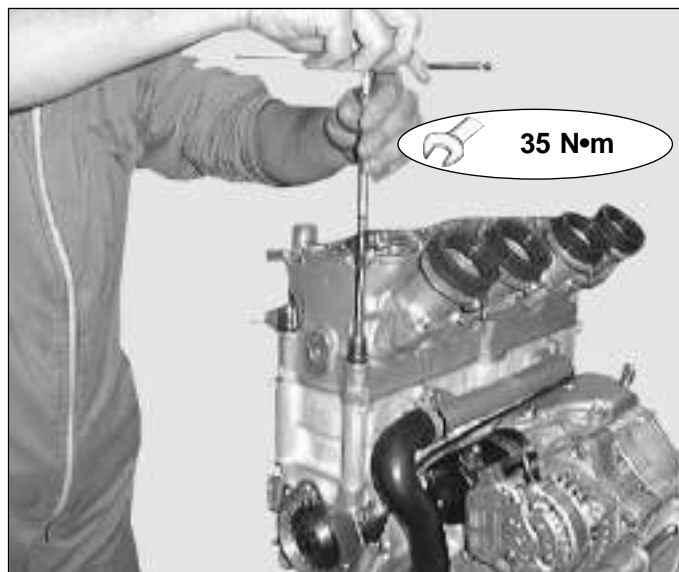
Engine F4 ORO

The gasket must be assembled with the letters ALTO on the superior facade and the protrusion towards the march gear.

Insert the centering bushes between the head and the cylinder. Insert the washers on the encarcement if necessary with the help of a screw driver to guide them onto the internal encarcements.

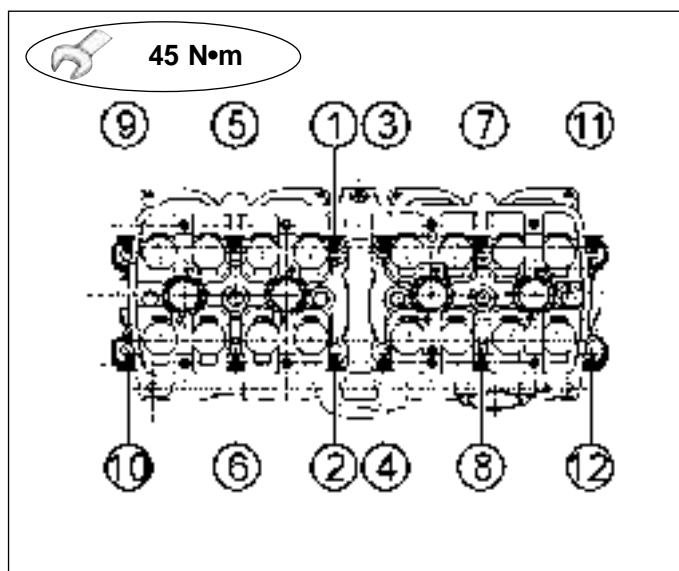
Lubricate with antibinding grease of the HSC MOLIKOTE type only on the nut threads.

Do not apply grease on the encarcement threads, which must be well cleaned and degreased



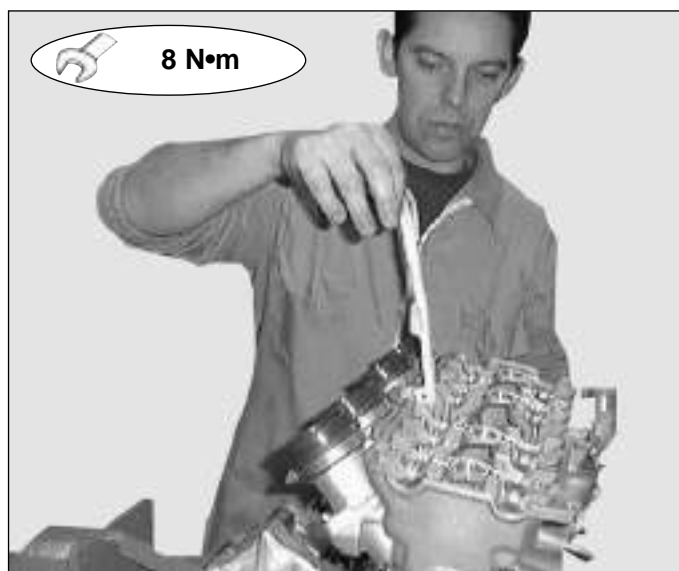
Screw the bolts with a brugle key and press them at a 35 Nm.

Tighten the bolts beginning with the internal ones towards the external ones following the outline indicated in the figure at 45 Nm.



Retrieve the distribution chain.

Insert the fixed sliding block with its screws and, after having carefully degreased it, tighten it at a torque of 8 Nm. with 242 LOCTITE





Engine F4 ORO

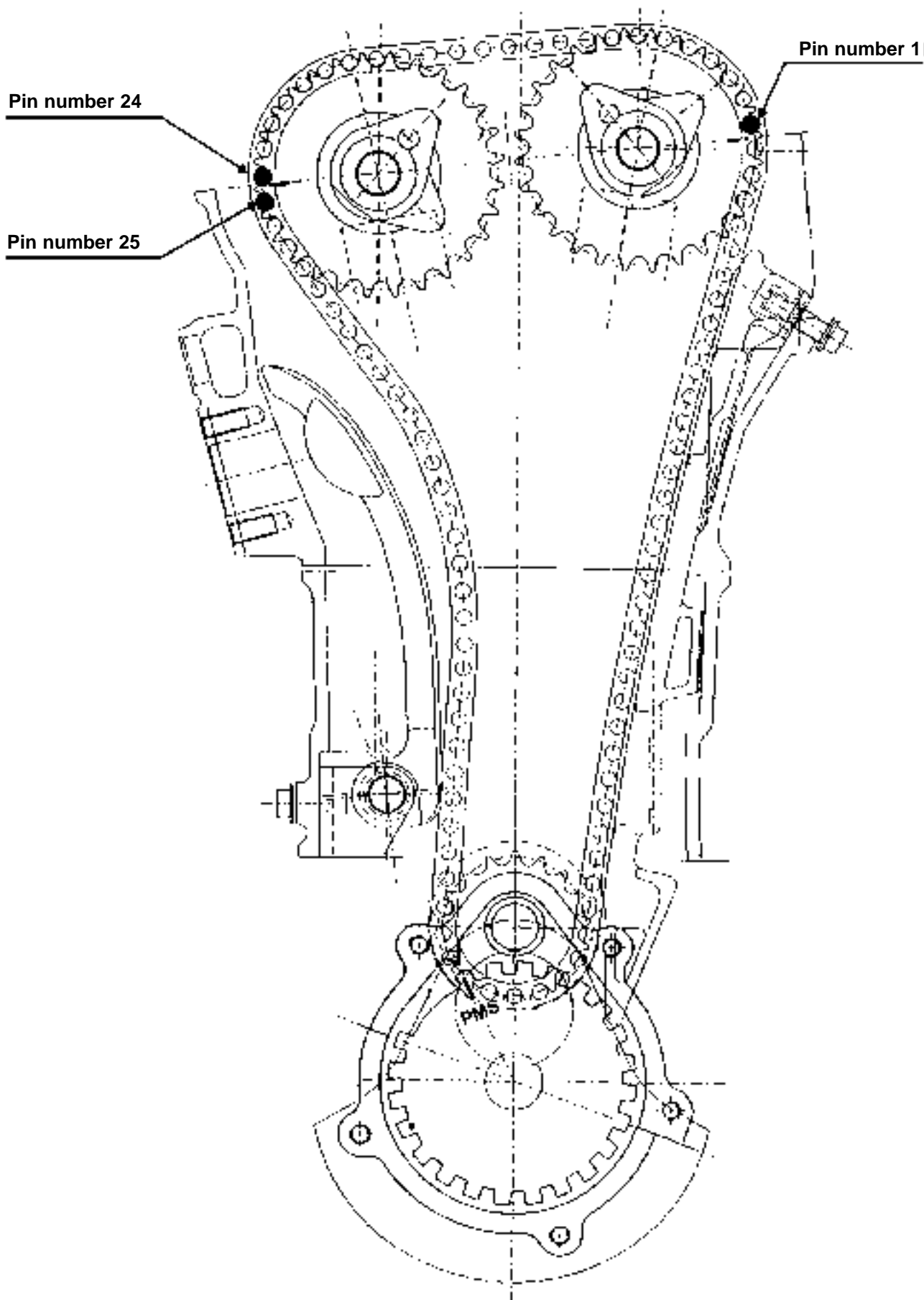
Continue with the setting as follows:

be sure that piston n° 1 is the MSP in burst phase; in this position "T" notch on the phonic wheel is in line with the reference notch on the bedplate.

Remove the copper thread from distribution chain, keep the chain tightened.



B



Insert the inlet camshaft so that the phase notch on the conveyer wheel is parallel to the head plane and facing the outside.

Insert the exhaust camshaft with the notch placed between the 24th and 25th chain distribution gudgeon, beginning to count from gudgeon after the inlet camshaft notch.

Check the correct position of all the O Rings under the head stands.



Position the n°2 and n°3 stands, referring to the numbers towards the inlet end;

Position the n°1 and n°4 stands,

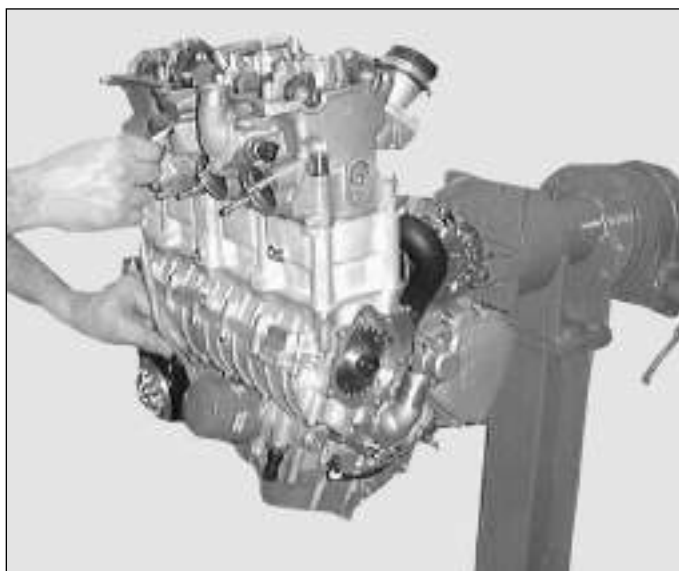
Bring the screws together manually hexagonally embedded.



Before tightening stand screws be sure that the chain tensioner is assembled.



Do not tighten the stand screws if the reaction springs are charged. Appropriately turn the camshaft so that the stand springs of which are to be tightened are uncharged and that the cams are positioned on the base radius.



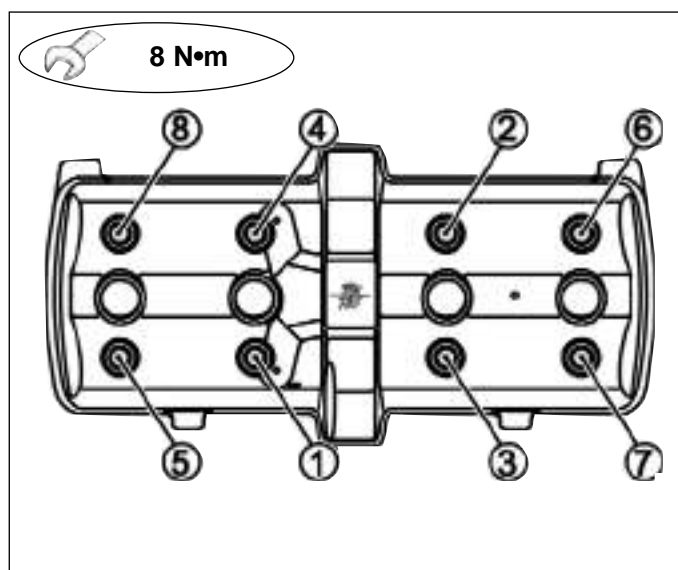


Engine F4 ORO

Progressively move the internal hexagonal screws close. Tighten the screws at a torque of 12 Nm., always beginning from n°2 and n°3 stands.

Check to be sure that the valve cap gaskets are in good condition.

Apply a layer of gasket 5552 silicone on the semi moons on the head in correspondence with the camshaft.



Position the valve cap.

Manually position the screws, thus tighten at 8 Nm.

Place the adduction oil tube at the head greasing the O-Rings.

Dismounting cylinder head pieces

In order to carry out this procedure the following tools are necessary:

tool n° 94796 to disassemble valves

tool n°95179 to remove semi cones

tool n° 94798 to take out rubber holdings



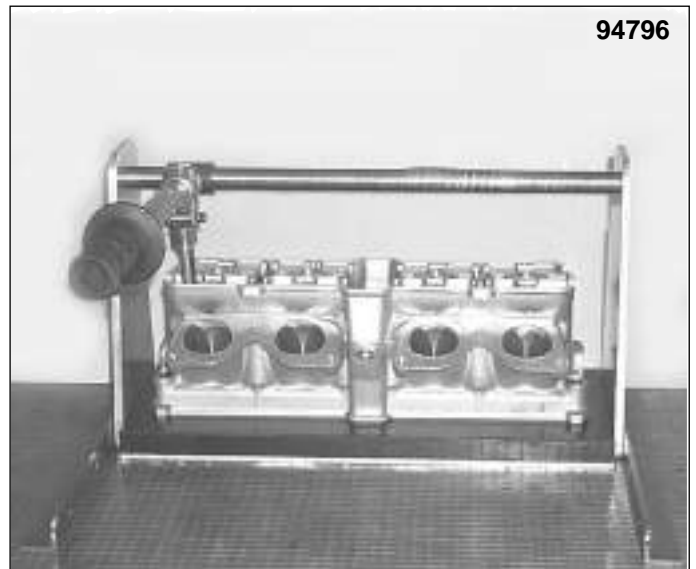
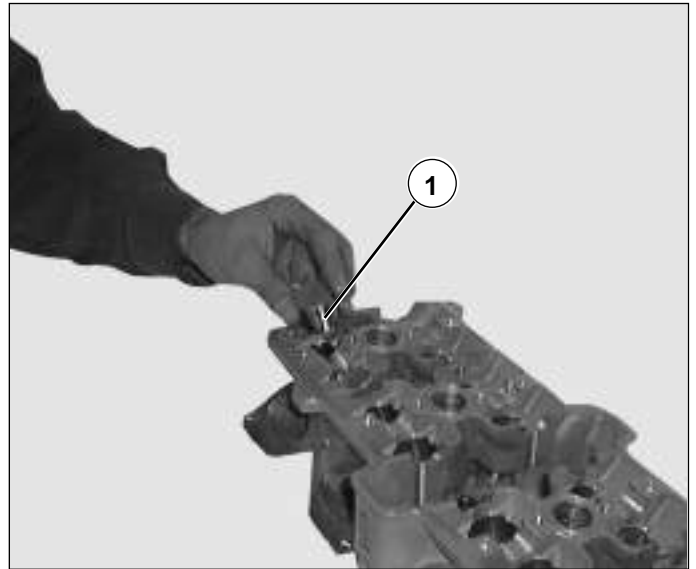
Each piece relative to the same valve (cup, spring, semi cone, etc.) must be reassembled onto the same valve from which it came off.

Remove the cylinder head as indicated the paragraph "cylinder assay removal".



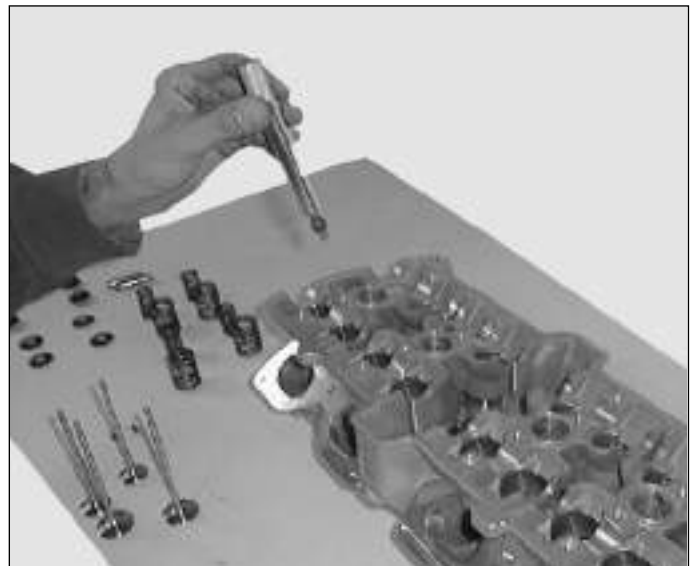
Valve removal

- A) Take out the cups (1) with the help of a magnet and number them with a marker so as to reassemble them in the same position.
- B) Remove the tablets (2) of play adjustment with a magnet and place them inside the relative cup so as to reassemble them in the same position. To remove the semi cones (3) exclusively use tool n° 95179 so as to avoid bending the valves:
- C) Assemble the head on tool n° 94796
- D) Hammer on the superior disk with a rubber hammer to unblock the semi cones
- E) Press the springs on the superior disk
- F) Take out the semi cones with a magnet
- G) Slowly release the disk pusher.

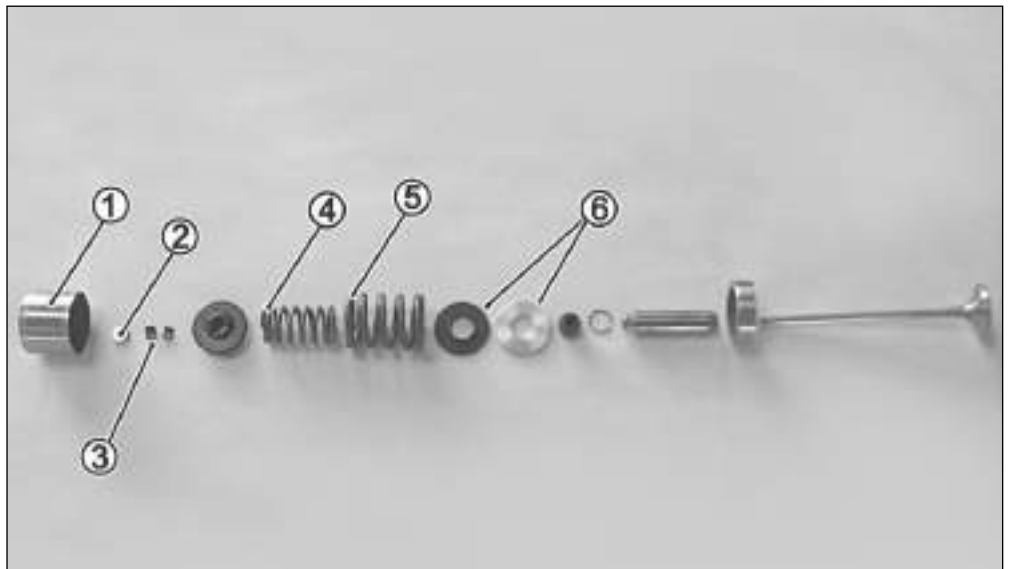


Then remove in the following order:

- A) Semicones
- B) The 2 coaxial springs (4 and 5);
- C) If necessary remove the rubber holdings using tool n°94798
- D) Remove the inferior disk more grazingly (6)
- E) Slide the valve out of the combustion chamber



94798



Maintenance of the valve slot

Check the stroke surface [A] between the valve [B] and the slot [C] : no traces of pitting or cracks must appear. Measure the external diameter [D] of the stroke surface on the valve slot.

If this should appear to be too elevated it is possible to repair the slot.

External diameter of the stroke surface of the valve slot

Standard : exhaust $24.6^{+0}_{+0.3}$ mm
inlet $28.6^{+0}_{+0.3}$ mm

Measure the width of the stroke [E] with a varnished gauge or with Prussian blue.

If it should turn out to be too wide, too thin or irregular it will be necessary to repair it.

Area thickness of the stroke

standard : exhaust, inlet $1^{+0}_{-0.3}$ mm [E]

The repair must be carried out by milling the slots using the appropriate monocutting milling machines at 78° (1), 45° (2) and 17° (3).

Then proceed with the grinding of the valves and verification of the holding.

Remove the minimum quantity of material from the slot.

Inlet max 0.5 mm (vertical)

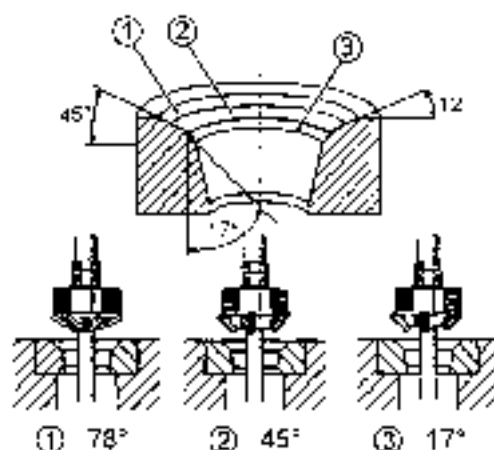
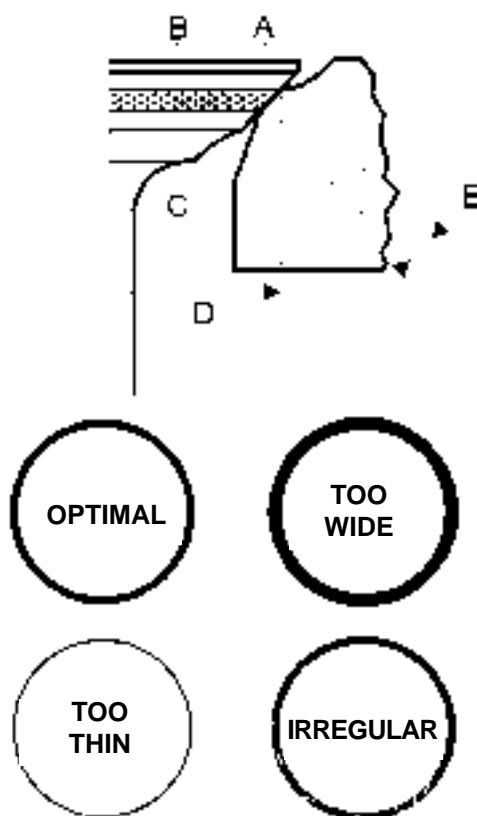
Exhaust max 0.5 mm (vertical)



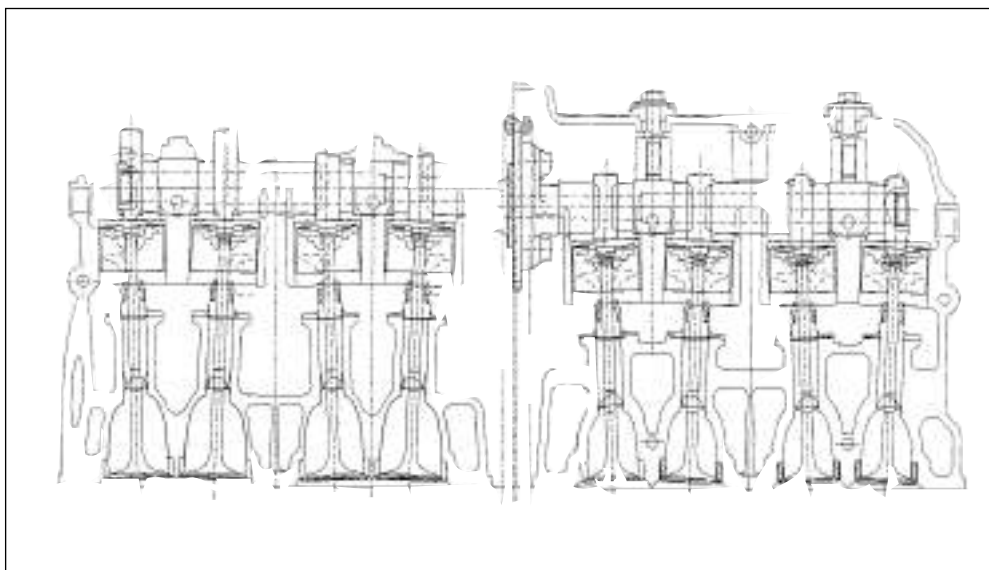
Verify that there is no leakage filling the inlet and exhaust of the gas canalization. If so, check the quality of repair with Prussian blue.



When reassembling never use calibrated tablets of a thickness inferior to 1.6 mm.



B

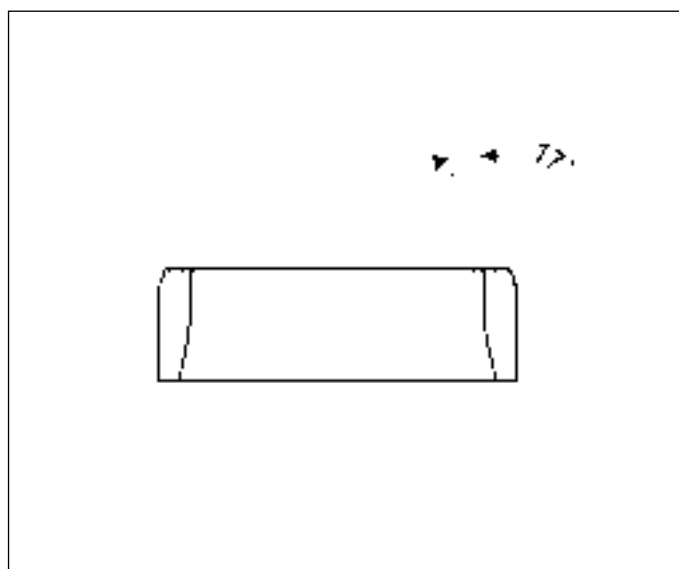


Substitution of the valve slot

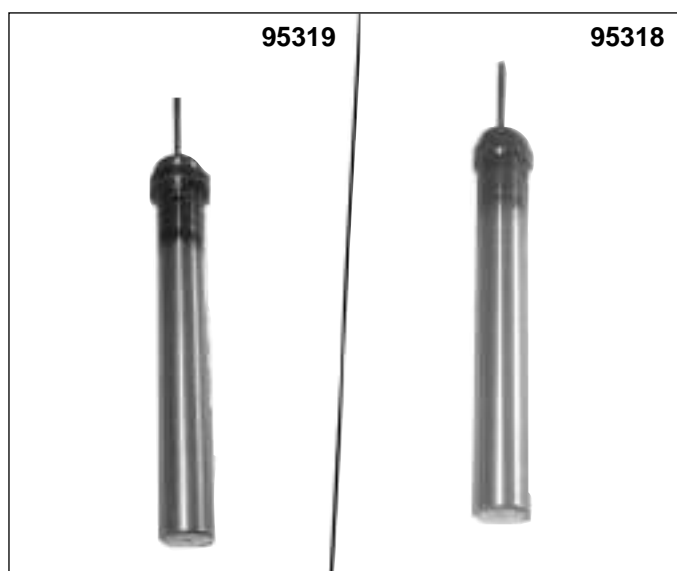
The following tools are necessary for this procedure:
prick-puncher n°95319 for inlet slot
prick-puncher n°95318 for exhaust slot

Proceed as follows:

- Remove the worn slots carefully milling them so as not to damage the head lodging
- Check the lodging diameter on the head and choose the oversized valve slot considering that the **assembling interference should be 0.10÷0.15 mm**.
- Valve slots are furnished with an increased replacement part of 0.03 mm on the external diameter.
- Slowly and evenly heat the head at a max temperature of 180°C and cool the new slots with dry ice.
- Place the slots perfectly in frame into its lodging, using the special n°95319 prick-puncher (INLET) and n°95318 (EXHAUST)
- Let cool and proceed with the milling of the slots and grinding the valves referring to the following quotients:



Ø A	$28.60^{+0.3}_{-0}$
Ø S	$24.6^{+0.3}_{-0}$
[E]	$1^{+0}_{-0.3}$



Valve guide check and maintenance

In order to carry out this procedure the following tools are necessary:

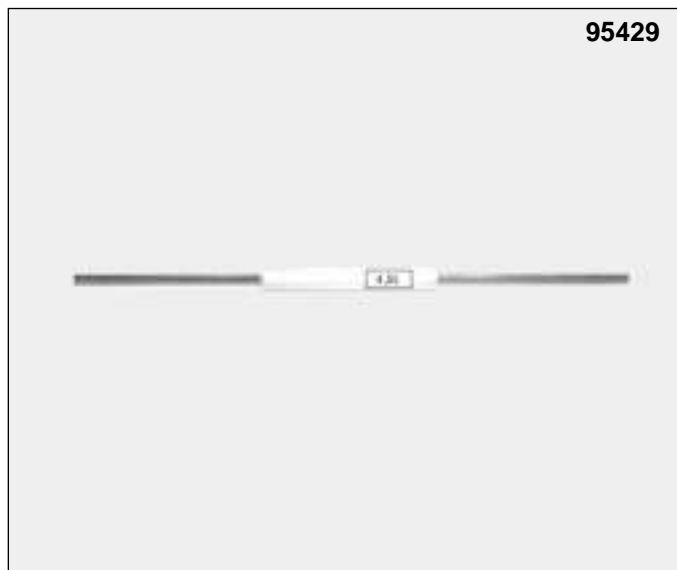
Control tampon n°95429
 Tampon n°95320

valve stem-valve guide play: **0.01÷0.03 mm inlet**
0.02÷0.04 mm exhaust
 coupling limit: **0.08 mm inlet**
0.1 mm exhaust
 internal guide Ø limit: **4.55 mm**

Proceed with an accurate visual check of the valve guide.
 In order to determine the coupling wear between guide and valve stem it is necessary to measure the play using a control tampon and micrometer.

[NOTE] The control tampon 95429 (Ø 4.55) must not pass.

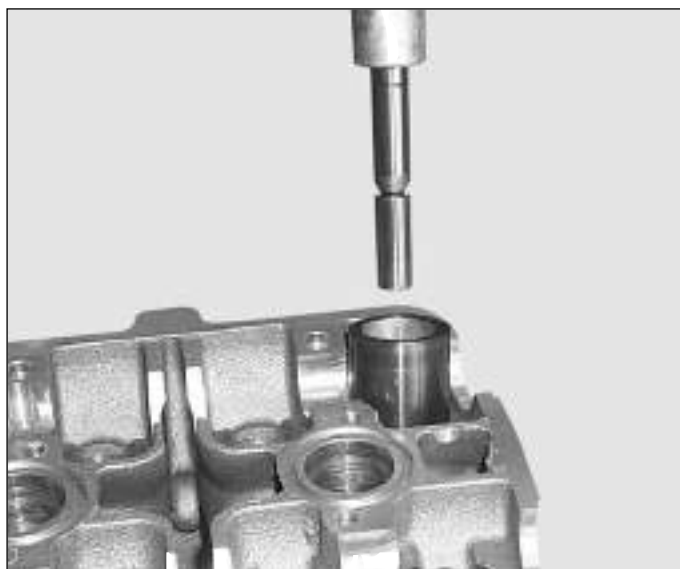
[NOTE] In the case of substituting the guide valve it is necessary to check and if necessary also substitute the valve.



Removal of the valve guide

After having removed the valves and rubber holdings as described in the relative paragraph, continue as follows:

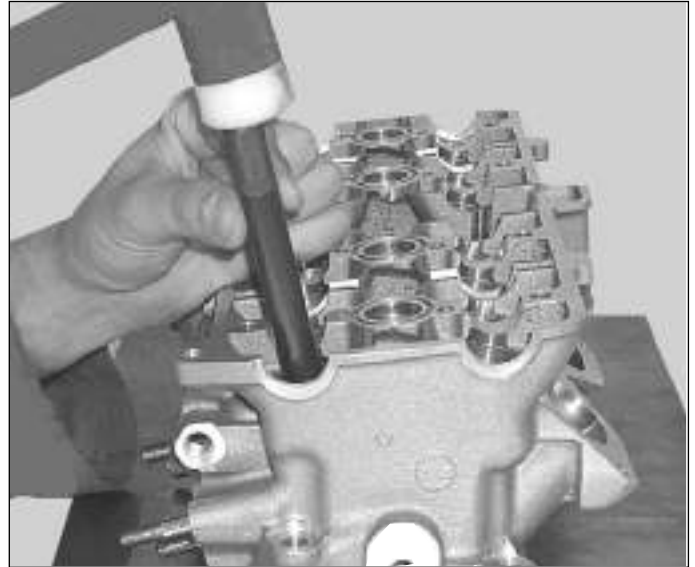
Slowly and evenly heat the cylinder head up to 100°. Using tampon n° 95320 slide out the valve guide. Continue with a visual check of the slot to verify its State.



Guide valve installation

Assemble an oversized valve guide as follows:

B Oil the external valve guide surface.
Slowly and evenly heat the cylinder head up to 150°. If necessary cool the valve guides with (N2) nitrogen liquid; or dry ice.
Insert the valve guide using the special n°95320 tampon up to the stroke and let rest until the temperature has stabilized.
Check to be sure the valve slides freely in the valve guide otherwise coat it with a 4.5 H7 reamer or broach N°8000 A2625.



Valve

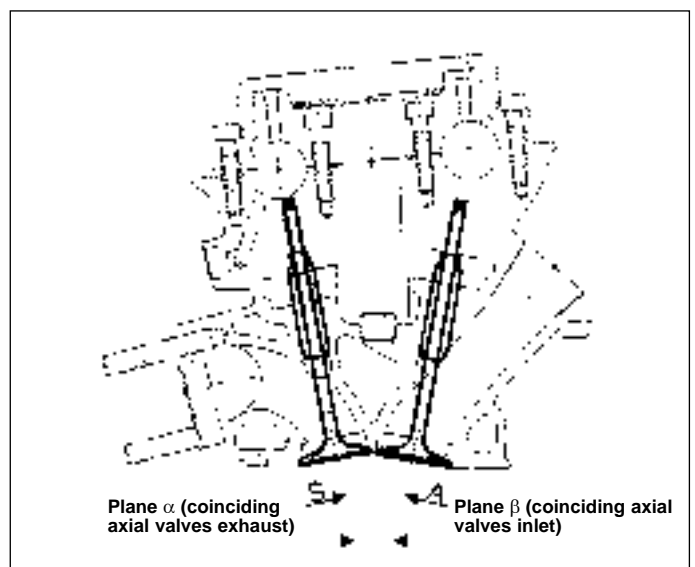
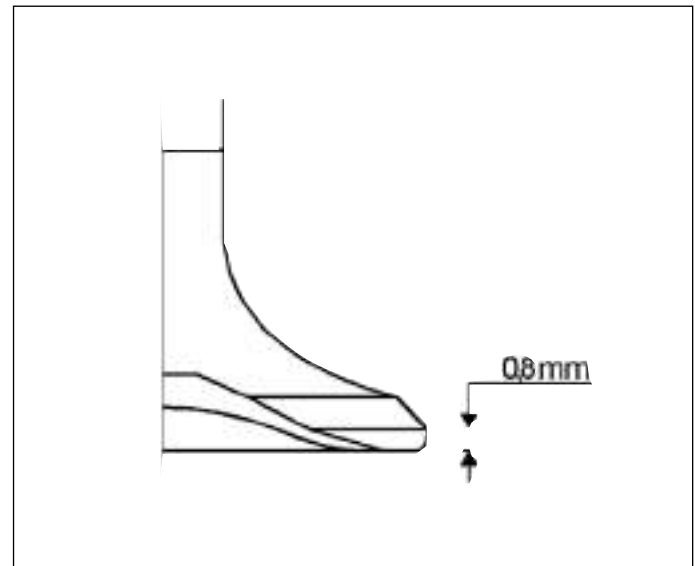
The stem diameters must not fall below:

4.485^{-2/100} mm inlet

4.475^{-2/100} mm exhaust

The minimum distance of the holding position at 45° on the valve plane must not be lower than 0.8 mm (see figure).

Check to be sure that the stem and the surface in contact with the valve slots are in good condition. No traces of pitting, cracking, deformations or traces of wear should appear. Verify that the stem is perfectly rectilinear.



Valve-guide valve coupling

Coupling play at assembly must be:

0.01 ÷ 0.03 mm inlet.

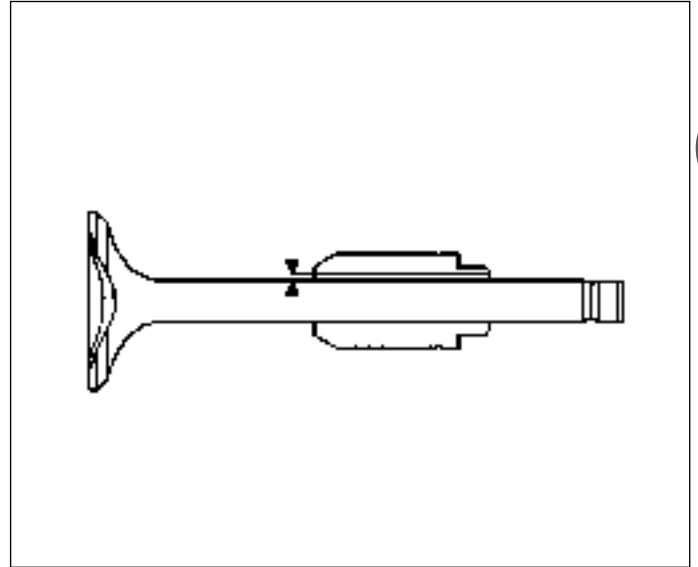
0.02 ÷ 0.04 mm exhaust

The maximum coupling limit permitted is even to

0.08 mm inlet

0.10 mm exhaust

If a major play should result, substitute valve and valve guide.



Springs

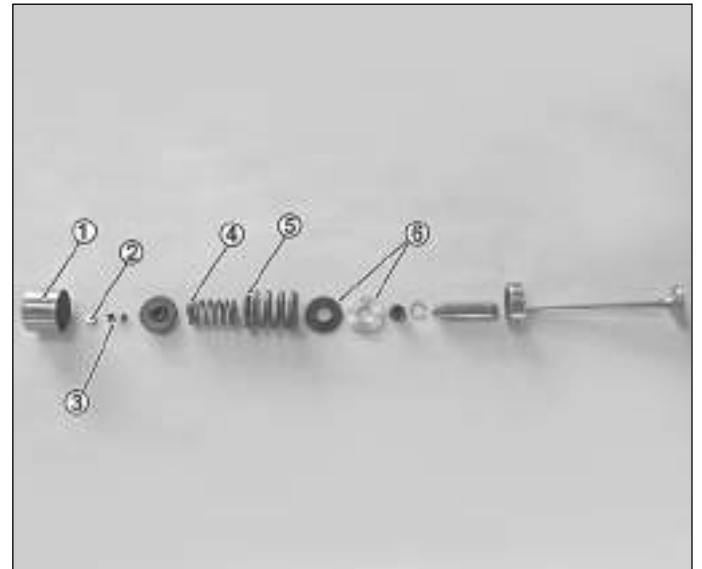
Check to be sure that the free value of length is not inferior to the suggested limit and in such case substitute the springs:

Internal spring l = 30.5 mm.

Service limit: 30 mm

External spring l = 32.6 mm.

Service limit: 32.1 mm



Valve reassembly

A) Carefully degrease the guide

B) Insert the inferior basement disk (6) and be sure that it is in beat.

C) Assemble the rubber holdings, always new, on the valve guide using tool n°95581;

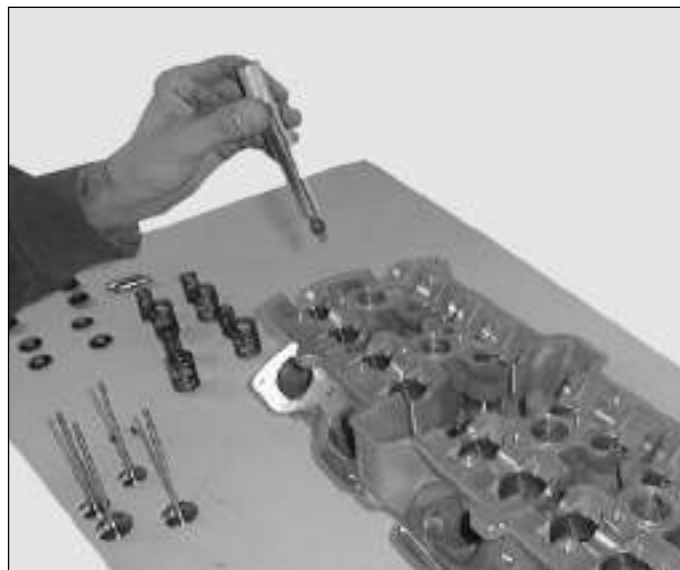
D) Sprinkle the valve stem with oil.



95581

Assembling the valve.

B



Insert in the order of:

- A) Insert the two coaxial springs
- B) Slide the semi cones into the superior disk slot and thus place the disk on the springs
- C) Assemble the head on the disassembling valve tool n°94796 and compress the spring with tool n° 95180 until the semi cones are inserted
- D) Using a rubber hammer strike a slight blow on the valve so as to place the semi cones.

NOTE Before placing the semi cones be sure that the head is not resting on a plane in order to avoid distorting the valve. Place it onto two bases which allow the valve to move.

95180



- E) Insert the tablet of the correct thickness and lubricate its surface
- F) Make sure it easily turns in its slot
- G) Insert the cup after lubricating the slot

Insert the cylinder head as described in the paragraph "Head assay assembly".



Regulating valve play

Verify that the spark plugs have been disassembled.



Should this procedure be carried out with the head assembled on the motor, block the spark plug holes with clean rags and assemble plate n°95191 to avoid the pieces accidentally falling into the chain distribution opening.

A) Rotate the drive shaft until completely unwinding the springs relative to the valves on which intervening (MSP in burst phase).

B) Measure valve play with a thickometer.

Inlet valve play	Exhaust valve play
0.15 ÷ 0.24 mm	0.20 ÷ 0.29 mm

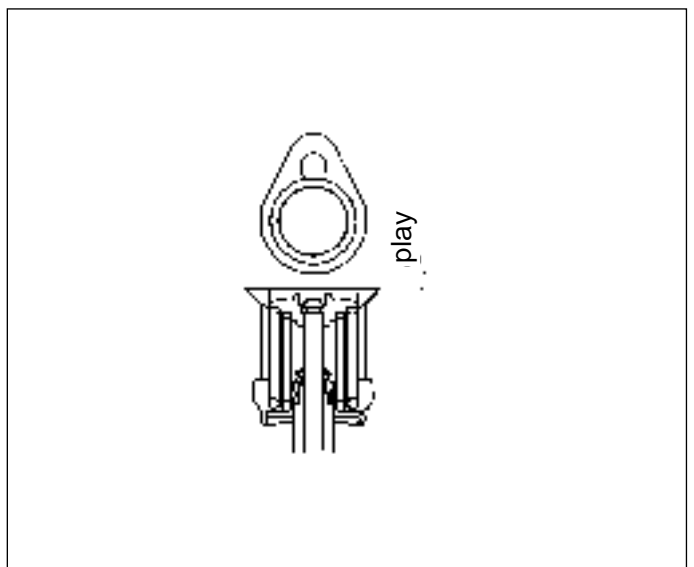
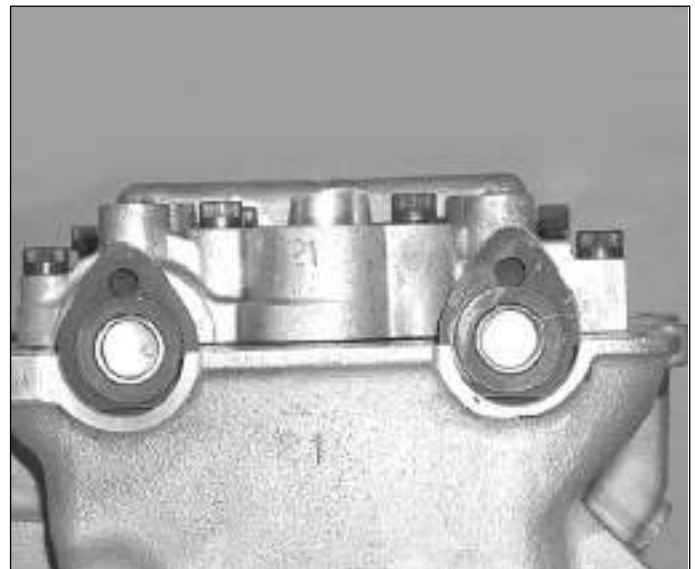
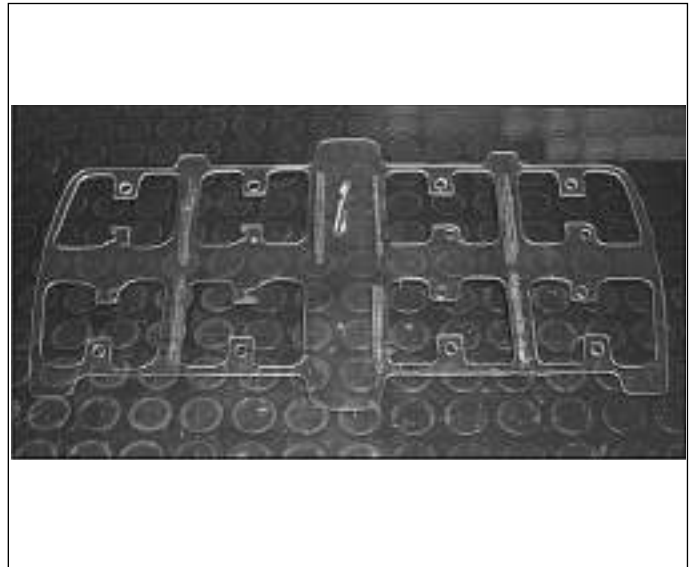
C) Calculate the D difference between the compared play and optimal play shown on the chart

D) Read the value of S thickness on the tablet;

E) Choose a new tablet with an S+D thickness.



During reassembly never use a tablet with a thickness less than 1.6 mm.



Chain tensioner

Remove the central screw-cap and withdraw the spring and the pin.

Remove the screws fixing the chain tensioner to the head.

Remove the chain tensioner.

Disassembly the chain tensioner and check the correct working of each part.

The internal pin must run clearly and the inner spring must give a quick response.

Replace the assembly in case of malfunction.

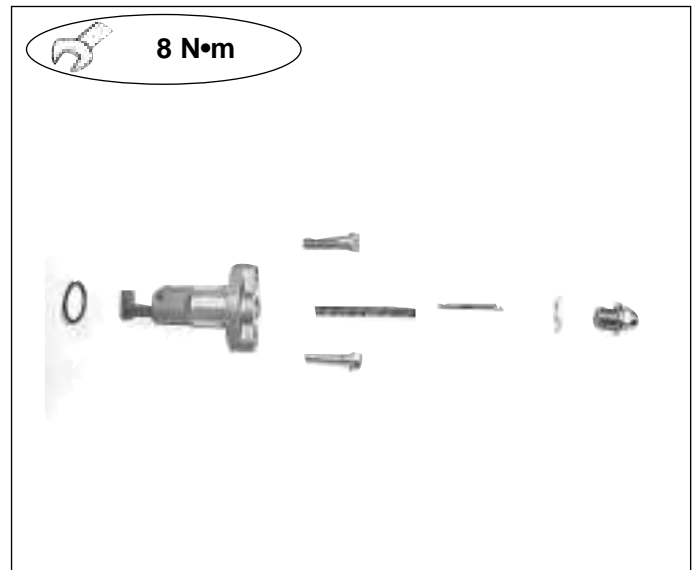
If everything works properly lubricate the parts and install the assembly with the chain tensioner in the minimum extension position (all in the main body)

Install the chain tensioner body locking the 2 socket head screws using a T wrench with a 8 Nm torque

Install in this order: the pin in the spring, the spacer and the screw cap.

Lock the screw cap by hand till you feel the tensioner extend, then lock it with a 8 Nm torque

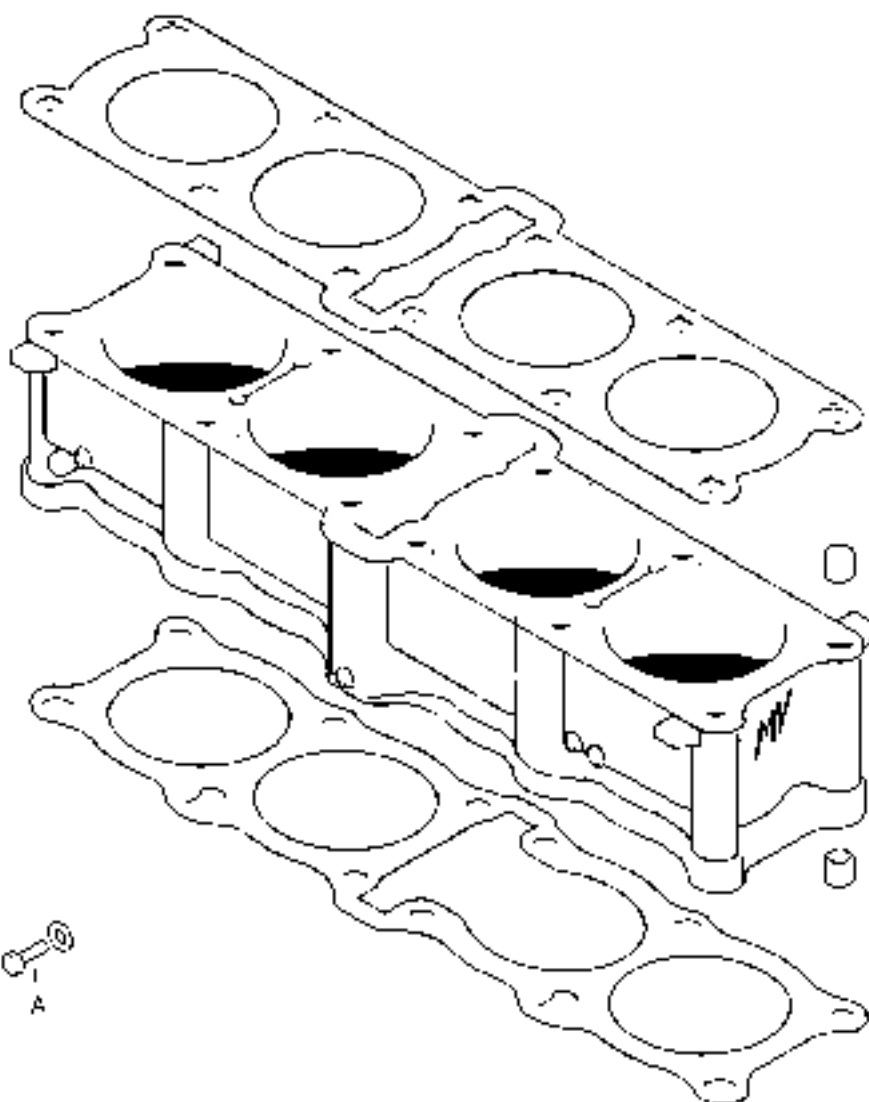
Acting this way the chain tensioner is adjusted.





Engine F4 ORO

CYLINDER AND PISTON GROUP



B

		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8									
	Kg·m										
	ft·lb										
Thread blockers		Medium									

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Removing cylinder and pistons

B Remove the cylinder head and rubber connecting rod between the cylinder and water pump as described in the relative paragraphs.

Carefully slide out the cylinder group being careful not to damage the elastic strips.

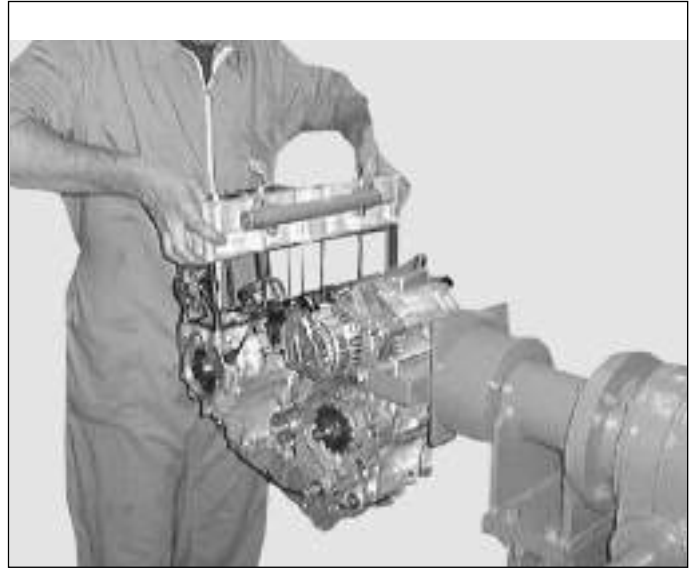
Work on one piston at a time to continue the removal. First remove the 2 pistons which are at the MSP and rotate the drive shaft at 180° and disassemble the 2 remaining pistons.

Remove the elastic ring which blocks the plug to the piston.

Slide the plug off.

Slide the piston off only after having marked the ceiling with a marker to reassemble it properly.

Slide the gasket off between the cylinder and bedplate.



Cylinder revision

Check to be sure that enclosures show no sign of seizures with the pistons.

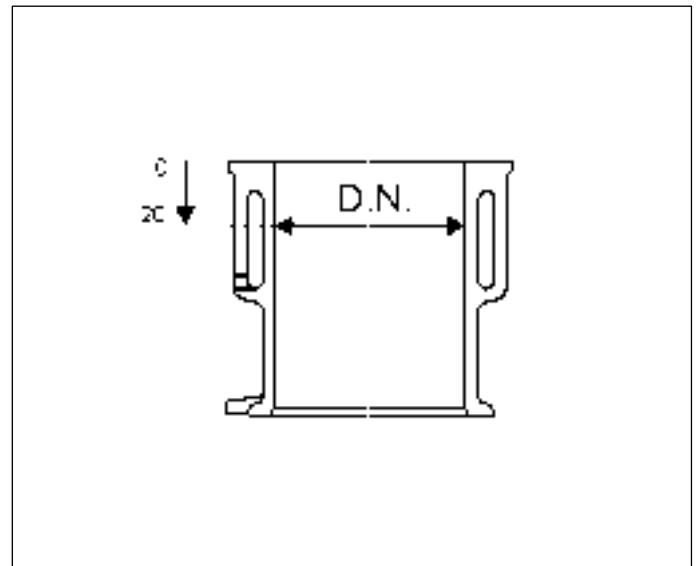
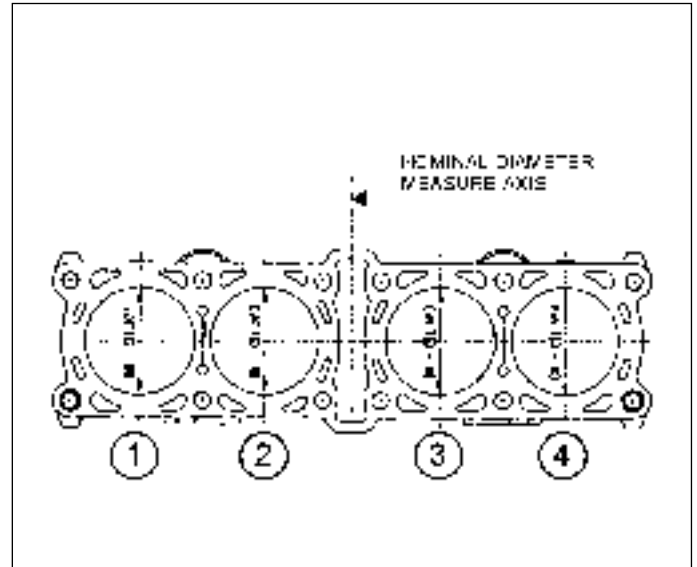
Check piston ovalization in the following way:

A) Measure the **nominal diameter of each cylinder at a distance of 20 mm from the superior edge** as indicated in the figure.

B) Perpendicularly repeat the measurements to the preceding ones.

C) Verify that the **ovalization is inferior to 0.015 mm** (wear limits).

In the case that not even one cylinder should pass this verification, substitute the entire block. If the block should be substituted and if necessary also substitute the pistons and elastic strips. The cylinder is marked with a letter which indicates the class it belongs to: A and B cylinders and A and B pistons exist which must be coupled with the same letter; the cylinder-piston coupling must be carried out between classes of the same origin (A cylinder-A piston; B cylinder-B piston).



Piston revision

Carefully clean the piston ceiling from carbon residues. Continue with a careful visual check of the piston; no signs of lines or other damage must appear.

Measure the diameter of the piston at the portion indicated in the direction perpendicular to the piston pin axle.

In the case of excessive wear of one of the pistons, substitute it. The piston should belong to the same class of the cylinder selection.

Piston-cylinder coupling

The cylinder-piston groups are furnished already coupled; if there should be an exchange of cylinders and pistons between them it would be necessary to proceed surveying coupling plays.

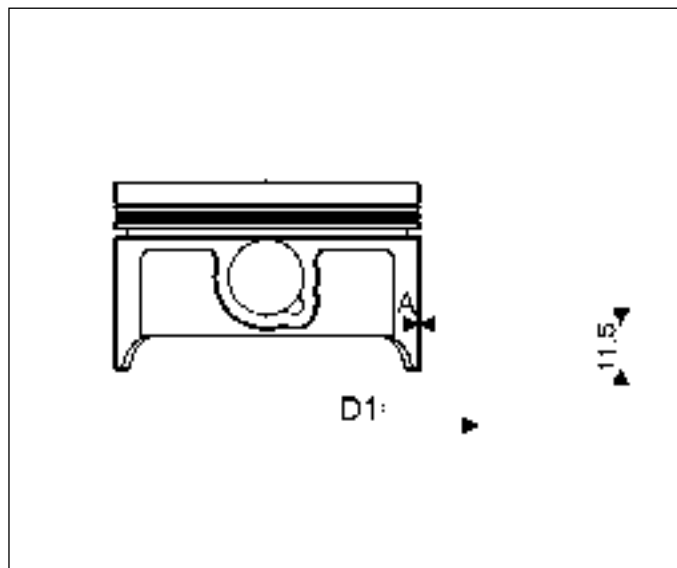
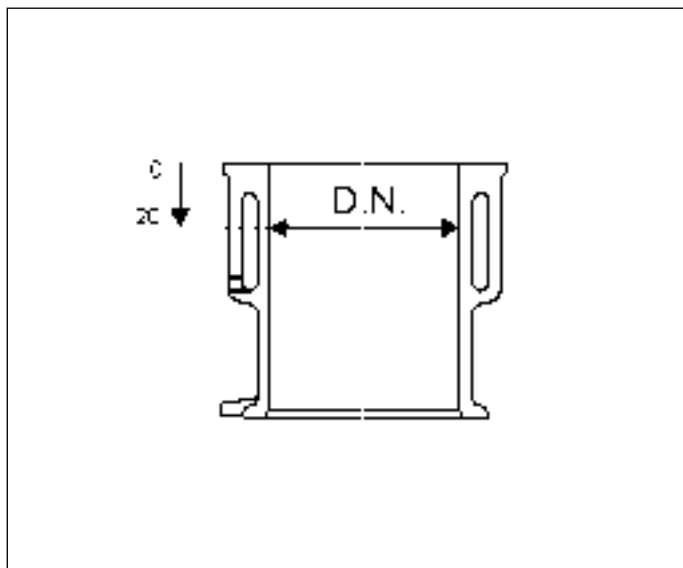
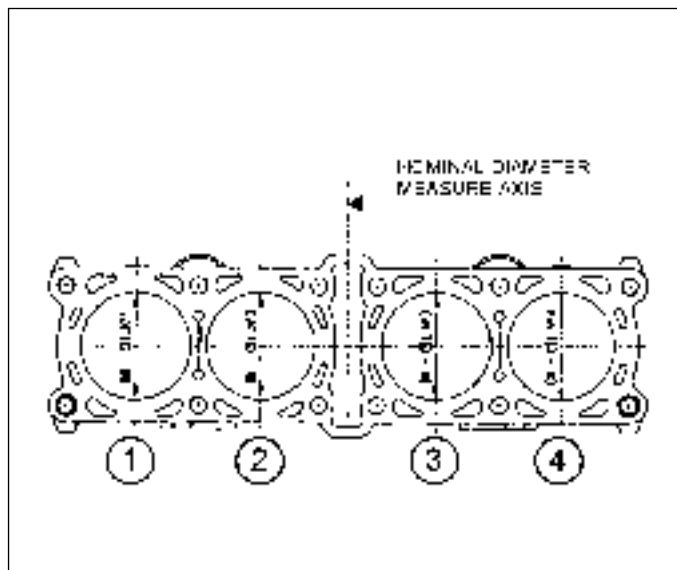
Measure the diameter of the (ND) pipe at 20 mm from the superior plane, as indicated on the sketch.

The piston diameter must be measured at 11.5 mm from the shell base, in a perpendicular position to the piston pin axle.

These measurements must be carried out at a stabilized temperature of 20°.

The play between piston and cylinder must fall between **0.025 and 0.045 mm**.

Maximum wear limit permitted 0.10 mm.



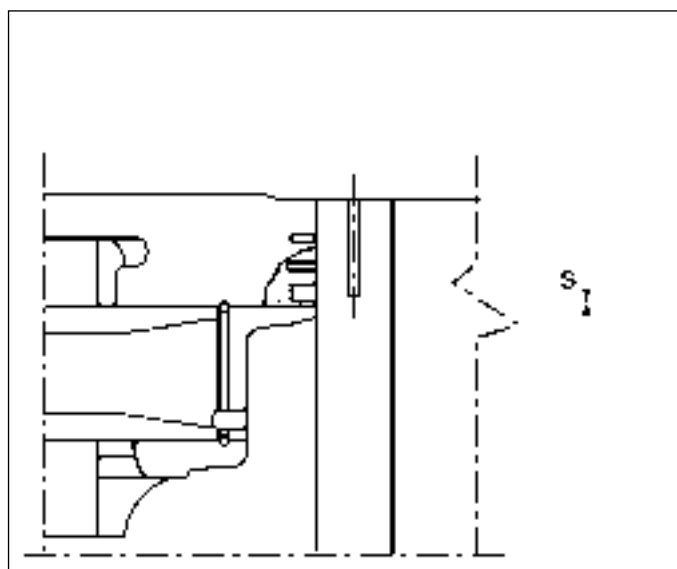
Piston pin revision

Verify that the piston pins show no lines or bluish colours which indicate overheating.

Piston-pin coupling

The (S) play between piston pins and piston must be of **0.004 ÷ 0.012 mm** in case the limit is exceeded it is necessary to substitute the piston pin and piston.

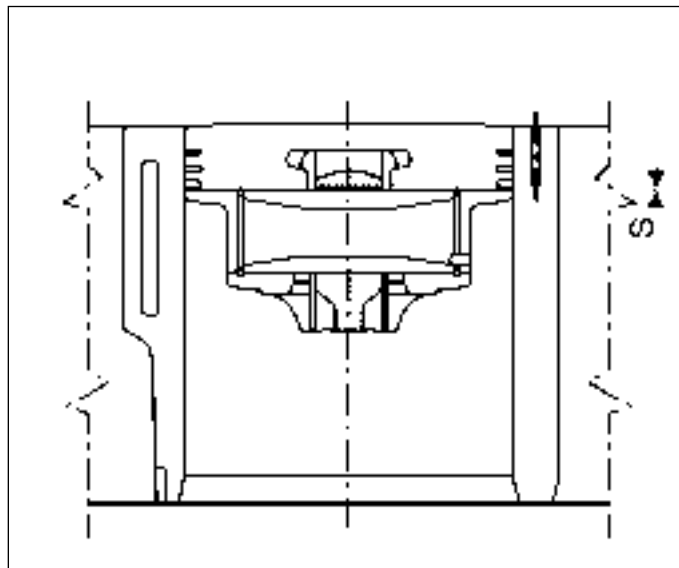
The limited wear permitted is **0.03 mm**.



Piston-pin connecting rod foot coupling

Play between piston pin and connecting rod foot must be of $0.015 \div 0.032$ mm.

Maximum wear limit allowed **0.04** mm.



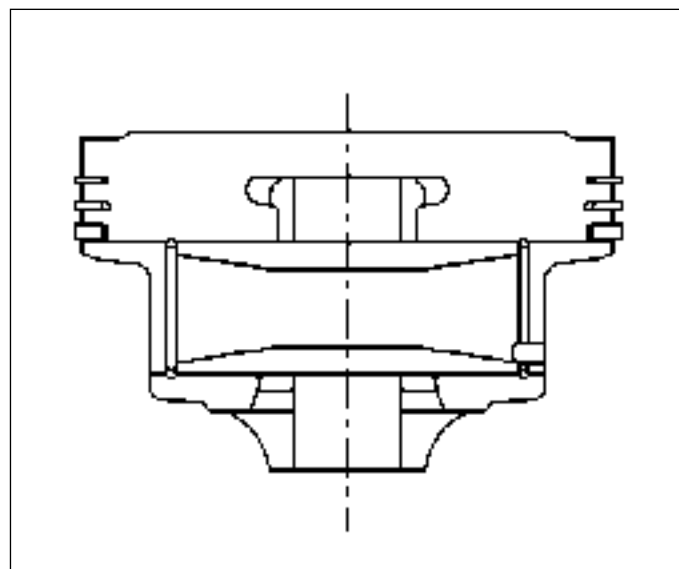
Segments

Verify the absence of lines and traces of shrinkage on each segment.

Verify that the edge of the segment is well defined and free in the segments.

The spare pistons are furnished complete with segments and piston pins.

Whenever segment wear is noticeable it is recommended to change the pistons as well.



SEGMENT	Standard	Wear limit
1°	SP 0.8 $\begin{smallmatrix} -0.01 \\ -0.03 \end{smallmatrix}$	0.75
2°	SP 1 $\begin{smallmatrix} -0.01 \\ -0.025 \end{smallmatrix}$	0.96
Oil scraper	SP 2 $\begin{smallmatrix} 0 \\ -0.1 \end{smallmatrix}$	1.88

Segment-cylinder coupling

Introduce the 5 mm segment under the head plane being careful to position it well in "square" and to measure the distance between the two ends of the segment.

The maximum play allowed between the ends of the ring is the following for each segment:

SEGMENT N°1: **$0.2 \div 0.4$ mm;**

Maximum wear limit allowed **0.6** mm.

INTERMEDIATE SEGMENT: **$0.2 \div 0.4$ mm;**

Maximum wear limit allowed **0.6** mm.

OIL SCRAPER: **$0.2 \div 0.7$ mm;**

Maximum wear limit allowed **1.0** mm.



Engine F4 ORO

Cylinder and piston assembly

The segments must be assembled on the piston with the writing Ne Top turned upwards and by following the outline in the figure.

Oil the connecting rod foot and piston pin.

Assemble the internal ring on the piston

Insert the pistons complete with segments on the connecting rods with the arrow facing the exhaust

Insert the piston pins into the piston until beat.

Assemble the external rings.



Before securing the piston pins with the blocking rings, cover the bedplate opening with a clean rag to avoid any pieces from falling into the oil cup. Always use new blocking rings.

Assemble a new gasket between the cylinder and bedplate.

Position the clamps onto the pistons in the direction shown in the sketch.

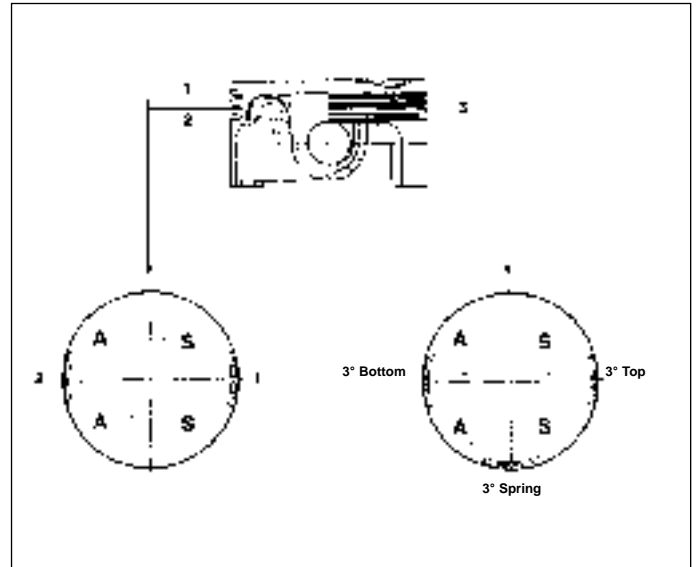
Oil cylinders and clamps.

Position the two pistons 1 and 4 at the MSP turning the drive shaft.

First insert the two pistons at the MSP, thus rotate the drive shaft at 180° to invert the piston positions and to insert the two remaining ones.

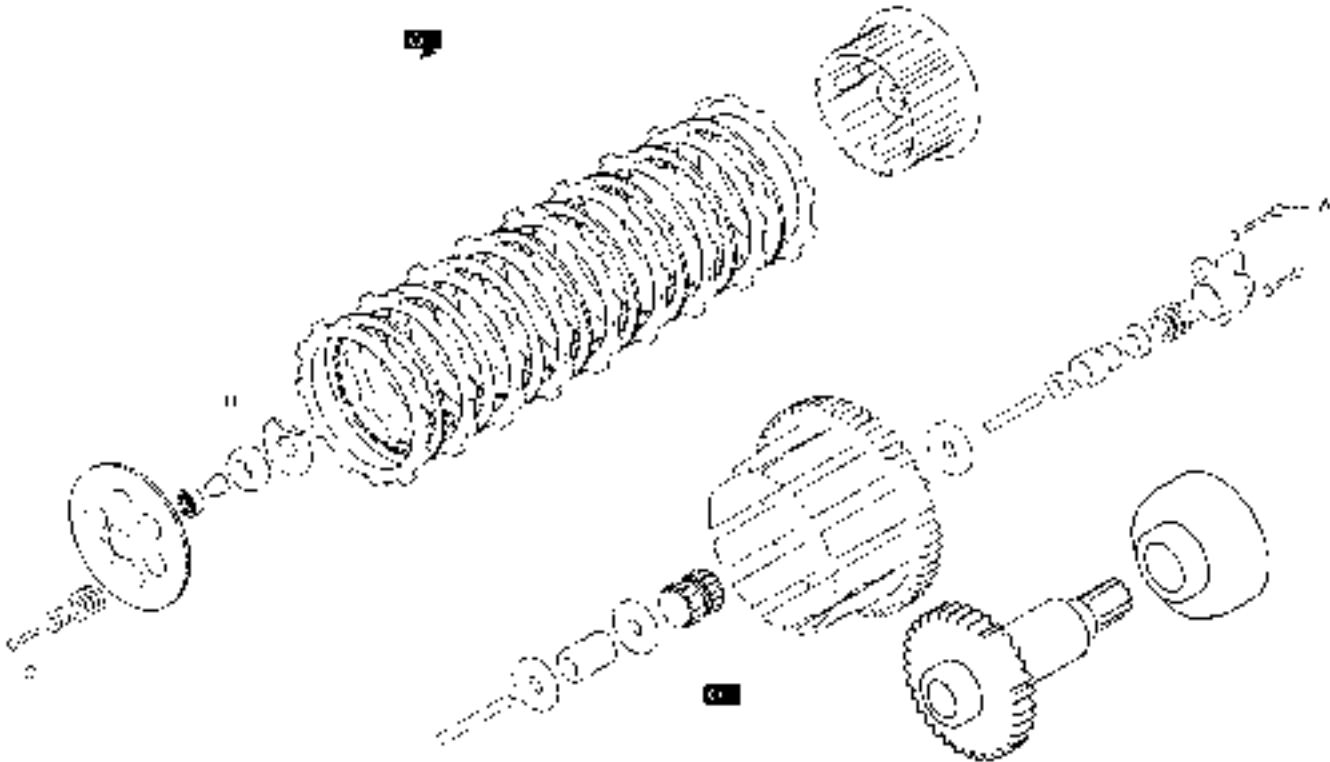
Insert the pistons by manually pushing down on the segments.

Proceed with maximum care since it concerns a very delicate procedure due to the fragility of the segments. Make some turns with the unloaded drive shaft and check to be sure that the pistons move freely without force.





CLUTCH



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	100	10							
	Kg·m										
	ft·lb										
Thread blockers			Strong								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

The clutch release occurs using a postponing return group composed of a small thrust piston placed on the left side of the motor and operated by a hydraulic system.

This small piston pushes a command rod which makes the disk pusher plate function.

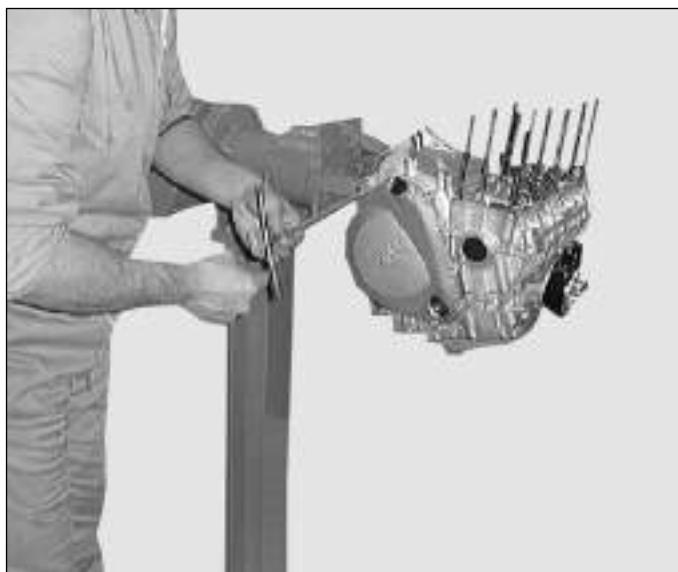
Clutch disassembly

In order to carry out this function the following special tool is necessary:

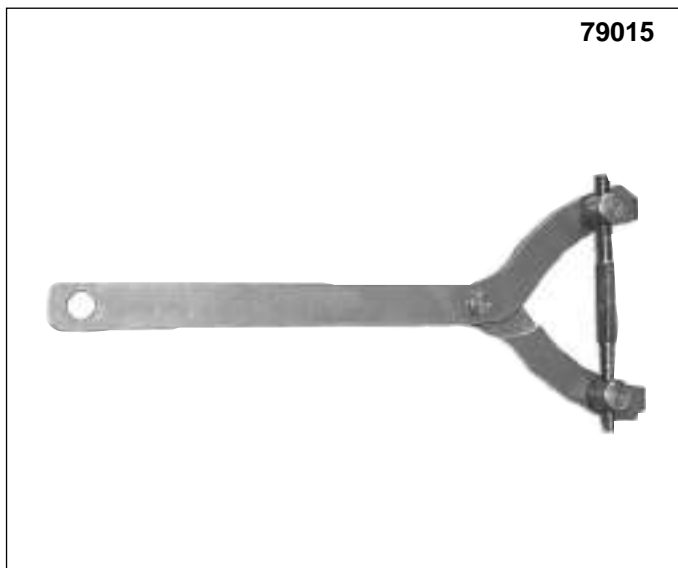
Utensil n° 79015

Remove the 11 screws which fasten the clutch cap to the bedplate.

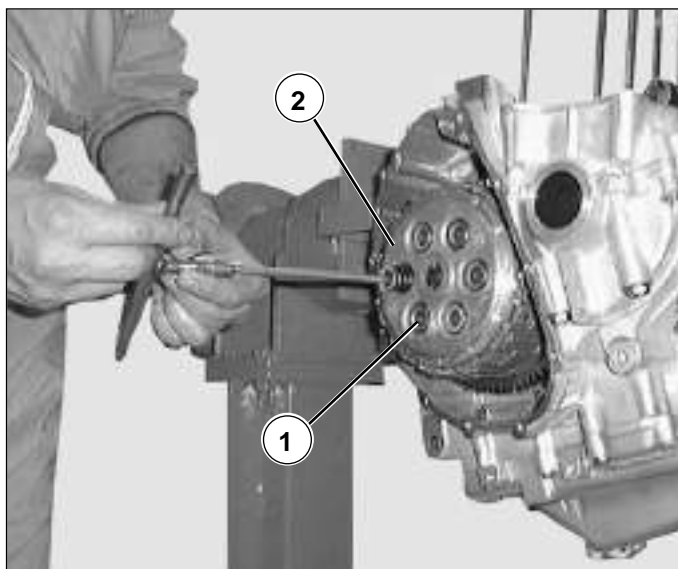
Remove the clutch cap together with the gasket which will be substituted during reassembly.



79015



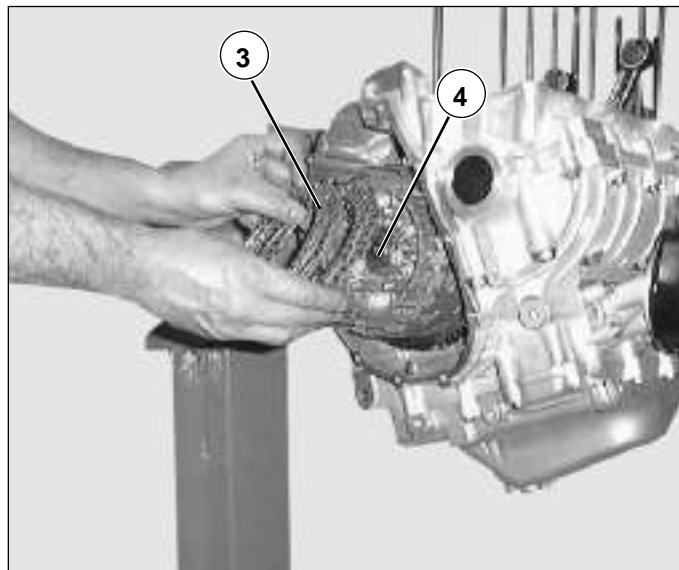
Remove the 6 disk pusher plate tightening screws (1) together with the relative springs (2).



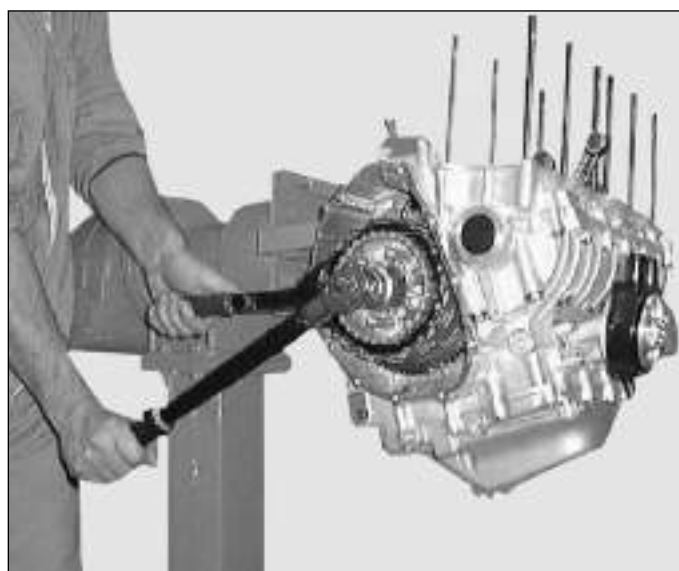
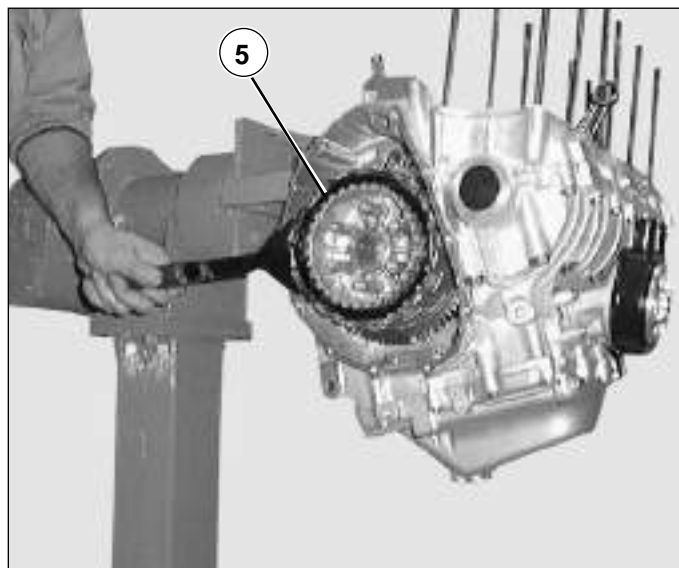


Engine F4 ORO

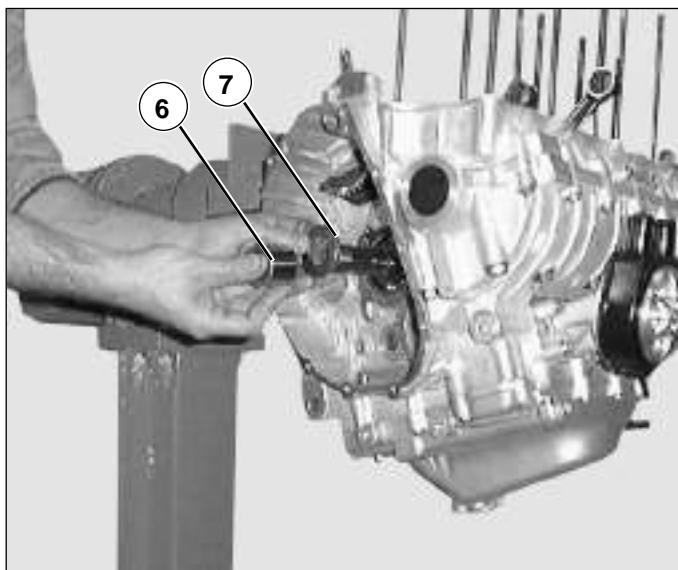
Remove the disk pusher plate.
Manually remove all of the attrition disks (3) that you can.
Straighten the nut washer (4).



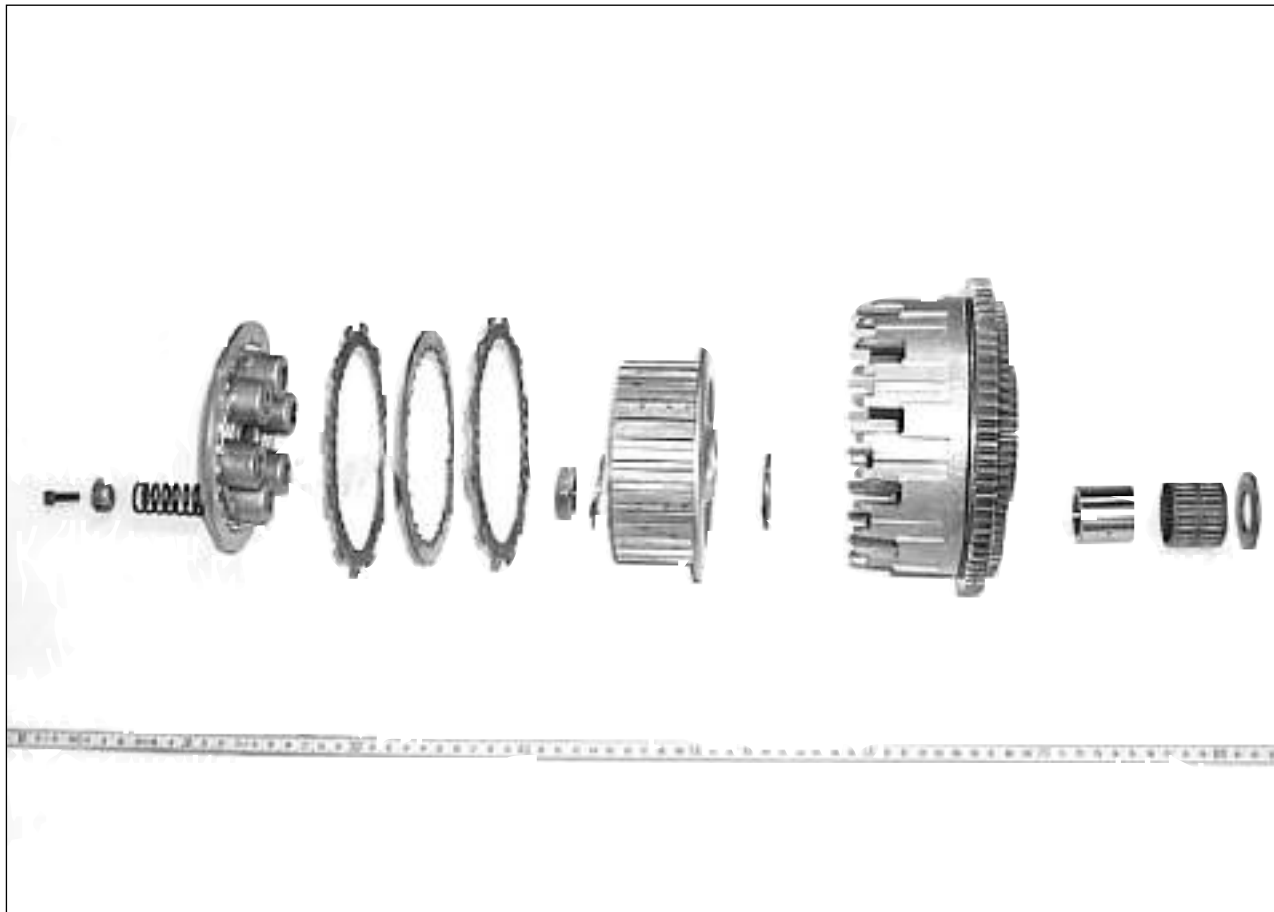
Unscrew the nut using tool n°79015 to hold the clutch hup still and remove it (5).



Remove the clutch block and then the separator (6) and the grazer washer (7).



Disassemble the clutch block following the sequence in the figure.



Clutch overhauling

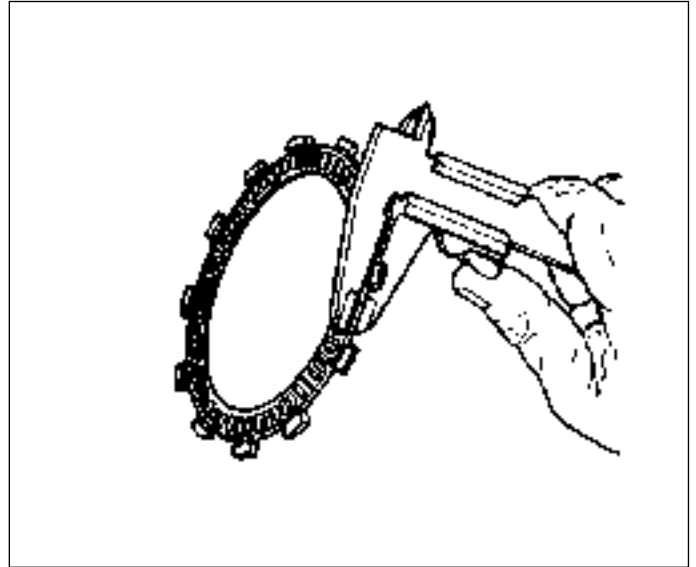
Check the rod for straightness and wear.

Check the friction plates for wear. **The standard thickness is 3 mm**

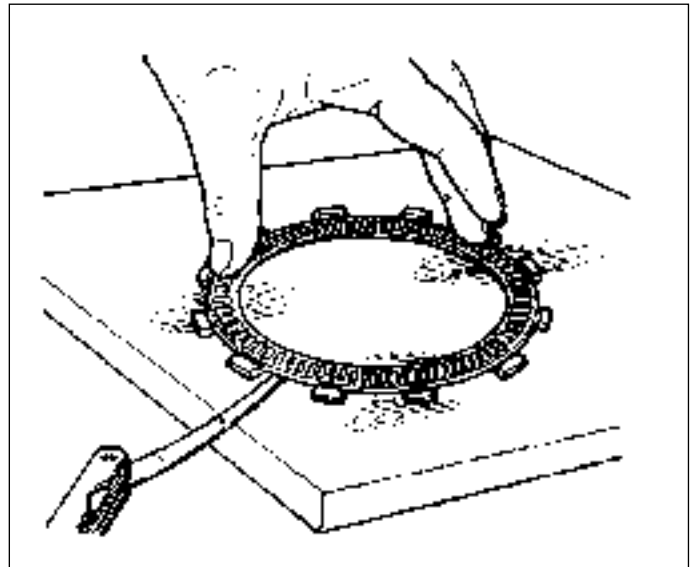
Wear limit : **2.8 mm**.

No signs of burning, grooves or other damages are allowed.

Replace the whole plates group even if only one is damaged.



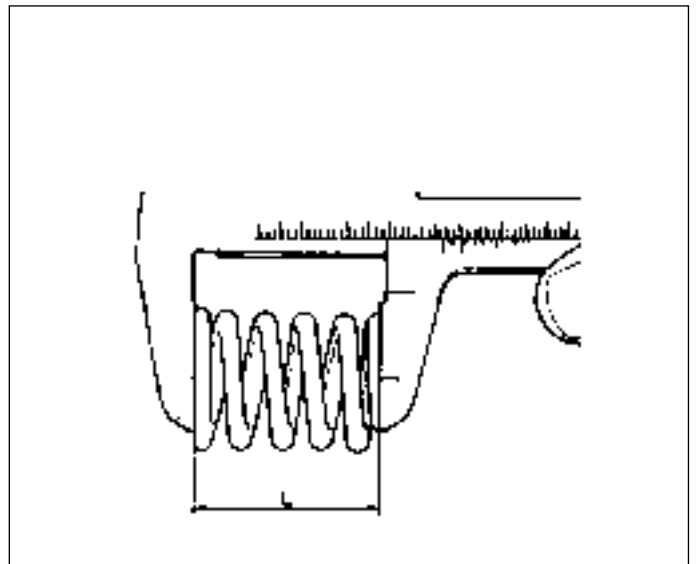
Put the plate on a table and check the deformation.



Measure the length "L" of the springs with a gauge.

Service limit: **38.8 mm**

Replace the springs exceeding the service limit.



Clutch reassembly

Assembling clutch block.

Assemble the disks alternating the 9 garnished ones with the 8 smooth ones beginning with a garnished disk.

Assemble the block respecting the 3 grippings particularly verifying the one with the drive shaft.

Insert the grazing washer and the separator.

Insert the clutch hub.

Insert the safety washer and nut.

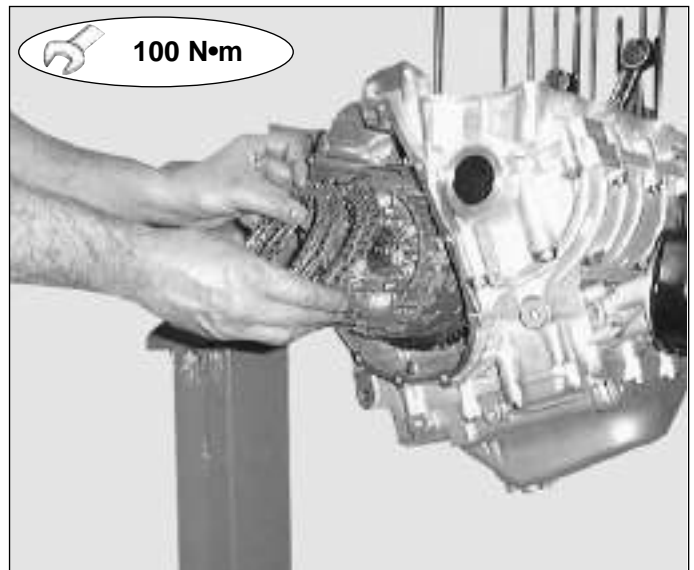


It is recommended that a new safety washer and nut be used during reassembly.

Tighten the nut at 100 Nm using a strong thread blocker and bend the safety washer.



The first 8 garnished disks must be assembled in the same clutch dome groove. The last disk must be rotated a pace further than the proceeding ones.



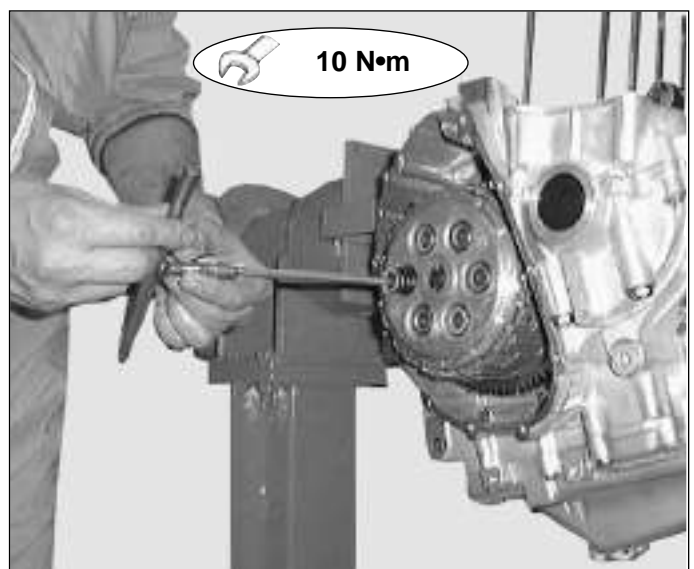
Assemble the disk pusher plate tightening the screws with springs as 10 Nm.

Substitute the cap gasket.

Aline the centering pins.

Position the cap and manually bring screws close.

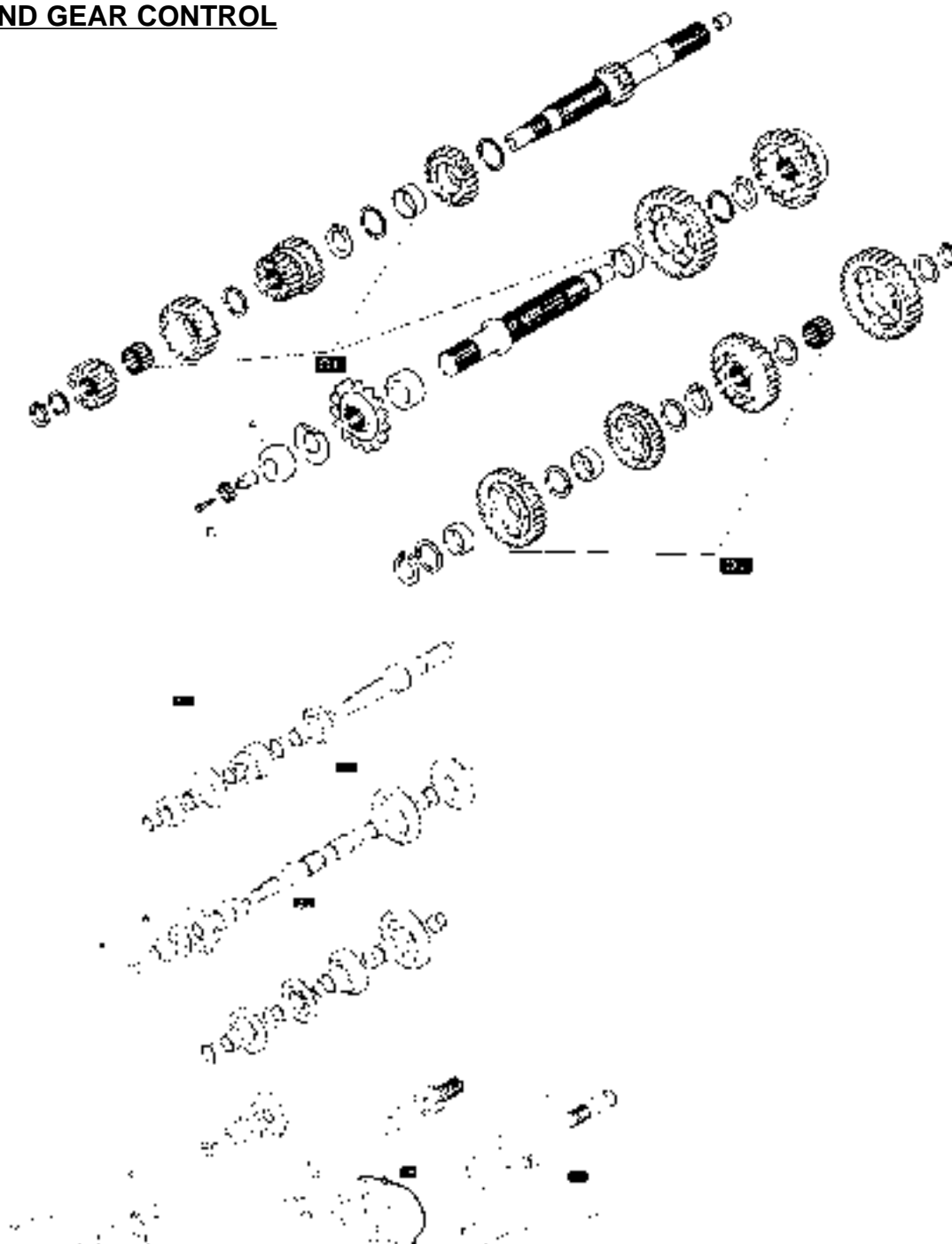
Tighten the screws at 8 Nm.





Engine F4 ORO

GEAR AND GEAR CONTROL



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	100	8	8	6	12	25				
	Kg·m										
	ft·lb										
Thread blockers		Strong	Medium			Medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



Engine F4 ORO

Disassembling gear group

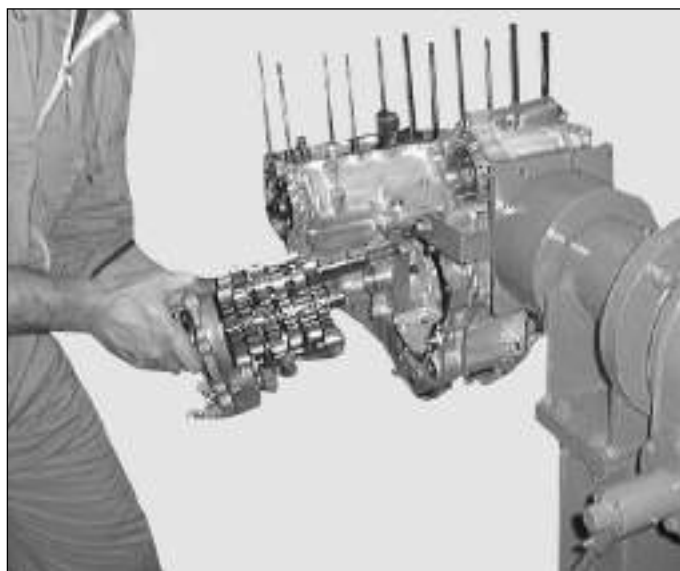
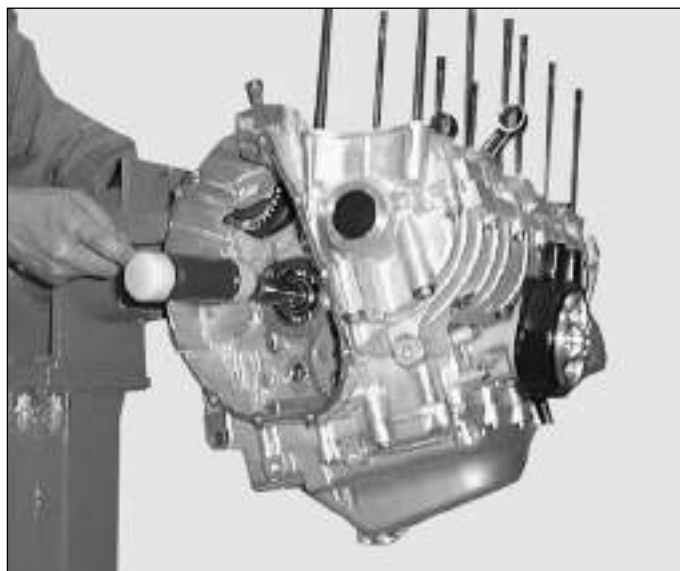
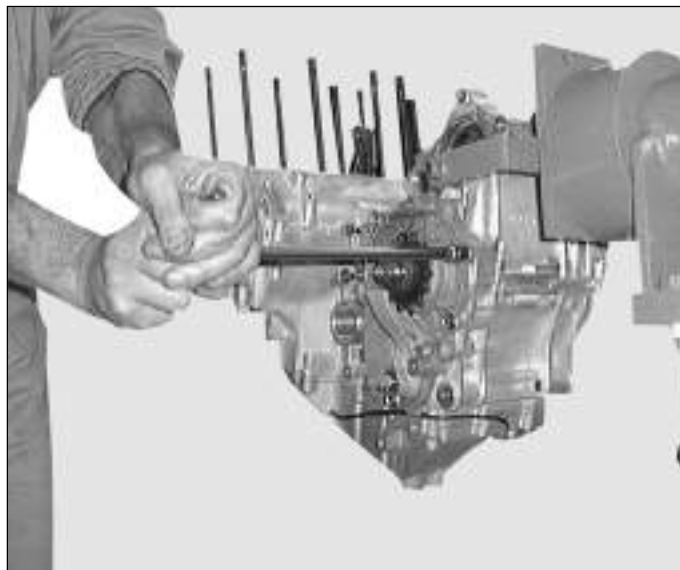
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.

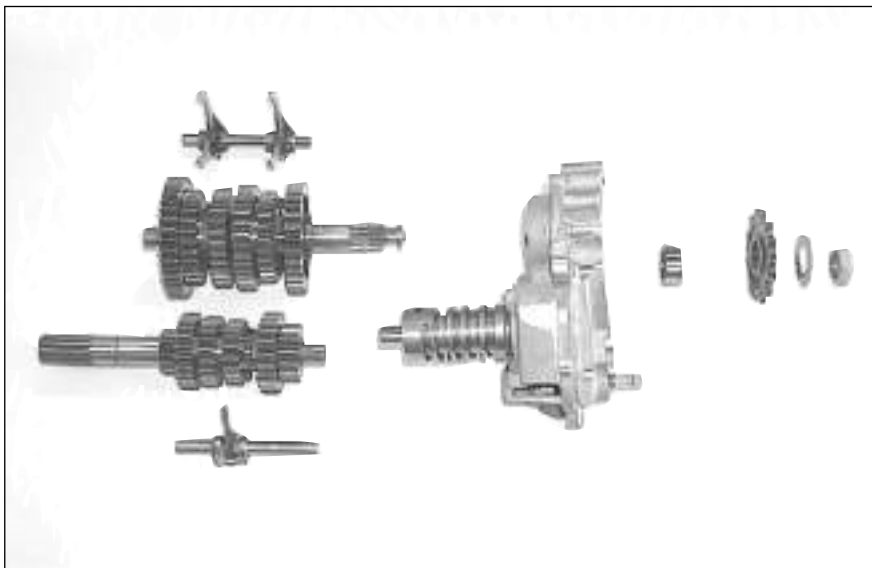


Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear or irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

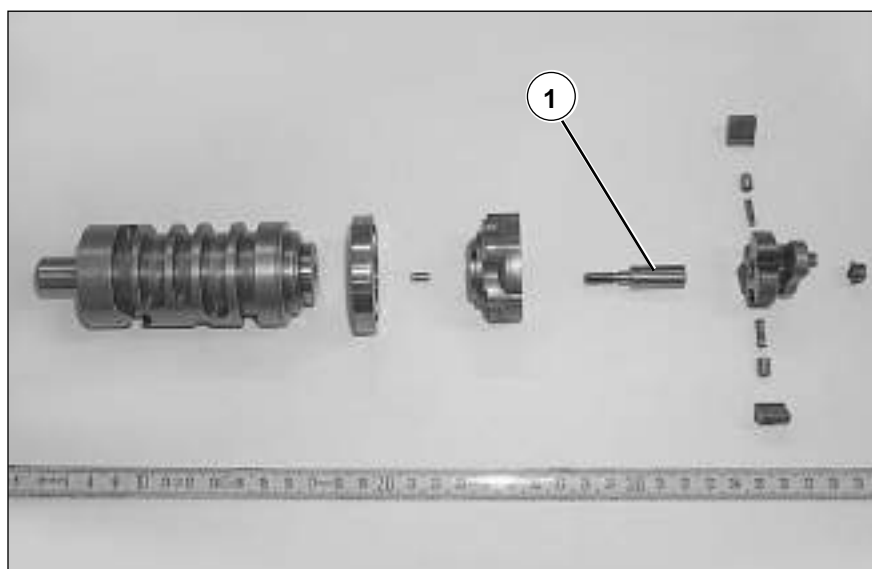
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.



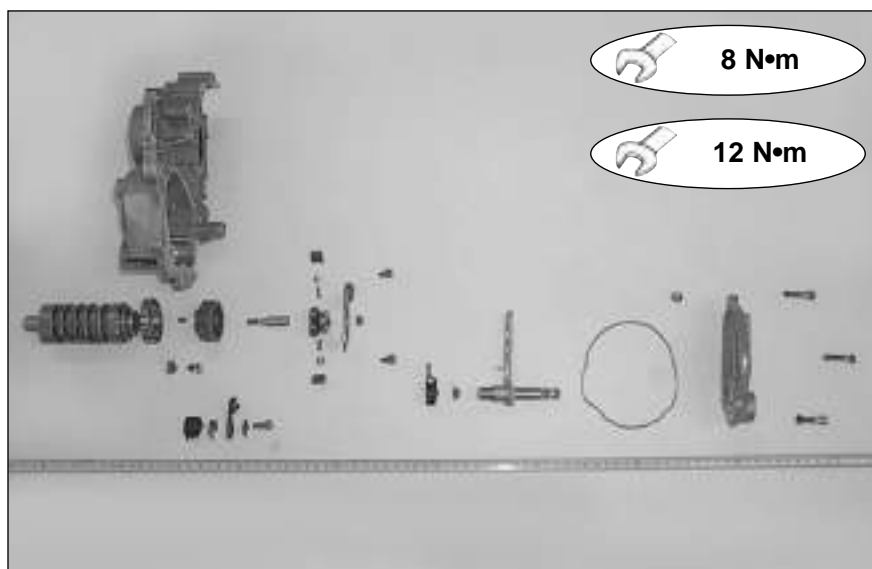
Verify the gear locker pawl free movement.

Reassemble the various parts by acting in the opposite way.

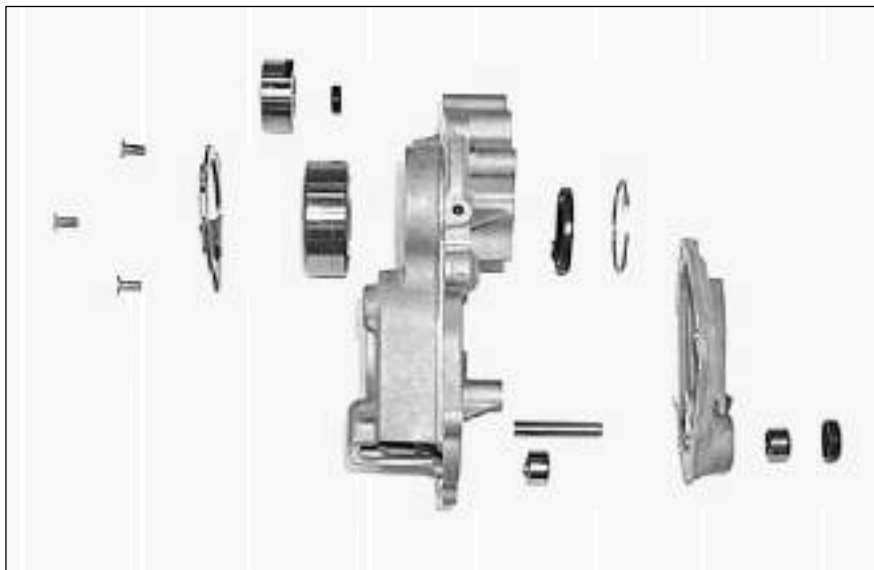


Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly.

Lock all the screws at a 10 Nm torque but the screw 1, needing a 12 Nm torque.



B

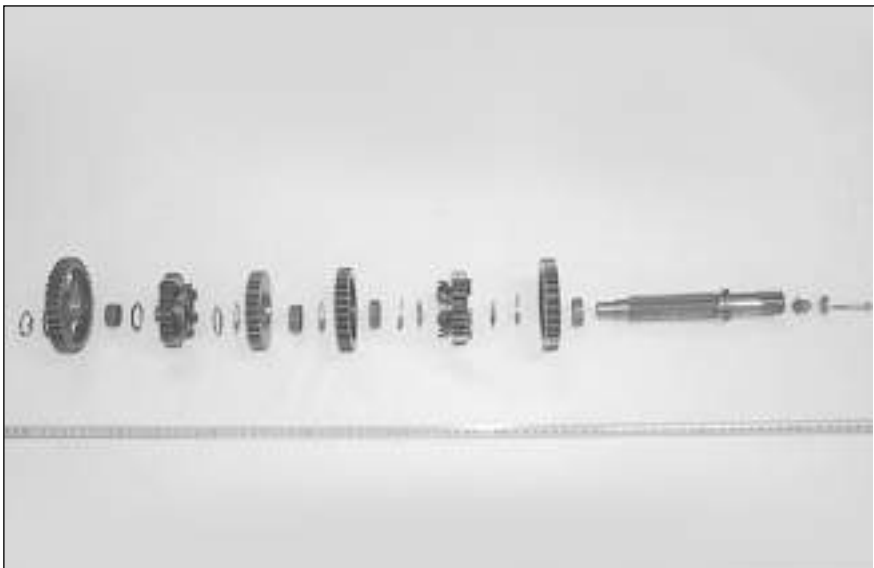
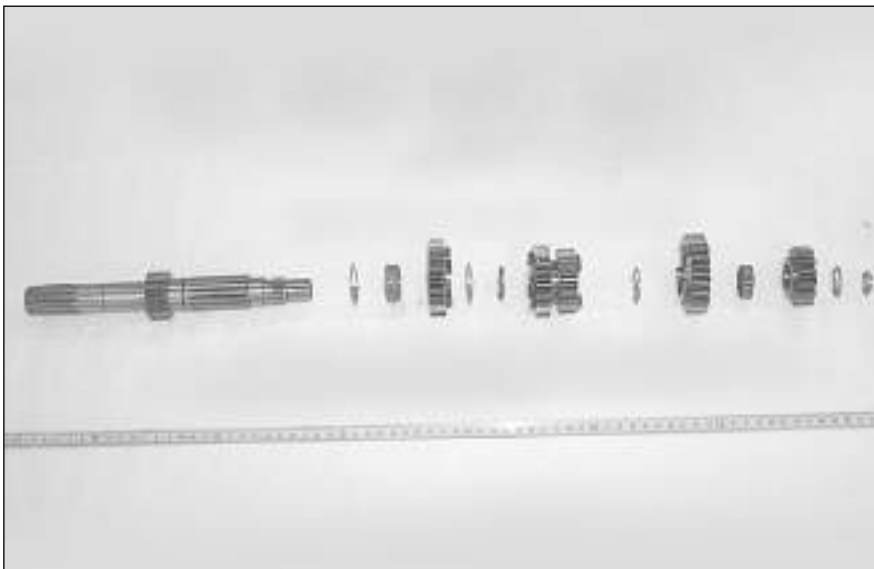


Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.





Engine F4 ORO

Gear group revision

In order to carry out the following procedure the following special tool is necessary:

Motor simulation utensil n° 94792

Disassemble the gear group from the motor and reassemble it on the special utensil n° 94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.

Gear selection forks

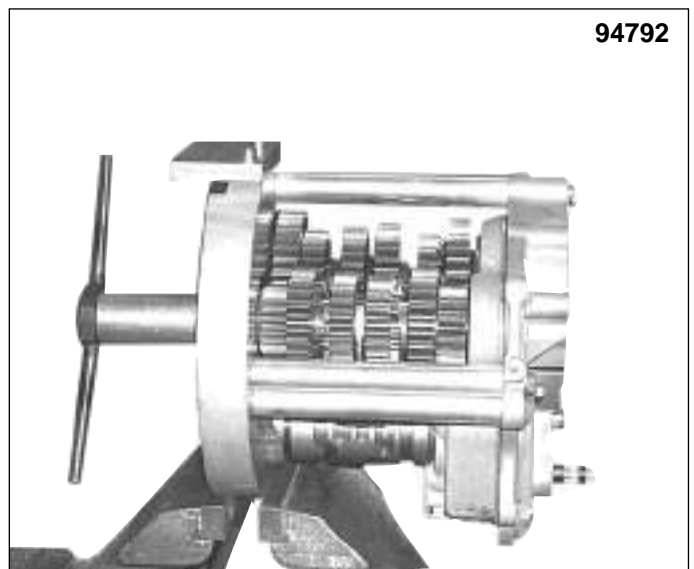
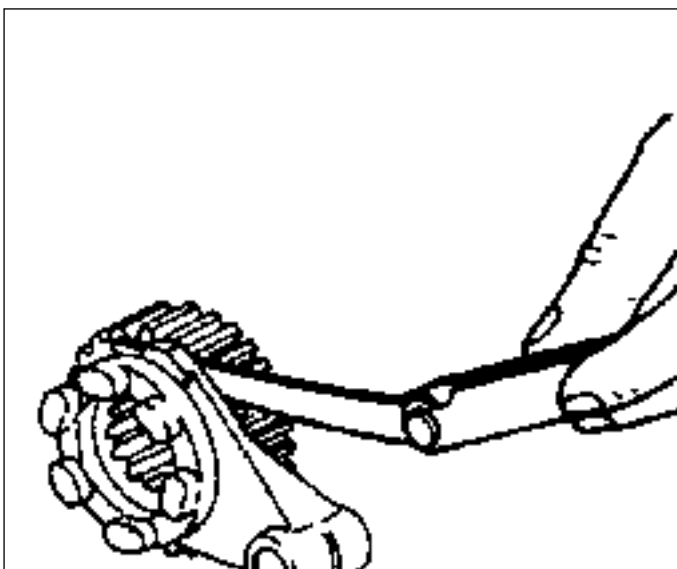
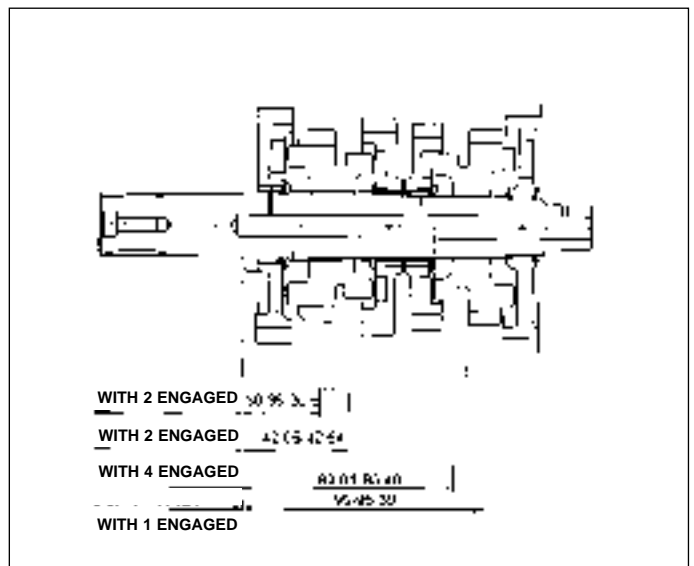
Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm Primary
	4.6 mm Secondary
Fork limits	4.65 mm Primary 5-6 gear
	3.65 mm Secondary 1-2, 3-4 gear

The fork must be able to move without force.

Grippage of the gears must flow without impediments and without excessive attritions.



94792

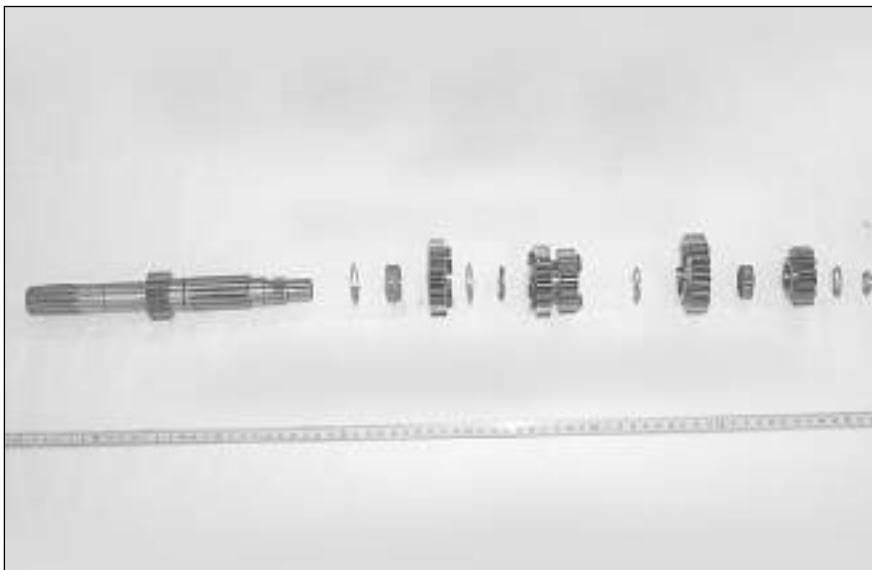


Engine F4 ORO

Installation

To execute this operation you need the following special tools:

B n° 94792 gearbox tool

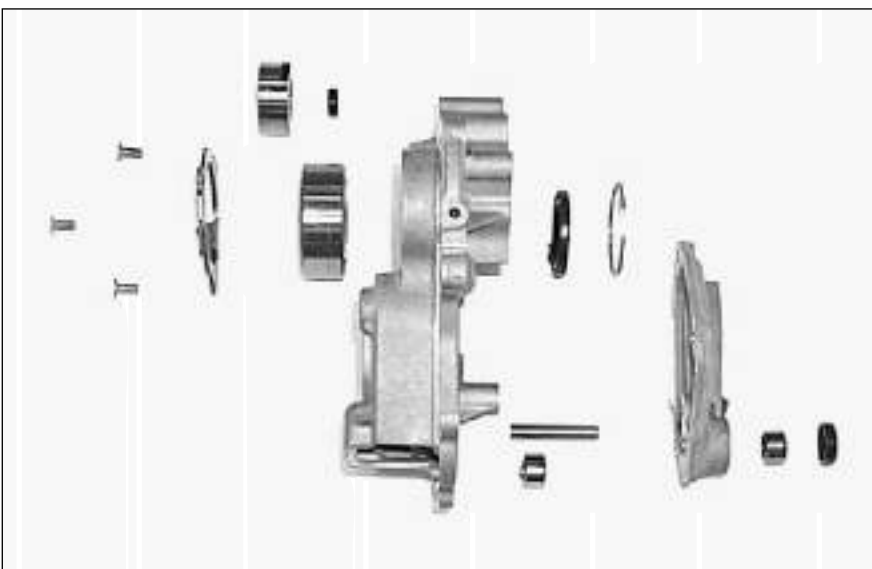


Reassembly the various parts by acting in the opposite way.
Install the 2 shafts on the n° 94792 engine simulation tool.
Install a shift pedal and check the gear box is correctly working.

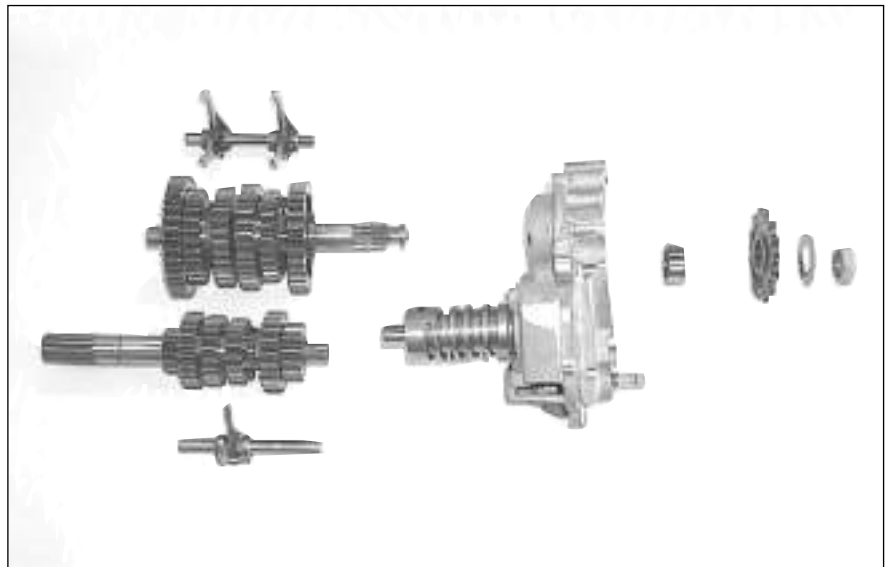
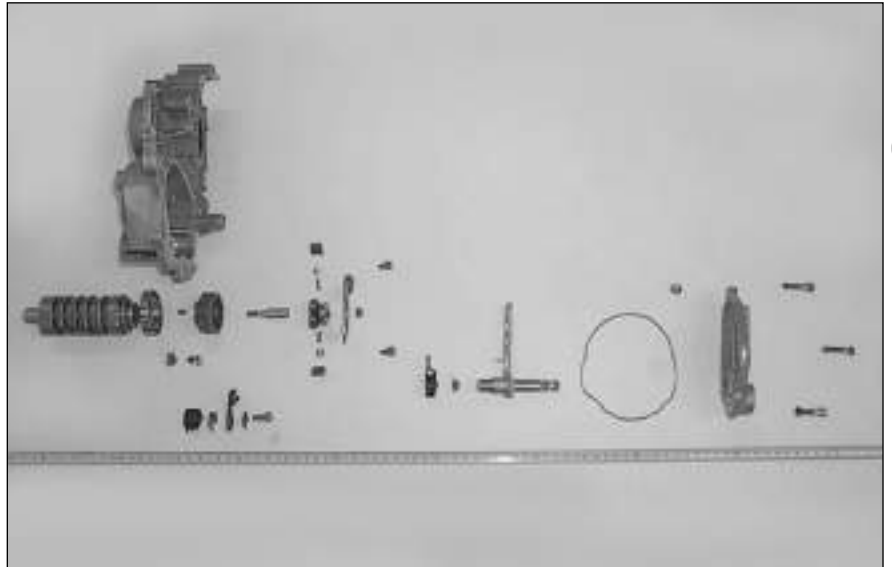


Always install a new washer under the pinion at reassembly. Carefully degrease the threads before reassembly.

Tighten the pinion nut at 100 Nm using a strong thread blocker. Turn the security washer again so as to avoid the accidental unscrewing of the pinion nut.



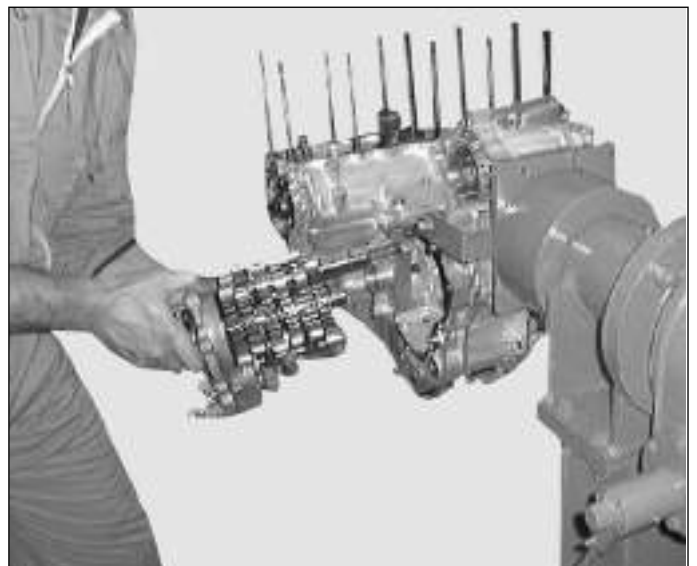
All the gears must be inserted and uninserted without stumbling.
In case of stumbling, verify that the axial play has been correctly restored.
With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to $0.2 \div 0.3 \text{ mm}$ placing it on both ends of the coupling.
The fork must be free.
Assemble the gasket on the internal end.



Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.



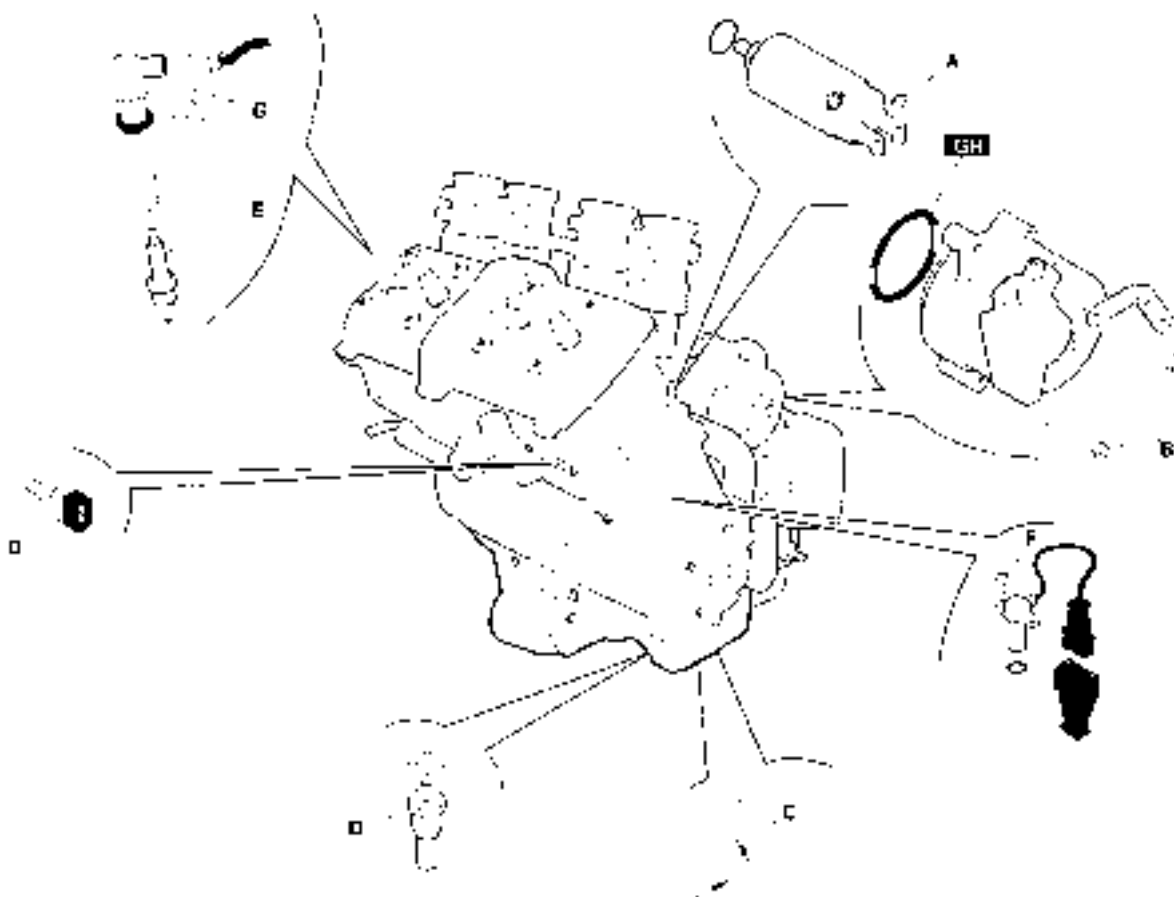
Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.





Engine F4 ORO

ELECTRICAL COMPONENTS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	25	10	22	12	6				
	Kg·m										
	ft·lb										
Thread blockers					Medium		Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Remove the pick-up from the phonic wheel.

Alternator

- Removal:

Working on the left side of the motor, remove the three alternators and the stiffening stirrup tightening nuts.

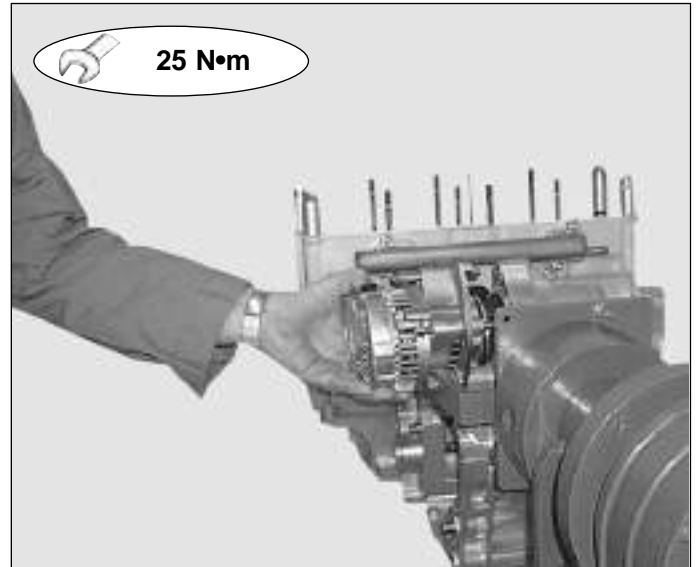
Slide the alternator out being careful not to let the rubber torsions fall .

Assembly:

Grease the torsions and O-Rings.

Insert the pallets together with the torsions.

Manually bring the screws together, thus tighten them at 25 Nm.



Starter motor

- Removal:

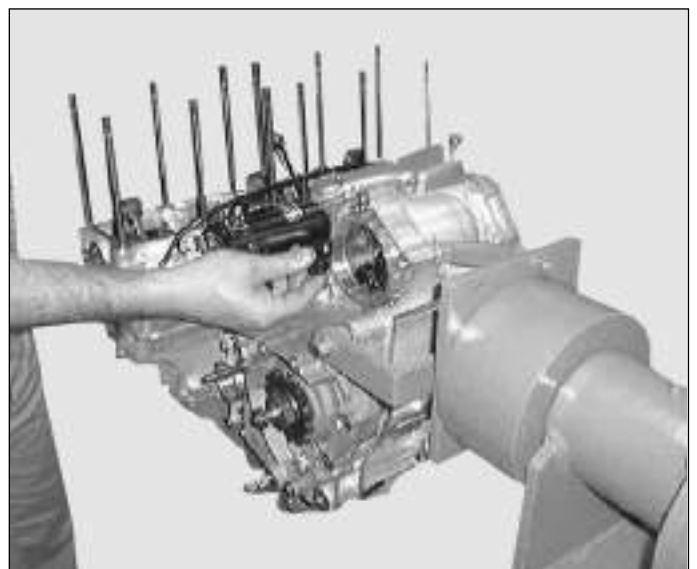
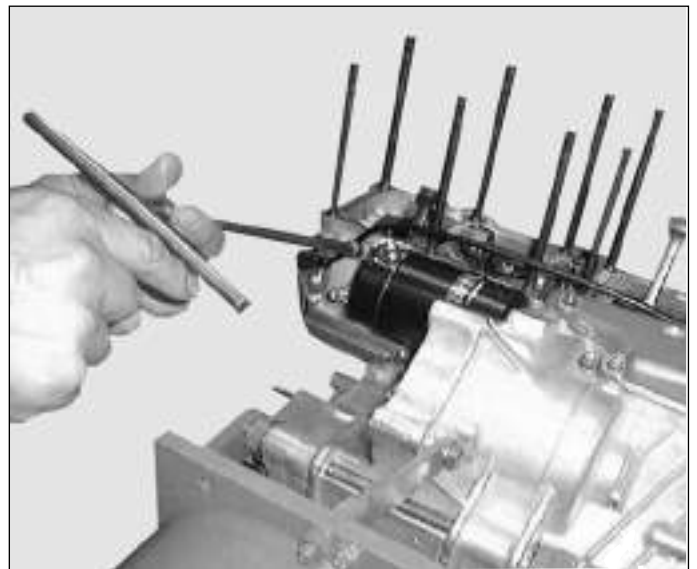
Remove the two tightening screws.

Slide the starter motor out, being careful not to damage the O-Rings on the shaft.

Assembly:

Reassemble the motor on the bedplate.

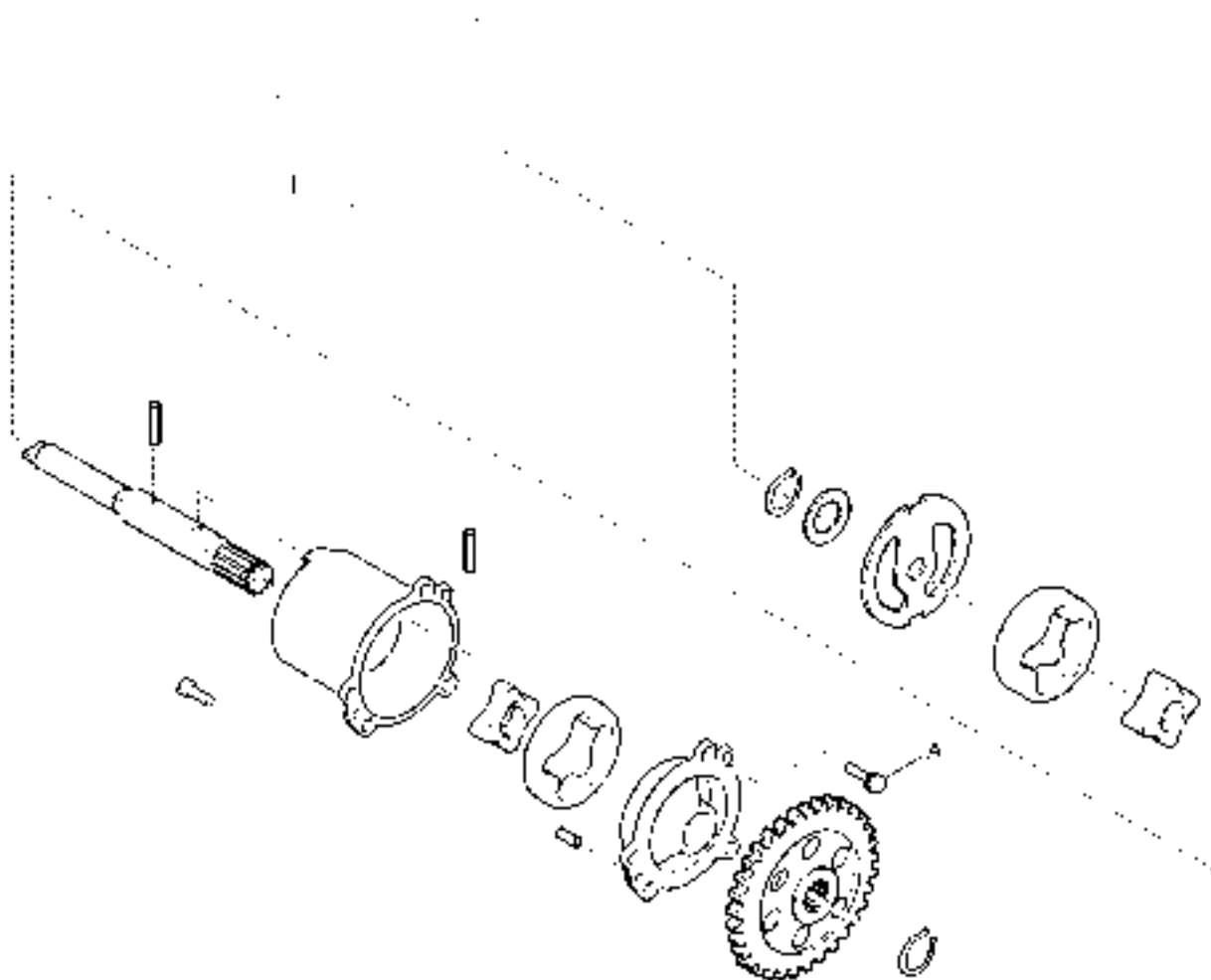
Manually bring the two screws together, thus tighten them at the prescribed coupling.





Engine F4 ORO

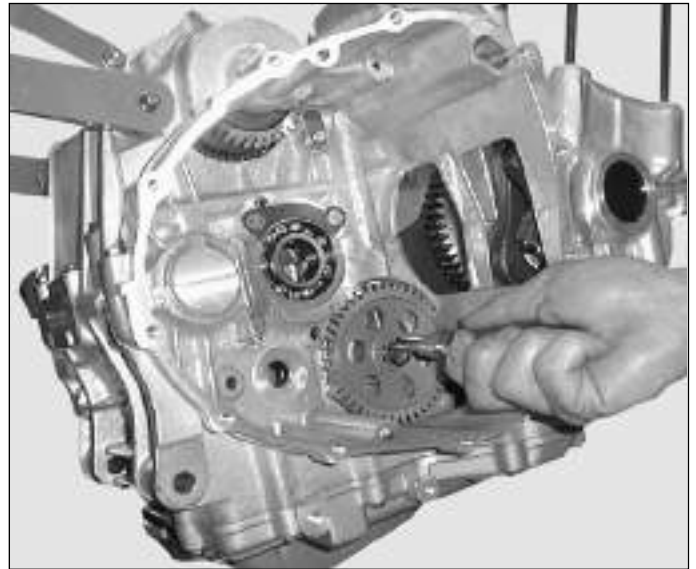
OIL PUMP



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8									
	Kg·m										
	ft·lb										
Thread blockers		Medium									

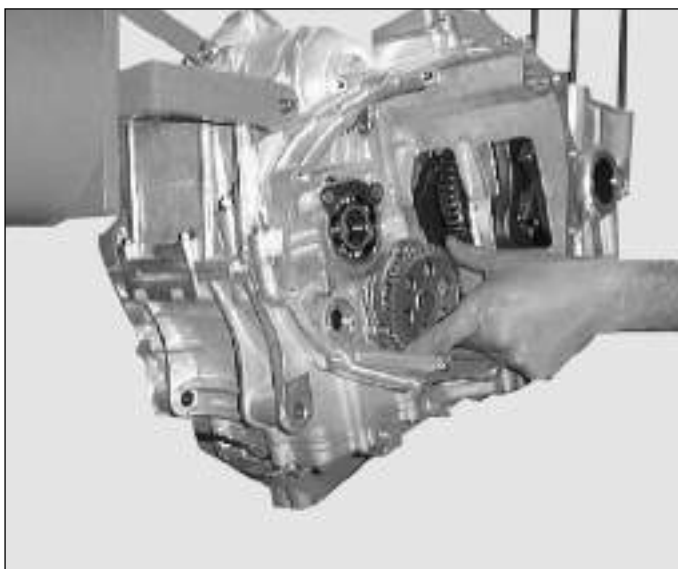
OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Remove the clutch and the gear as described in the relative paragraphs.
 Remove the seeger and the oil pump gearing.
 Remove the 3 tightening screws.
 Push the oil pump shaft from the gear end and slide the oil pump body from the clutch end.
 To disassemble the oil pump remove the external screws.
 Separate the various components as indicated in the figure.



B

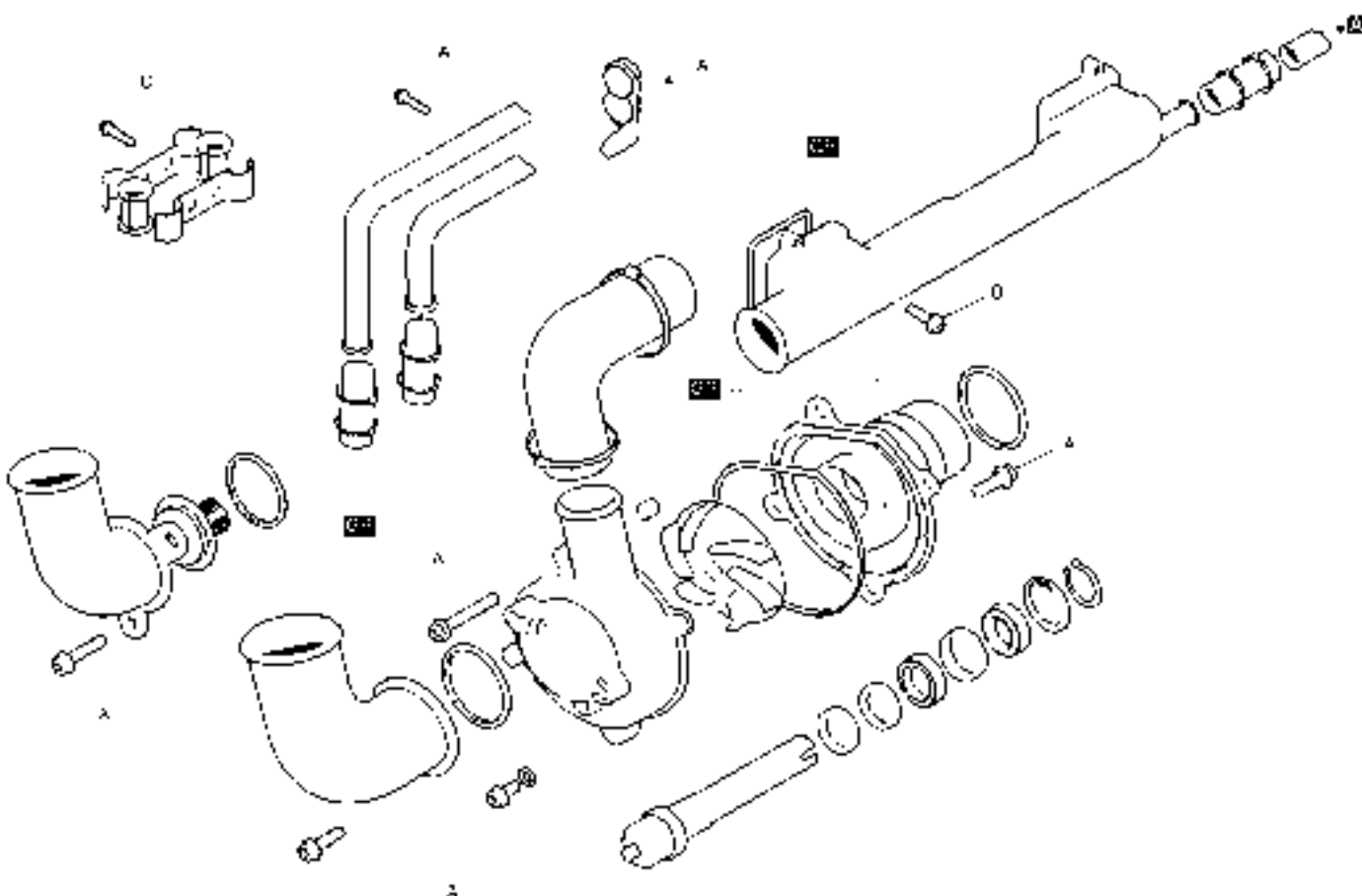
Visually check the components to be sure that there are no lines of deformations.
 In case one of the pieces should be damaged, substitute it with a new one.
 Reassemble the oil pump in the reverse order of assembly.
 Tighten the 3 screws at 8 Nm with 242 LOCTITE carefully degreasing them before reassembly.





Engine F4 ORO

WATER PUMP



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	8	6							
	Kg·m										
	ft·lb										
Thread blockers			Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Removing water pump



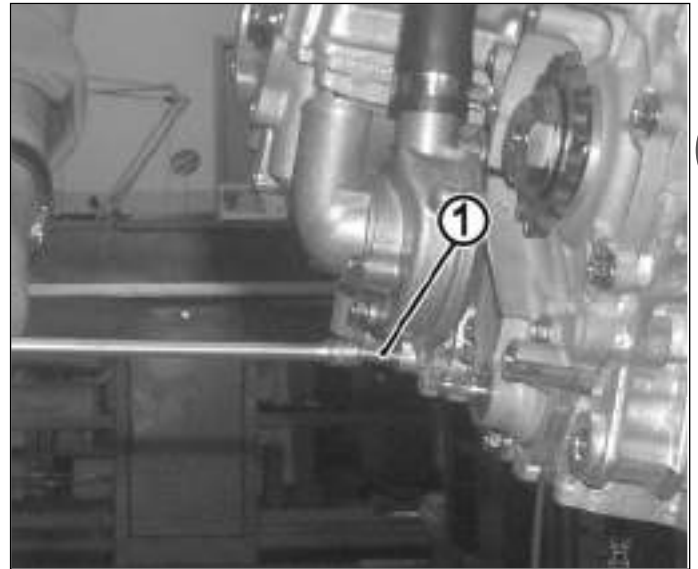
Work with cold motor.



Drain liquid.

A) Loosen the clamp and remove the coupling from the cylinder group, being careful not to damage it.

B) Remove the screws (1) which fasten the pump body to the bedplate.



C) Slide the pump out of the bedplate.



Disassembling water pump pieces

After having extracted the pump from the bedplate disassemble the pump as follows:

A) Remove the tightening screws from the pump body (1) and separate the latter from the cap.



Be careful no to let the two centering bushes fall (9).

B) Remove the two O-Rings (2)

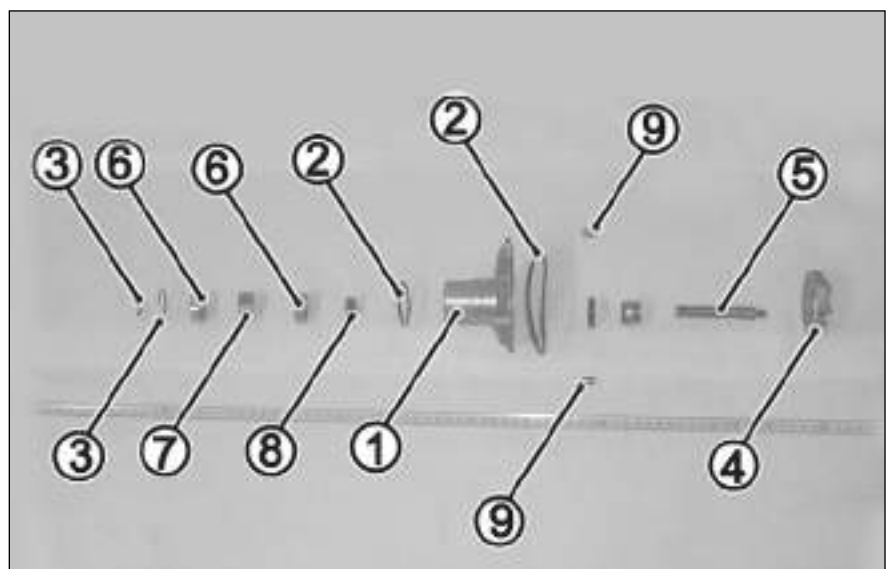
C) Remove the two seeger rings (3)

D) Take the impeller out (4) from its shaft (5)

E) Separate the impeller (4) from its shaft (5) by unscrewing.



During the following procedure use the necessary precautions so as not to get burned.

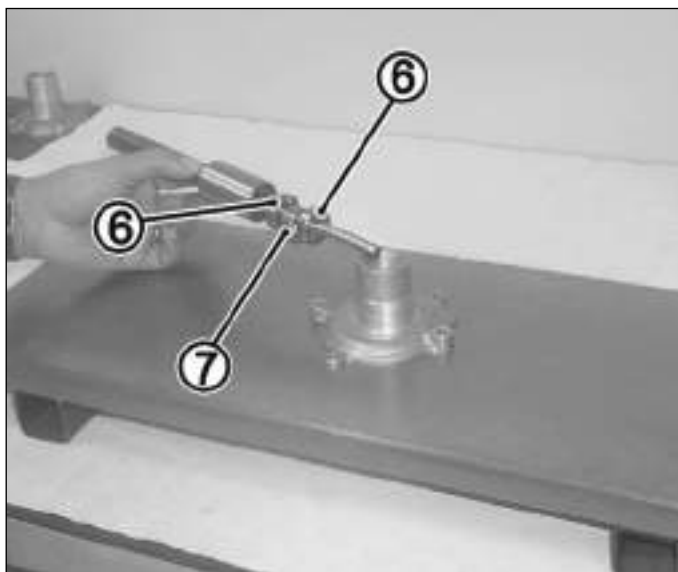




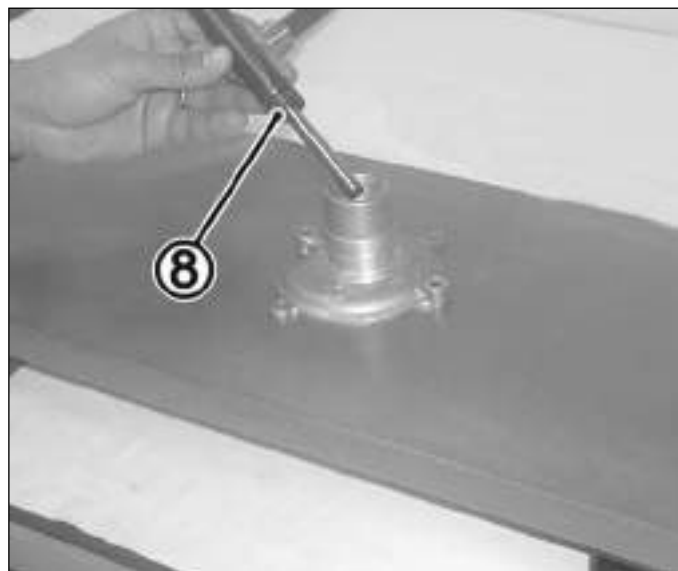
Engine F4 ORO

- A) Heat the pump body (1) at 120°C.
B) Remove the two bearings (6) with its relative space (7).

B



- C) Reheat in oven at 120°C
D) Take the ring out (8)



Revision of water pump pieces

Verify that each component does not show any wear signs.

In particular verify the flowness of the bearings and the O-Ring condition

Verify that the impeller does not show signs of giving away or slits.

Verify the absence of excessive play between the impeller shaft and bearings.

In case of wear of one of the components substitute it

Reassembling water pump parts



During the following procedure use the necessary precautions so as not to get burned

- A) Heat the pump body (1) to 120°C
B) Insert the ring (8). Always use a new ring carefully degreased in alcohol.

C) Insert the two bearings (6) with its relative separators

D) After having waited for the pump body to cool (1),
Insert the impeller (4) complete with its shaft (5)

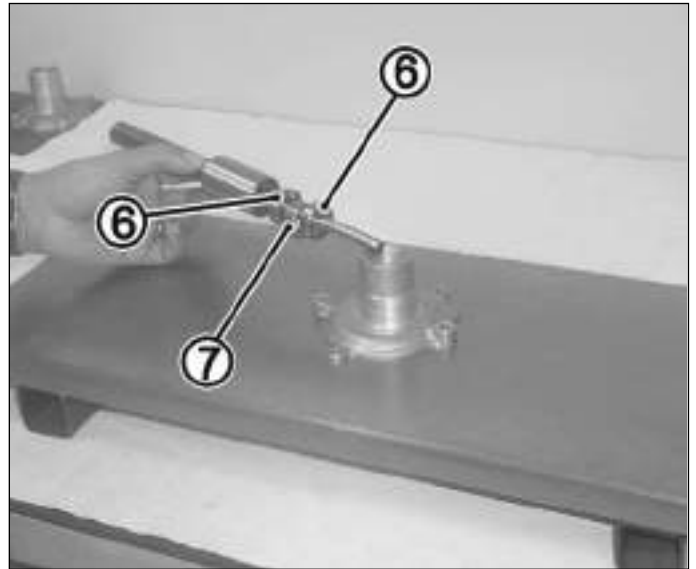
E) Insert the two seeger rings (3)

F) Insert the two O-Rings (2)



Be careful not to let the two centering bushes fall (9).

G) Insert the two pump body tightening screws (1) and unite the latter to its cap.

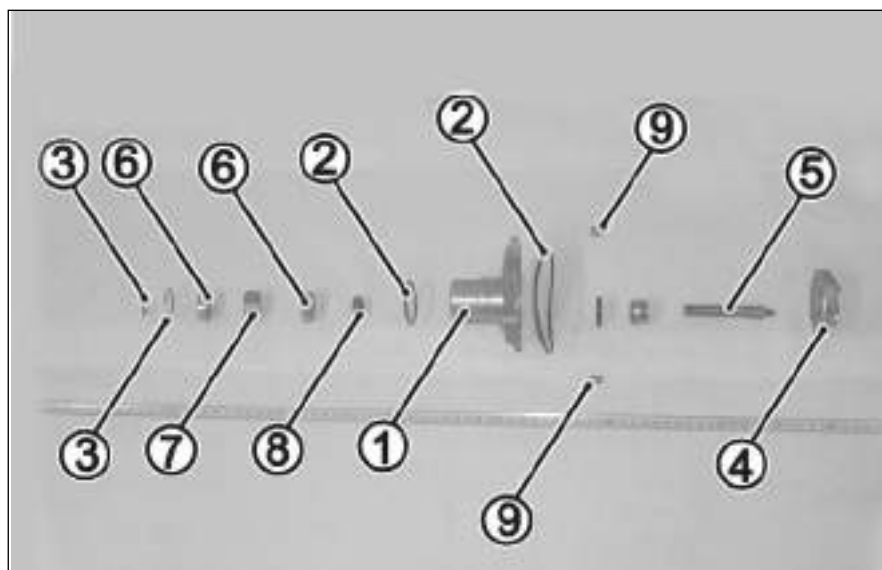


Water pump reassembly

A) Insert the pump on the bedplate being very careful not to damage the O-Ring on the pump body

B) Insert the screws (1) which fix the pump body onto the bedplate

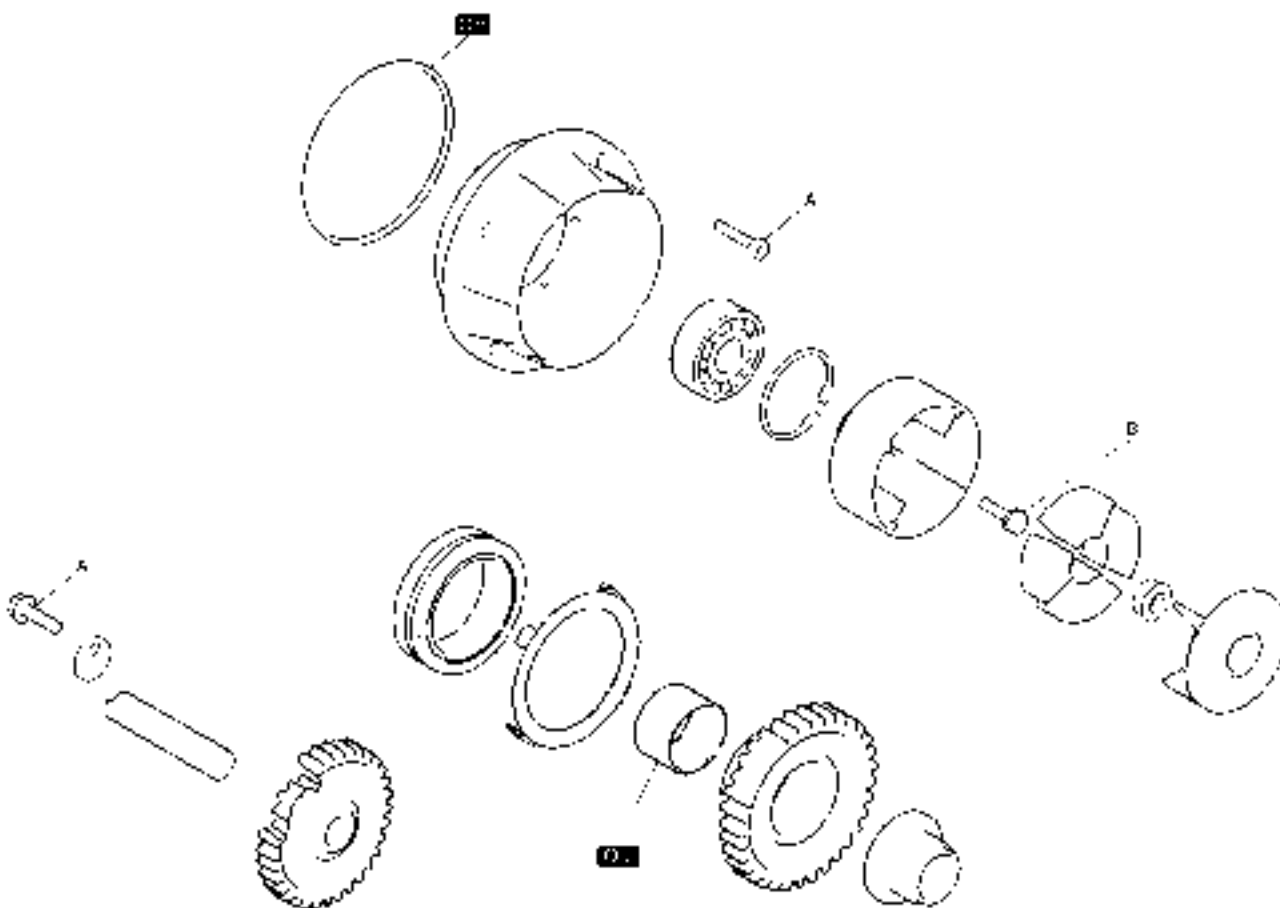
C) Install the coupling with its clamp onto the cylinder group, being careful not to damage it.





Engine F4 ORO

STARTING



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	25								
	Kg·m										
	ft·lb										
Thread blockers		medium	medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Free wheel starting

Remove the clutch and gear indicated in the relative paragraphs.

Slide out the intermediate starting gear pin, first disassemble the pin-blockage plate.

Slide the intermediate gear.

Slide the alternator flange and generator shaft out.

If necessary disassemble the male torsion from the generator using tool n° 94794 to unscrew the nut.

Disassemble the generator command shaft using the appropriate 94795 blockage tool to unscrew the screws.

Disassemble and verify the free wheel state.

Reassemble the free wheel with the seeger turned towards the inside; to facilitate the procedure, insert the part where the seeger is opened last. Verify that the free wheel only turns clockwise.

Assemble the group on the tool 94795 and block the screw with a dynamometric key at 25 Nm and 242 LOCTITE.

Reassemble the male torsion joint on the generator tightening nut with 242 LOCTITE at 25 Nm.

Turn the oil drainage hole downwards present on the flange.

Tighten the screws with 242 LOCTITE at 8 Nm.

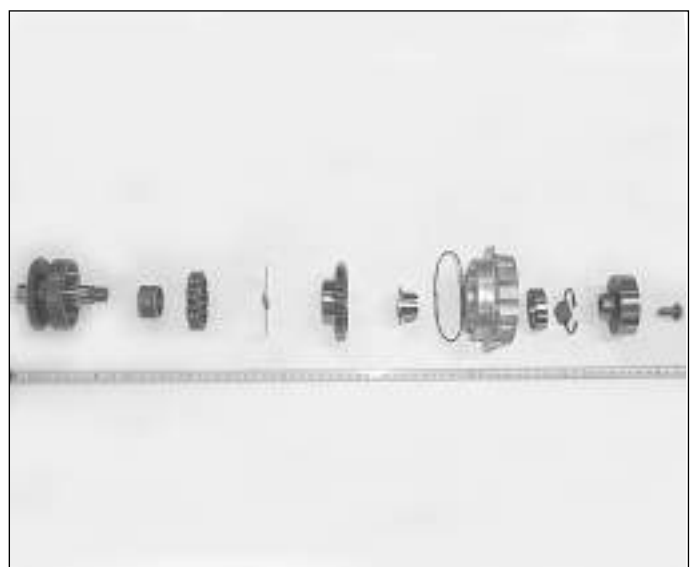
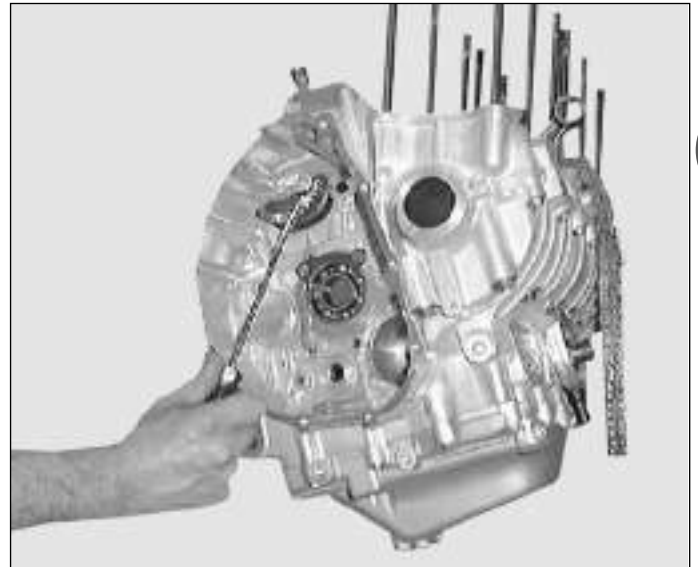
Insert the starting gear with the smaller tothing turned inwards from the gear end.

Insert the pin from the clutch end.

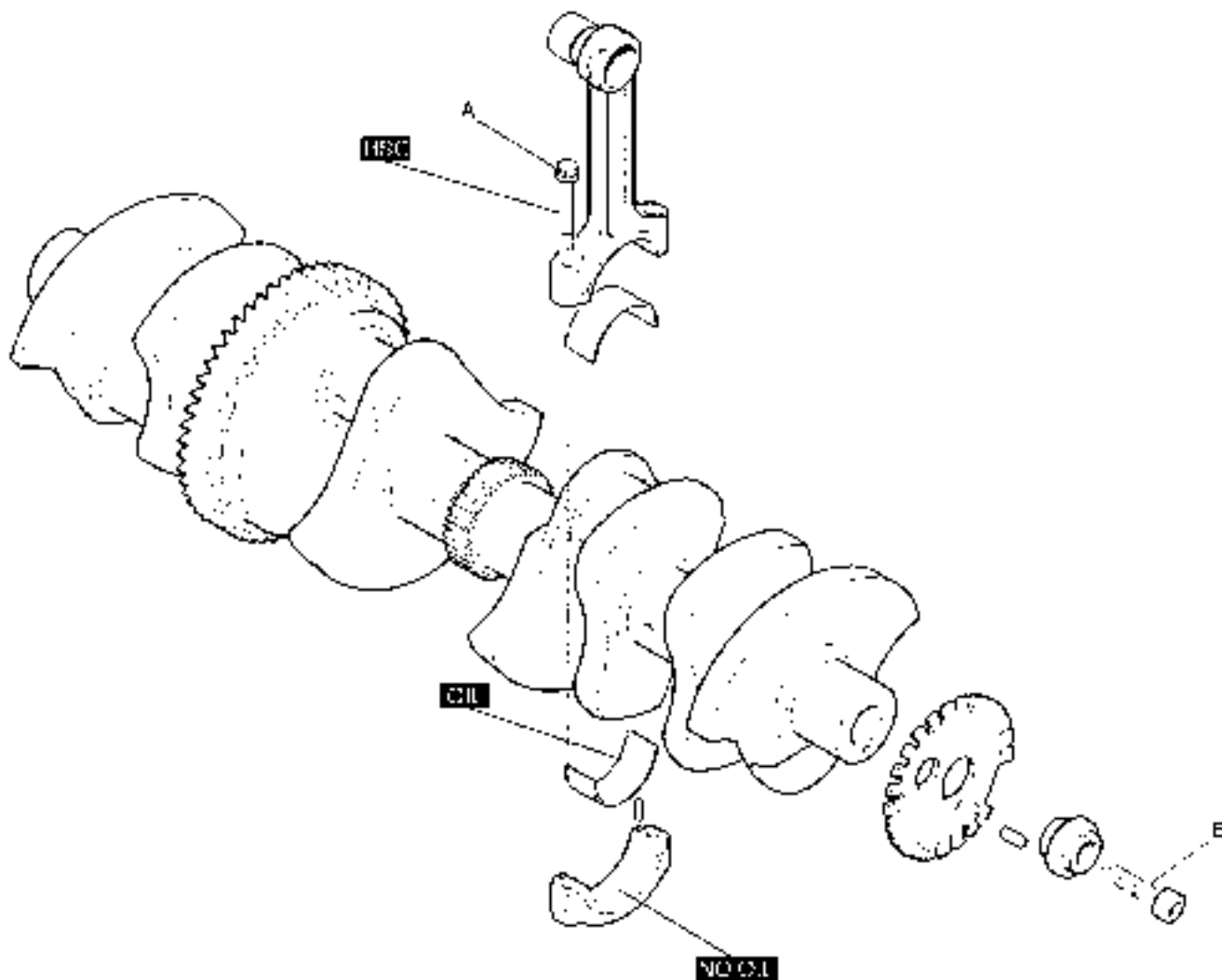
Assemble the pin-blockage plate fastening the screw with 242 LOCTITE.

Neutral switch

This component does not call for maintenance. In the case of a malfunction, substitute the switch. When reassembling it insert the switch with the help of a tube key and tighten at 10 Nm.



MOTOR SHAFT



		A*	B	C	D	E	F	G	H	I	J	K
Tightening torque	N·m	25 + 55°	25									
	Kg·m											
	ft·lb											
Thread blockers			Medium									

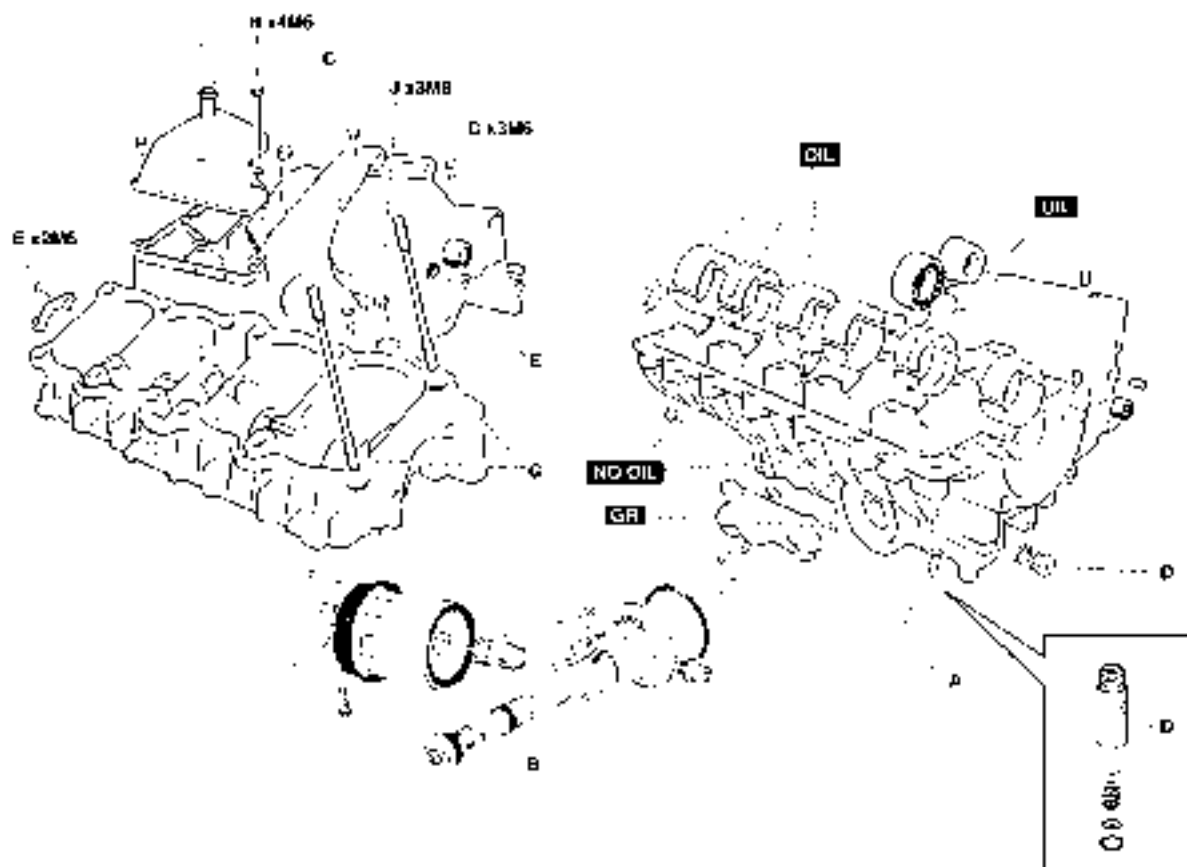
* See text.

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



Engine F4 ORO

BEDPLATE



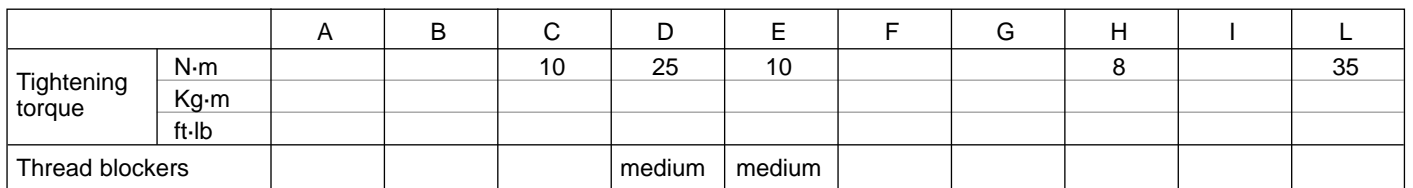
		A	B	C	D	E	F*	G	H	I	J	K
Tightening torque	N.m			10	25	10	25	22	8	14	25	30
	Kg.m											
	ft-lb											
Thread blockers					Medium	Medium		Medium				Medium

* See text.

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



B



<https://www.motorcycle-manual.com/>

Oil cup

Remove the oil cup by means of the 6 mm tightening screws.

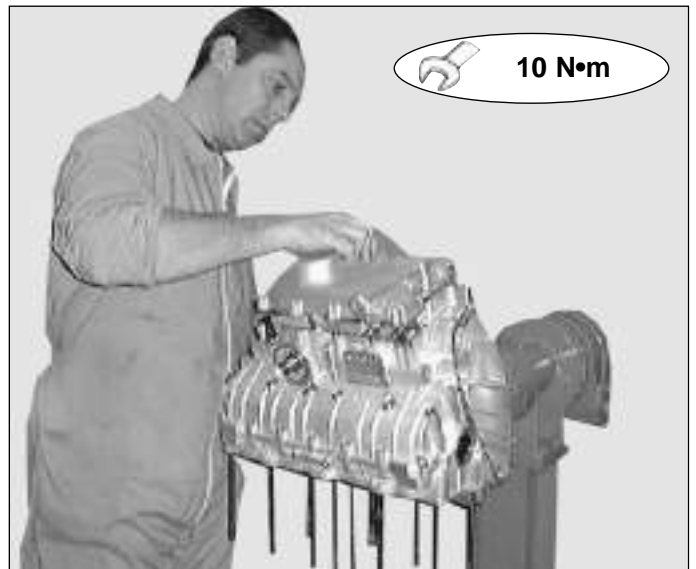
Always substitute the gasket during reassembly.

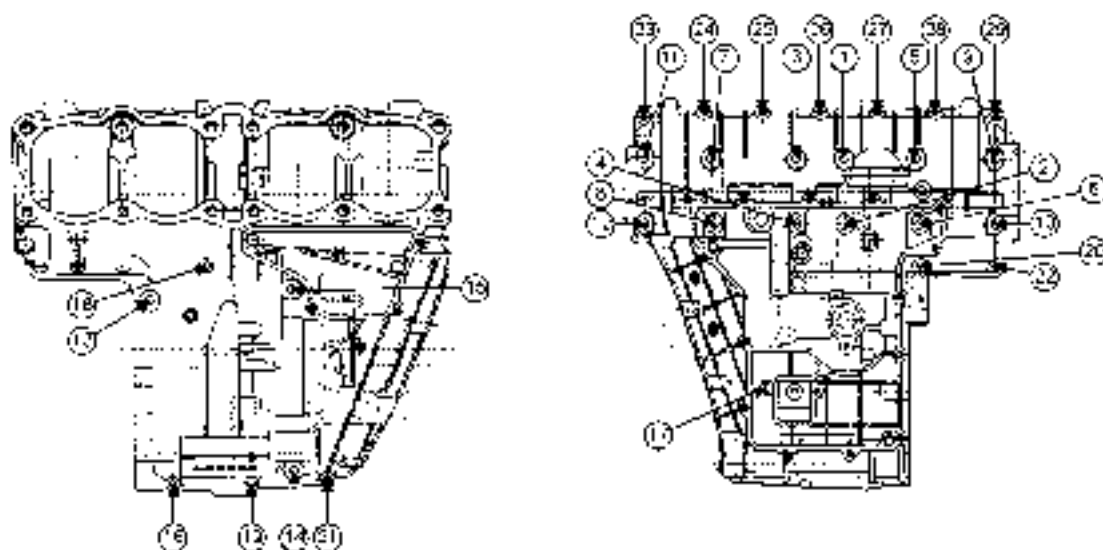
Check to be sure that the oil inlet filter is integral with no cracks or slits; clean it with compressed air at a low pressure blown from the inside towards the outside.

To remove the oil inlet filter unscrew the tightening screws. At reassembling tighten the 2 screws at 8 Nm and block them with 242 LOCTITE after having carefully degreased them.

Position the gasket and manually bring the screws closer.

Tighten the cup screws at 10 Nm.





Disassembly

Remove the oil filter exchanger with heat relative bearing.

Remove as follows as indicated in the relative paragraphs:

- A) The head
- B) The cylinder group
- C) The pistons
- D) The clutch
- E) The gear

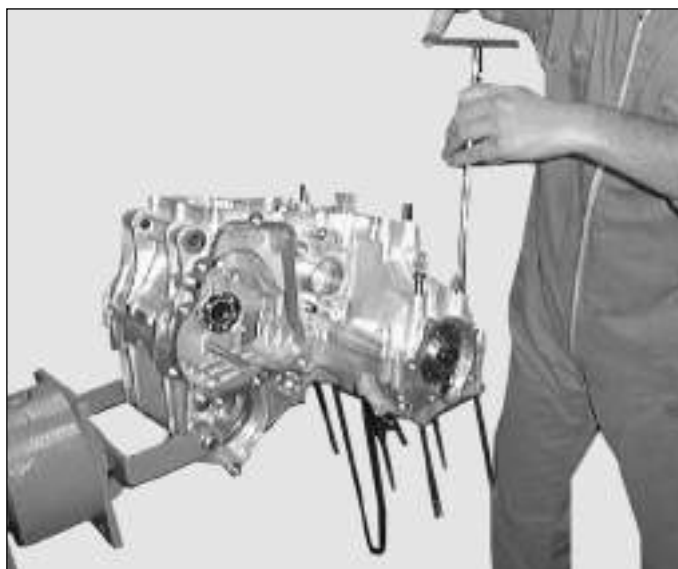
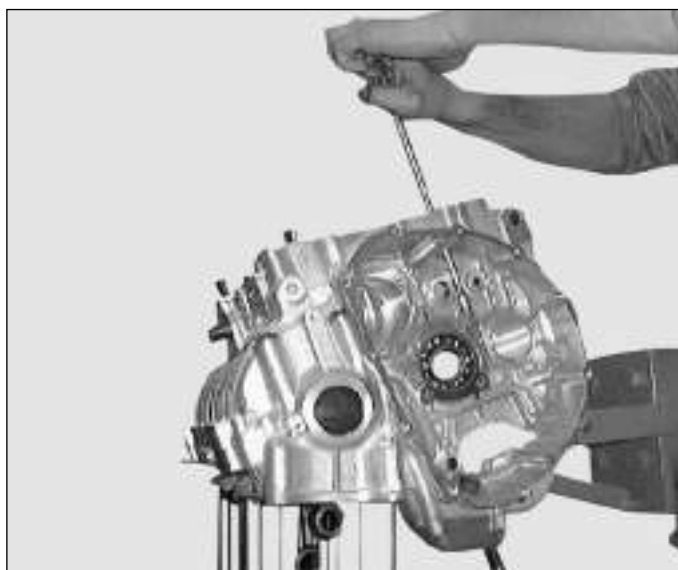
Remove:

F) The screws including the one for the blow-by cap.

NOTE Remember to unscrew the screw inside the carter indicated in the picture at the right.

G) The size 8 screws.

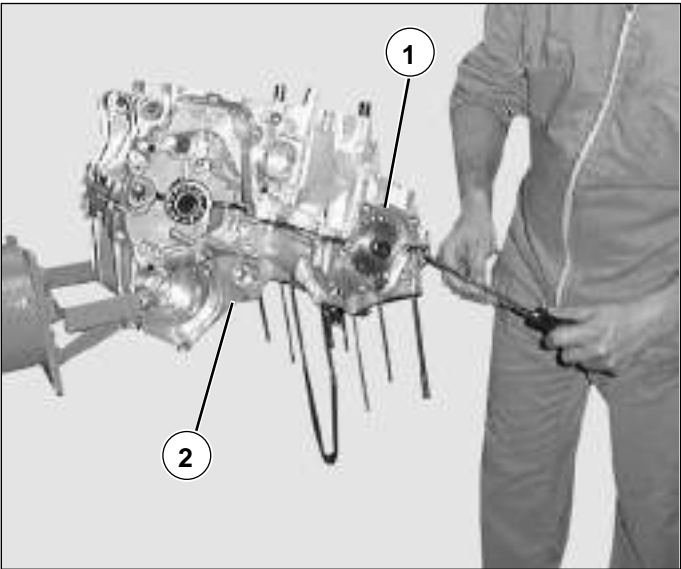
NOTE All the screws are of the same length or visually different; it is therefore impossible to confuse them during reassembly.



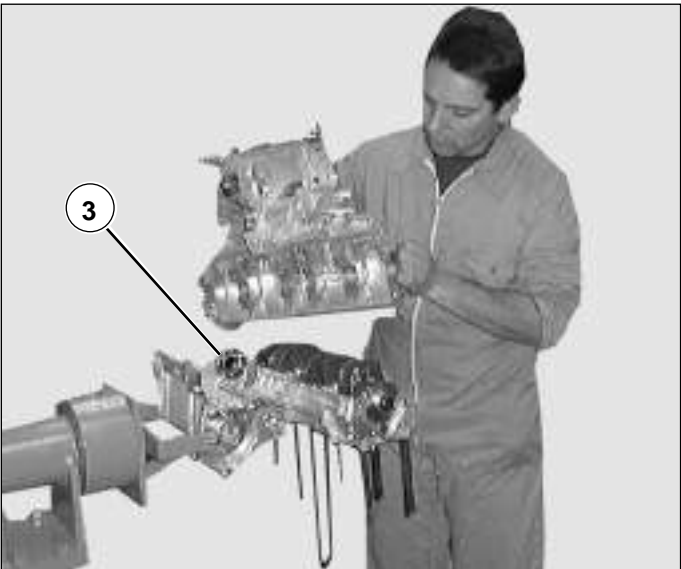


Engine F4 ORO

H) Separate the two carters (1 and 2) by manipulating the protrusions.



I) If necessary remove the bearings (3).



L) Slide the motor shaft out.

In the event that the bushings should be temporarily removed (4) it is a good idea to identify the bearing number and its carter with a number using a marker. For example the bushing removed from the n°1 bearing of the superior carter (starting from the left) will be identified by the mark S1.

For the couplings refer to the groups they belong to shown on the chart.

SELECTION TABLE FOR F4 BEARINGS						
			BEDPLATE SLOT DIAMETER			
			A	38.103 38.111	B	38.112 38.119
BENCH PIN DIAMETER	A	34.981 34.988	1.546/1551 BLUE		1.550/1.555 YELLOW	
	B	34.989 34.997	1.542/1.547 RED		1.546/1.551 BLUE	
FUNCTIONING PLAY 0.012/0.038						



Revision

Once you have disassembled the motor shaft and in case there should be any doubt substitute the bench bushings as well as the connecting rod.

Verify the motor shaft wear tolerance.

The function **play** of the **bench bearings** must be between **0.012 ÷ 0.038 mm**.

Service limit is **0.06 mm**.

The function play of the **connecting rod bearing** must be between **0.036 ÷ 0.061 mm**.

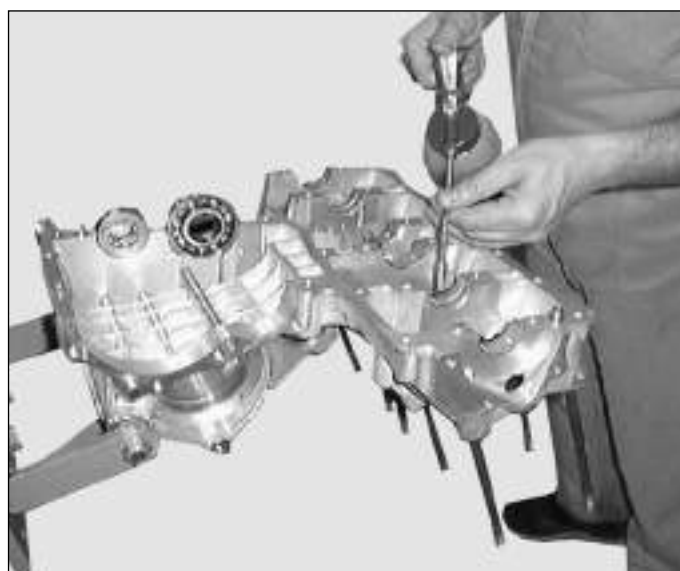
With a service limit of **0.08 mm**.

Reassembly

Carefully degrease and clean from any paste residues
Position the bushings into the carter without lubricating.



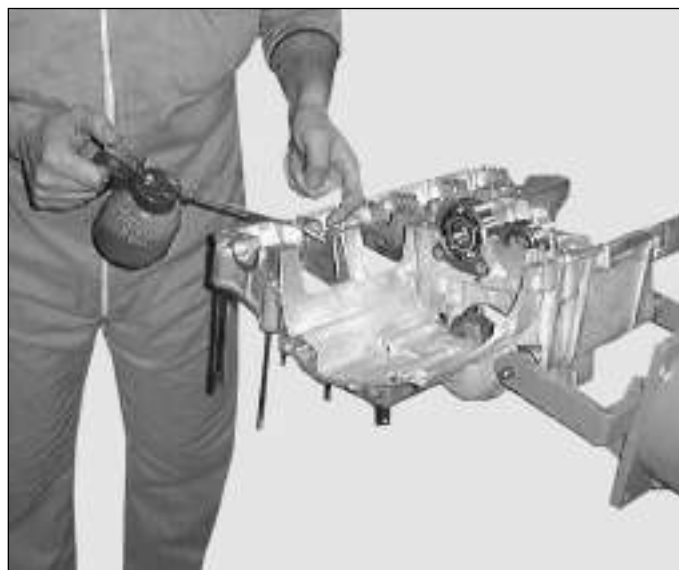
After having positioned them put oil on each bush.





Engine F4 ORO

Laterally lubricate the n° 5 support as it carries out the function of the motor shaft centering.



Put the new cap on the right side after having put the silicone type paste on the cap's surface, between cap and carter bearing.



Assembly the motor shaft.

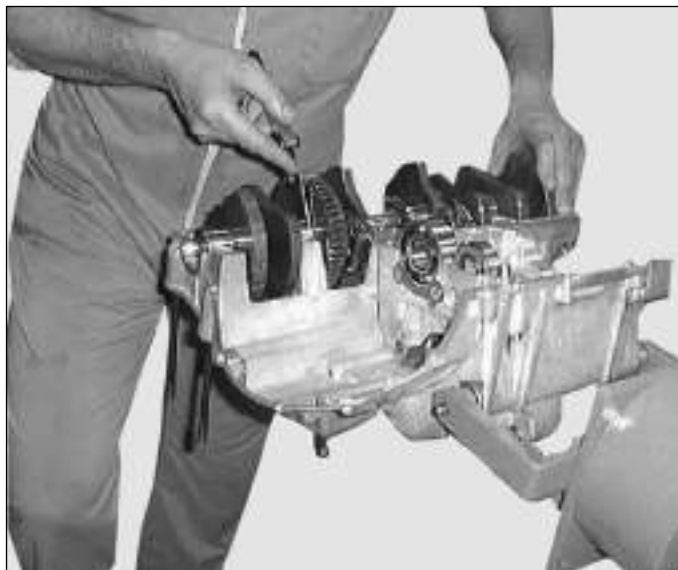




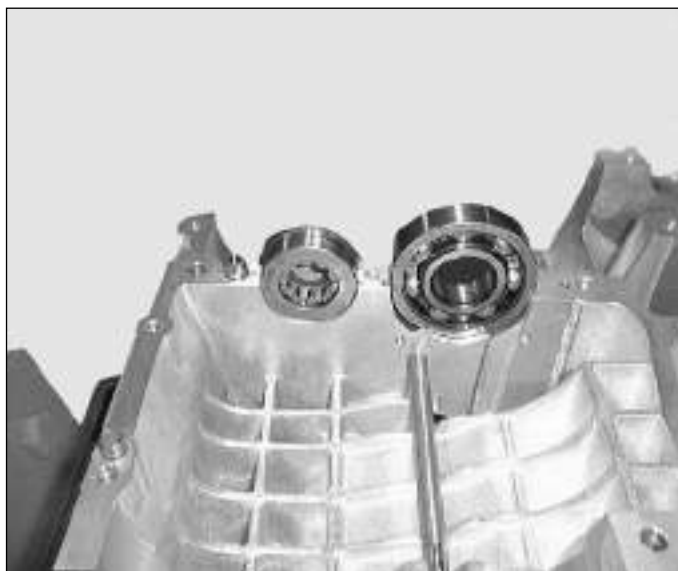
Engine F4 ORO

Verify with a thick meter that the motor shaft has an **axial play** of **0.2 mm** as regards the bench bearings. In case there should be different values contact the manufacturer.

B

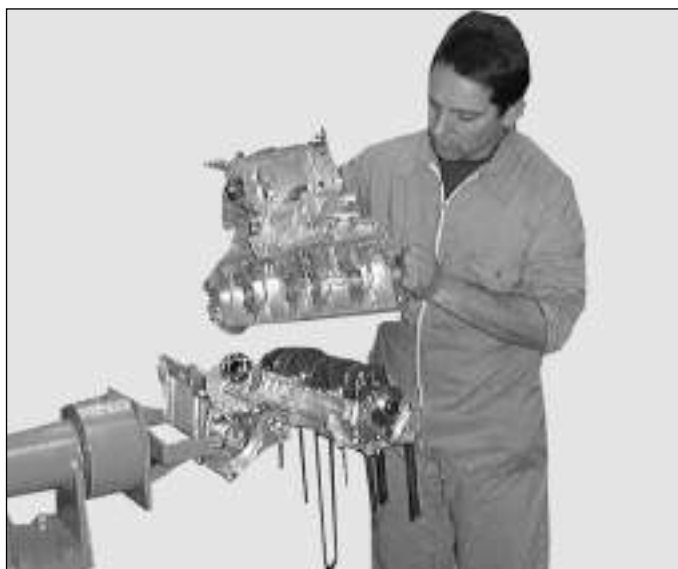


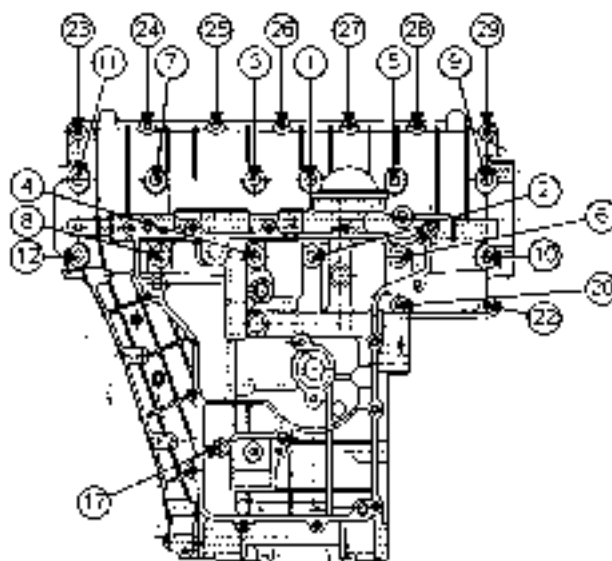
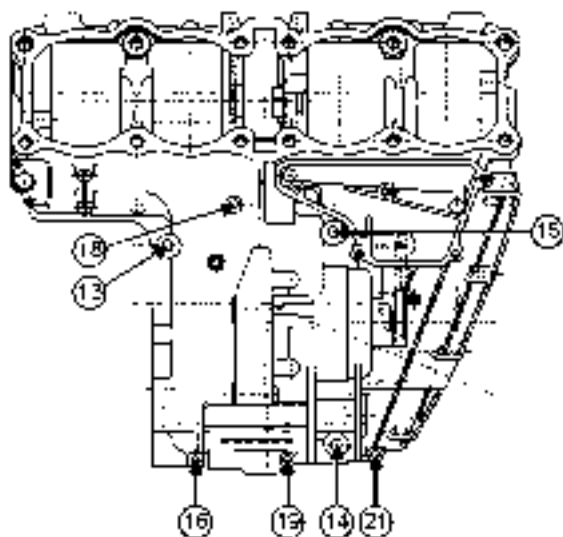
Reassemble the bearing on the inferior semi carter with the locks facing each other and turned inward the bedplate.



Be sure that the centering bushes are installed on the inferior semi carter. Spread a layer of the 1215 THREEBOND type garnish on the stroke points of the two semi carters.

Couple the two semi carters carefully beating them with a plastic hammer until completely closed.





Insert the 12 size 8 screws manually manipulating them thus tightening them to the coupling at 25 Nm.
Insert the remaining M6 screws manually manipulating them and tighten them to the coupling at 10 Nm.



Tighten all the screws inversely to the order they were disassembled.

Install the heat exchanger with the O-Ring and lock the support screws at a 10 Nm torque, the exchanger aluminium screw at a 14 Nm torque.
Always replace the aluminium seal washer at reassembly.



It is possible to update the Gold Series motor with the oil exchanger screw and its relative antiunscrewing mechanism assembled, starting from the S2002 motor. See relative paragraph in the index dedicated to the S2002 motor.



Engine F4 ORO

Disassembling connecting rod

Remove the driveshaft following the suggested procedure.

Position the shaft with the connecting rod downwards. Work on each connecting rod separately.

Loosen the two screws that tighten the foot of the connecting rod and the head of the rod.

Remove the two screws that sustain the connecting rod stem.

Move the two motor drive shaft parts away.

NOTE Reassemble each connecting rod before working on the next one.

Removing semi bearings

Disassemble the connecting rod following the suggested procedure.

Unscrew the screws and remove the semi bearings from the foot and head of the connecting rod.

Coupling semi bearings-connecting rod pin

If no substitutions have been made it is sufficient to verify the connecting rod measurement and its pins and refer to the chart included, choose the semi bearings according to the colour.

The measurement has to be carried out on the principal axle of the stem, after having tightened at 35 Nm.

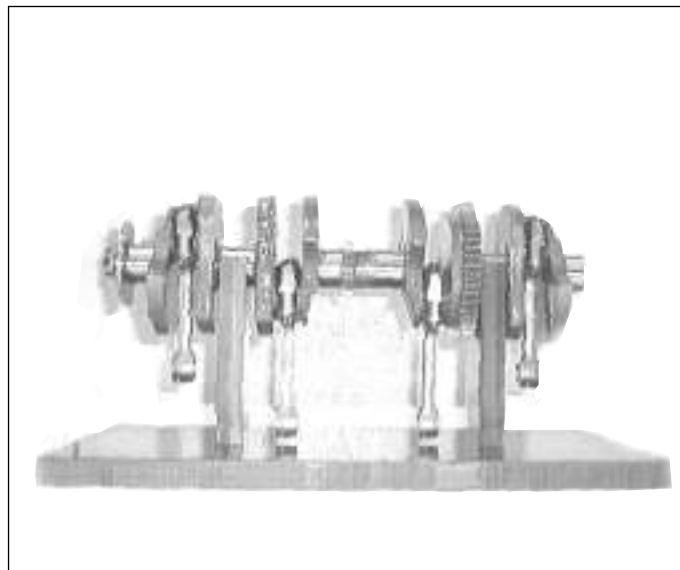
If substitution of one or more parts is necessary, it is sufficient to follow the indications of the letter indicating the class that the connecting rod and bushing belong to, indicated on them.

Assembling semi bearings

Screw the semi bearing to the foot of the connecting rod and to the head.

Tighten at a couple equal to 25 Nm + 55°.

Always use new screws, even with the used connecting rod.



SELECTION TABLE FOR F4 CONNECTIN ROD						
			CONNECTING ROD HEAD DIAMETER			
			A	38.114 38.122	B	38.123 38.130
CONNECTING ROD PIN DIAMETER	A	34.981 34.988	1.450/1.545 BLUE		1.544/1.549 YELLOW	
	B	34.989 34.997	1.536/1.541 RED		1.540/1.545 BLUE	
FUNCTIONING PLAY 0.036/0.061						

Check and placement of distribution chain

At each motor revision verify the wear state of each transmission distribution component. If the gear teeth appear to be very worn substitute each piece. Substitute the chain at the foreseen mileage (see section 5).



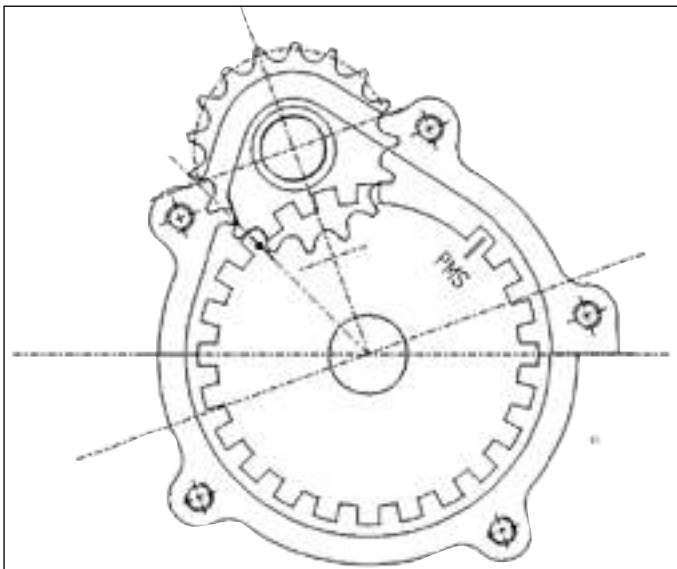
In case wear should result beyond the permitted allowance even of just one of the distribution components, check them all and if necessary substitute them.

Rotate the drive shaft until the pellet on the phonic wheel tooth coincides with the notch on the bedplate, as shown in the following picture.

Attention: the drive shaft in this position is NOT in the MSP position.



B



Fit the distribution chain on the intermediate gear. Position the intermediate gear being careful that the pellet on the gear corresponds with the pellet on the bedplate, being careful that the drive shaft has not moved from the position priorly described. Insert the intermediate gear rotation pin and tighten it with the relative seeger. Without rotating the drive shaft check again to be sure that the pellet on the phonic wheel corresponds to the notch on the bedplate. At this point, rotate the drive shaft and verify the correct teeth gripping.

Attention: The relative pellet position will repeat itself only after a few rotations of the drive shaft.





Engine F4 ORO

Substitute oil filter

Take an oil filter out of (black version) the new motor oil filter kit (Part. code n° 8000A1428) of new furnishing. Exclusively us MV Agusta components.

Before assembling the filter lubricate the gasket holding.

Using the appropriate tool, code 99010 and a dynamometric key proceed by tightening the filter. Tightening couple: 15 Nm.

Take the new motor oil filter clamp and the relative screw out of the oil filter kit (Part. Code n° 8000A1428) of new furnishing. Insert the clamp bringing it in beat on the posterior edge of the oil filter.

Position the clamp blocker in contact with the screw on the bedplate. Place clamp screw without tightening it.

Mark the screwing point on the screw as well as on the clamp with a marker.

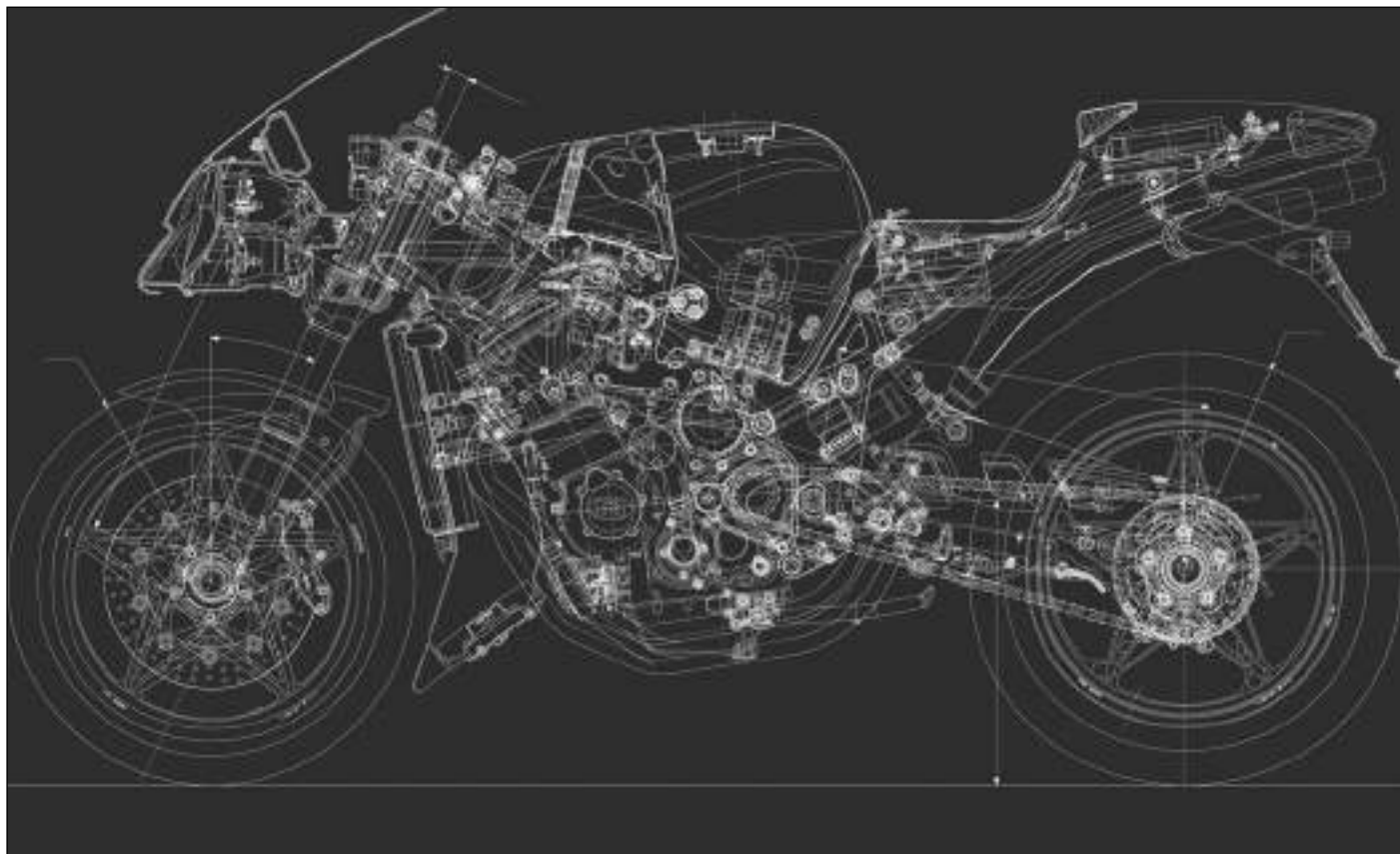
Carry out the final tightening of the screws by making 2 turns and 1/4 beyond the already obtained position (see phase 13).

Mark the final tightening position on the filter as well as on the clamp with a marker. Be sure that the final distance between the screw and clamp blocker falls between 0,5 and 1 mm.





Engine F4 STRADA MY 2000



C

SECTION C

Revision 1



SUMMARY

CLAMPING TORQUES TABLE	PAGE 3
MAINTENANCE TABLE	PAGE 5
CO REGULATION	PAGE 10
DISTRIBUTION CONTROL UNITS	PAGE 12
CLUTCH	PAGE 32
GEAR AND GEAR CONTROL	PAGE 38
MOTOR SHAFT	PAGE 45
BEDPLATE	PAGE 46
CAPS	PAGE 47

NOTE For the sub-groups not listed, refer to "F4 Oro Series" model.



Engine F4 STRADA MY 2000

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	100	9.5	Strong
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	100	9.5	Strong
Gear selection drum tightening screws	12	1.2	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	



Engine F4 STRADA MY 2000

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws (mat. n° up to 545)	10+50°	1.0+50°	
M8 torque screws (mat n° from 546)	10+60°	1.0+60°	
Bearing exchange screws	10	1	
Aluminium exchanger screws	14	1.4	
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate thread with Molikote HSC Plus



Engine F4 STRADA MY 2000

MAINTENANCE TABLE

Slip		Pre-delivery	A		B		C	
Frequency	km	0	1000	6000	12000	18000	24000	30000
Procedure								
Cooling liquid level	C	•	•	•	•	•	•	•
Cooling liquid substitution	S		Substitute every 2 years				•	
Motor oil level	C	•	Check every 1000 km					
Motor oil	S	6000 km or 12 months	•	•	•	•	•	•
Motor oil filter	S		•	•	•	•	•	•
Valve play	C		•	Check every 12000 km				
Distribution chain	S							•
Mobile distribution block	C/S				•		•	
Chain tightening block	C/S				•		•	
Spark plugs			Substitute every 12000 km					
	S				•			
Minimum synchronizing regime	C		•	•	•	•	•	•
Fluttering body: synchronization, minimum, CO control	C/P		•	•		•		•

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions



Engine F4 STRADA MY 2000

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter		
Exhaust.....	$24.6^{+0.3}_0$ mm	
Inlet.....	$28.6^{+0.3}_0$ mm	
Sealing face thickness.....	$1^0_{-0.3}$ mm	
Stem-guide clearance		
Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	$4.5^{+0}_{+0.012}$ mm.....	4.55 mm
Valve stem		
Exhaust.....	4.475 ± 0.005 mm.....	4.455 mm
Inlet.....	4.485 ± 0.005 mm.....	4.465 mm
Valve spring		
Internal.....	30.5 mm.....	30 mm
External.....	32.6 mm.....	32.1 mm
Valve-cam clearance		
Exhaust.....	0.20 ÷ 0.29	
Inlet.....	0.15 ÷ 0.24	



Engine F4 STRADA MY 2000

ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.025 ÷ 0.045 mm	0.10 mm
Piston-pin play.....	0.004 ÷ 0.012 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	0.8 ^{-0.01} _{-0.03} mm.....	0.75 mm
2 nd	1 ^{-0.01} _{-0.025} mm.....	0.96 mm
Oil scraper.....	2 ⁰ _{-0.1} mm.....	1.88 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	34.4 mm

C



Engine F4 STRADA MY 2000

ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

- Heat the motor to the usual functioning temperature (of regime);
- Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;
- Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

<i>Cylinder compression control (280 rpm-min)</i>		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- carbon deposits on the walls of the combustion chamber and on the piston ceiling;
- the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- The seat of one or more valves is damaged and the valves do not maintain the compression pressure;
- One or more valves have null functioning play;
- The piston, cylinder play is excessive;
- The cylinder head is twisted and/or the head gasket is damaged;
- Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.

CO REGULATION

Attention: CO regulation is of vital importance for the correct functioning of the motor.

Prior to carrying out the CO regulation accurately check:

- That there are no cracks or damage of the rubber tubes of the vacuum meter line
- That gas does not seep out of the exhaust pipe joints
- That the gas tube links are correctly inserted in the tank lodgings and that the tubes are neither bent nor crashed

A) Verify and if necessary regulate the butterfly valve opening to minimum using Magneti Marelli MDST software.

Motor-bike with chassis number up to 3844: The butterfly valve angle must be of 1.5 degrees. Fluctuation between 1.5 and 1.7 are allowed; fluctuation between 1.3 and 1.5 are not allowed.

Motor-bike with chassis number above 3845: The butterfly valve angle must be of 1.7 degrees. Fluctuation between 1.7 and 1.9 are allowed; fluctuation between 1.5 and 1.7 are not allowed.

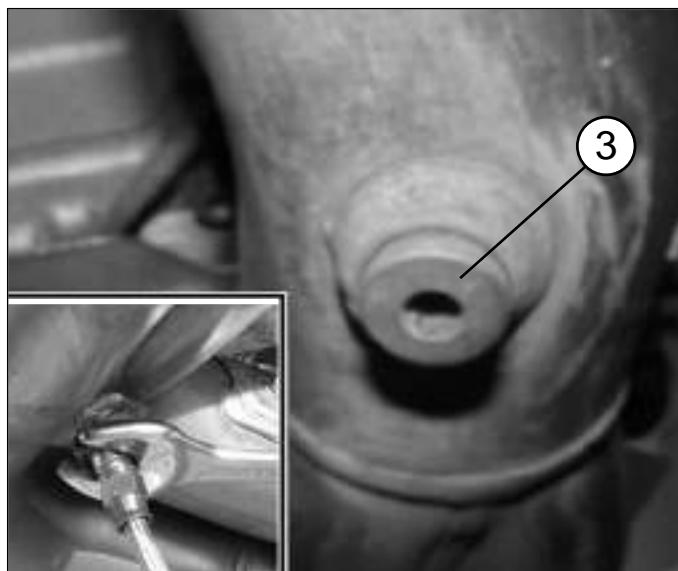
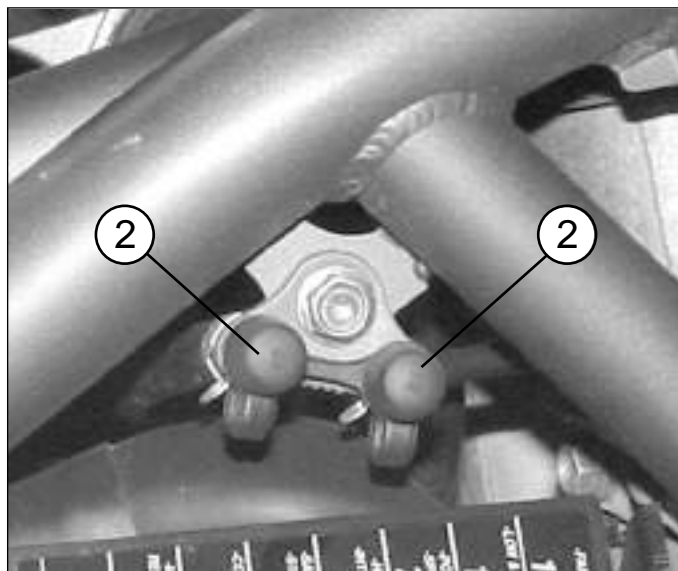
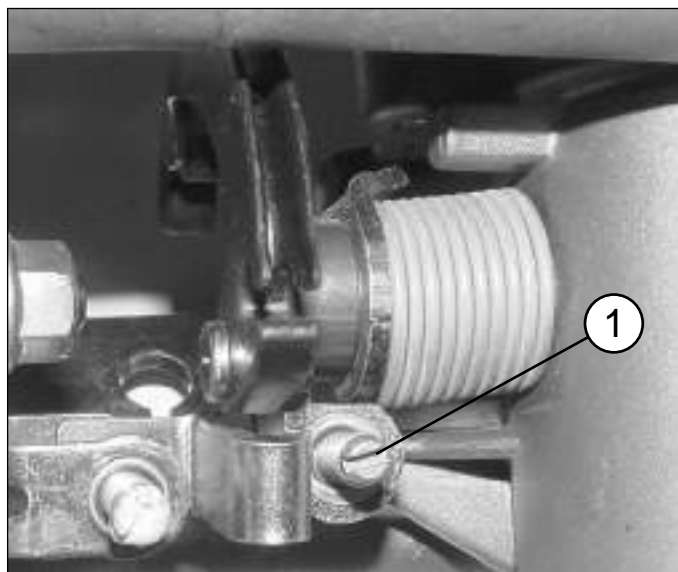
If required, You can intervene exclusively operating on the specific screw (1) placed on the opening gudgeon of the fluttering body.

NOTE Operate only on the right screw (the smaller one).

B) Verify the correct functioning of the water temperature sensors and environmental air and pressure and the battery tension using Magneti Marelli MDST software.

C) Wait with the motor at minimum speed for the culling vents to start up.

D) Connect the vacuometer to the sockets (2) and the CO tester to the socket (3) after having unscrewed the cap with a number 5 hexagonal closure.





Engine F4 STRADA MY 2000

E) Balance the cylinder depression by means of the bypass screws (1) of the fluttering body trying to get close to the inserted vent at following CO levels and minimum functioning:

Motor-bike with chassis number up to 3844

Bypass opening 1/2 - 1 turn

CO 4 +- 0.5%

Minimum RPM 1050 +- 50

Motor-bike with chassis number above 3845

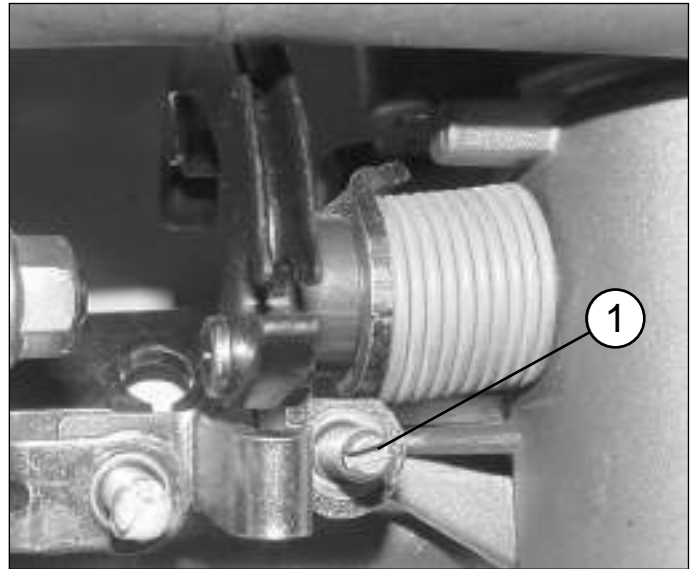
Bypass opening 1 1/4 - 1 1/2 turns

CO 3.5 +- 0.5%

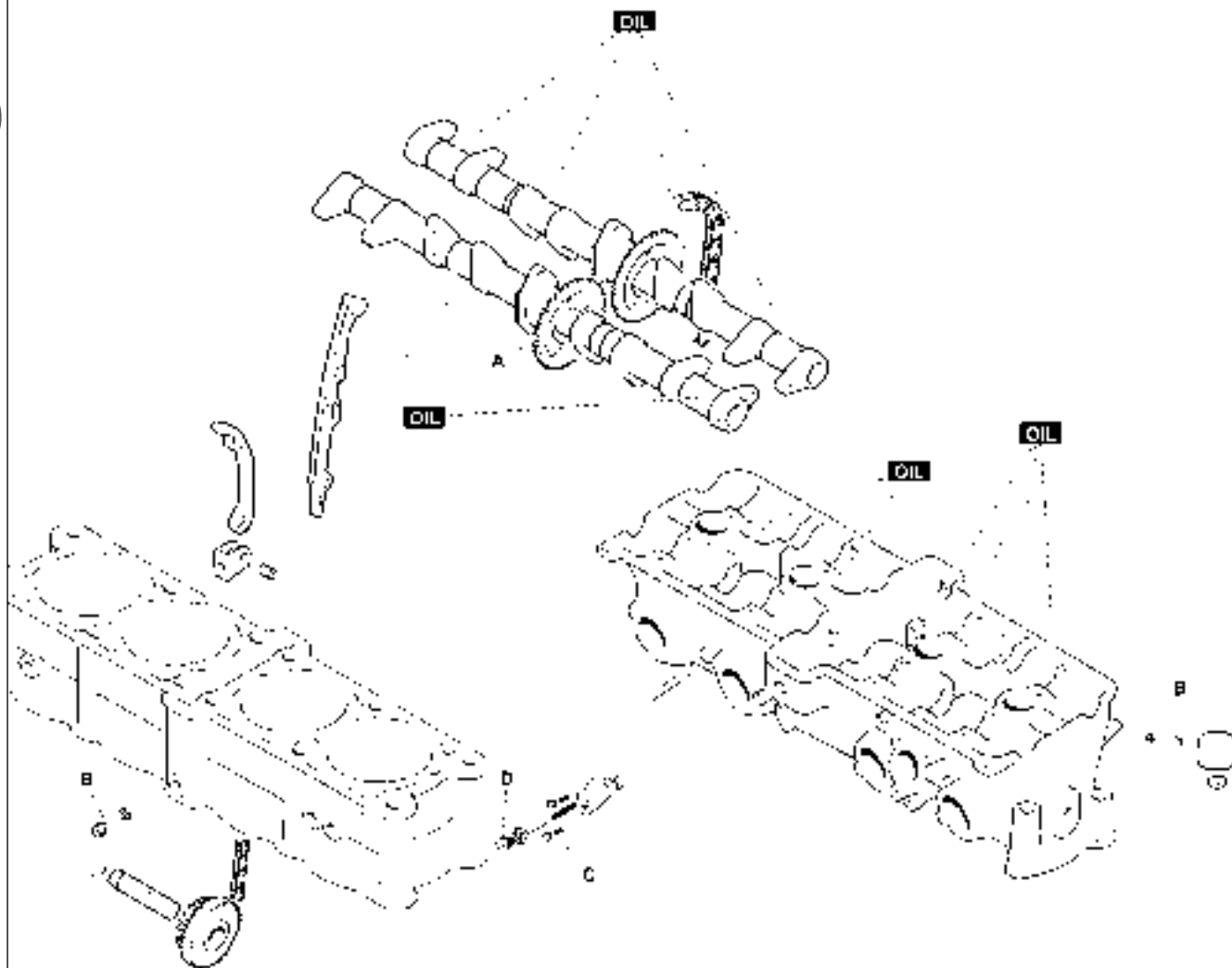
Minimum RPM 1050 +- 50

F) Disconnect the vacuumeter, speed up the engine and verify the throttle goes back to the value previously defined, wait for the CO value stabilisation and verify CO and rpm values are in the given clearance.

G) If the values are out of range check the vacuumeter line for air infiltration, reconnect the vacuumeter and repeat the operation starting from the E) point.



DISTRIBUTION CONTROL UNITS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	12	8	8	12						
	Kg·m										
	ft·lb										
Thread blockers		Strong	Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

In order to facilitate the detachment of the stands use a rubber hammer or delicately the end part of a flat screwdriver.



Slightly rotate without force the unloaded end of the gearshaft shifting it from its slot; by doing so, the tension on the distribution chain will loosen.

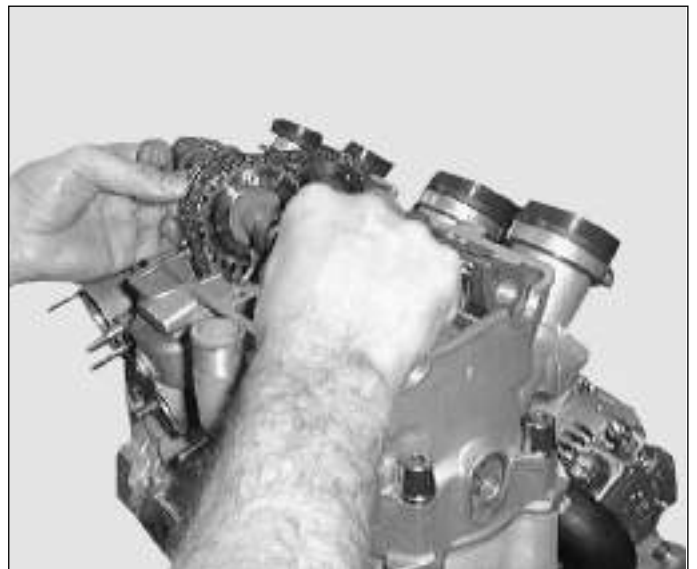
Release the distribution chain.
First remove the unloaded end of the gearshaft. Fasten the distribution chain with copper thread in order to retrieve it during the following procedure.

Remove the inlet end of the camshaft.

Remove the first link block for the distribution chain by using the tightening screws.

In case it should be necessary to substitute the distribution chain at the expected mileage (see the programmed maintenance chart), it is advisable also to substitute the gears on the camshaft (INLET n° 82453-EXHAUST n° 82454).

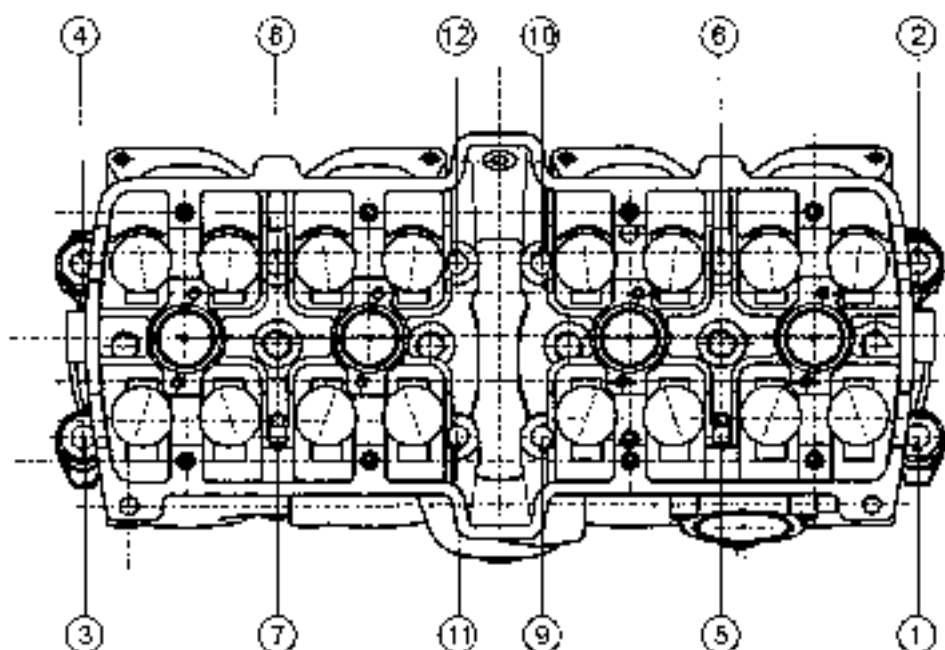
In this case carefully degrease and use LOCTITE 648 on new n°62726 screws locking them at 12Nm.



Remove the 12 tightening nuts from the head beginning from the external ones proceeding towards the internal ones, following the sequence indicated in the figure.



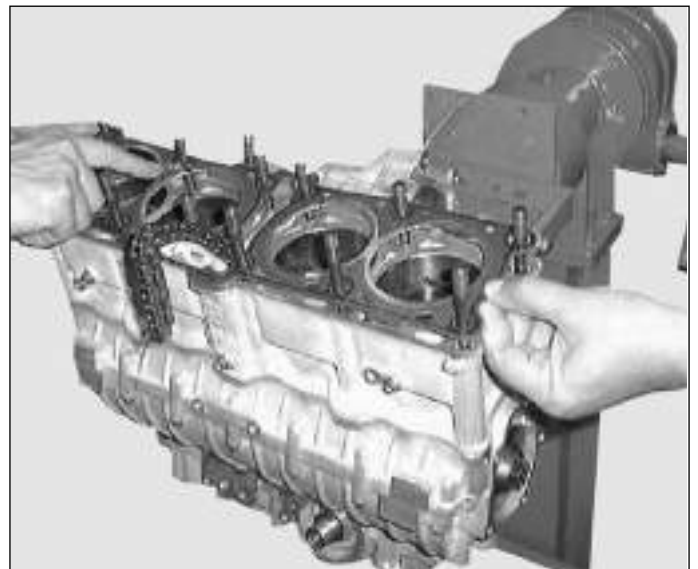
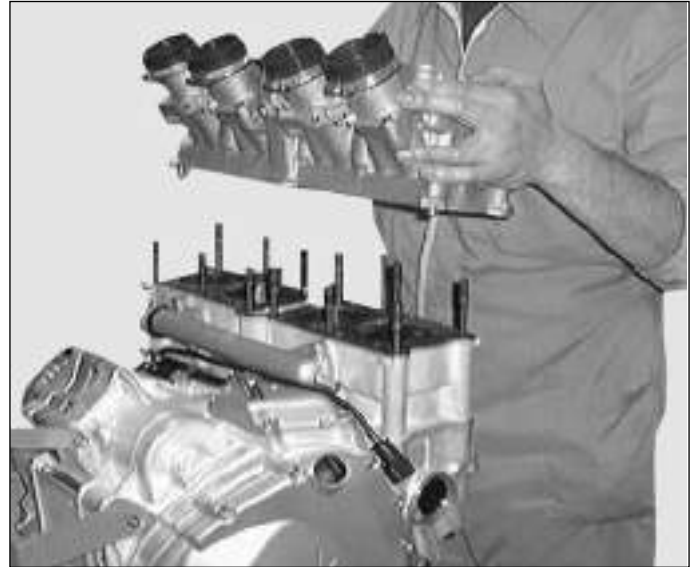
On each encarcement there is a washer. Be carefully no to let it fall into the motor, you may block the holes with clean rags.



Remove the head and place it onto a clear place

Remove the gasket which will be substituted during reassembly.

Avoid placing the head upside down.



Inspection of the head group

Remove carbon deposits from the combustion chambers. Clean away eventual encrustments from the canalizations of the cooling liquid. Check to be sure that there are no cracks and that the holding surfaces are free of crevices, runs or any other kind of damage.

Verify the planarity of the stroke surfaces.

Verify the perfect state of the spark plug threads

Head assy assembly

To execute this operation you need the following special tool:

- A) n° 94793 piston / cylinder plane distance measuring tool

Place the new gasket on the cylinder plane.

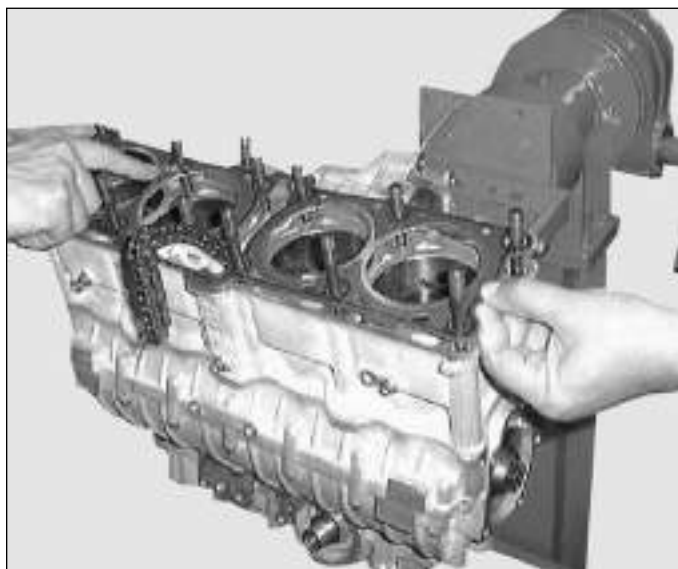
The gasket is of the same thickness of the one installed before if no parts replacement occurred.

If replacement is necessary you'll need to measure the piston / cylinder plane distance with the n° 94793 tool, tightening the head nuts at 12 Nm. The choice is made following table below:

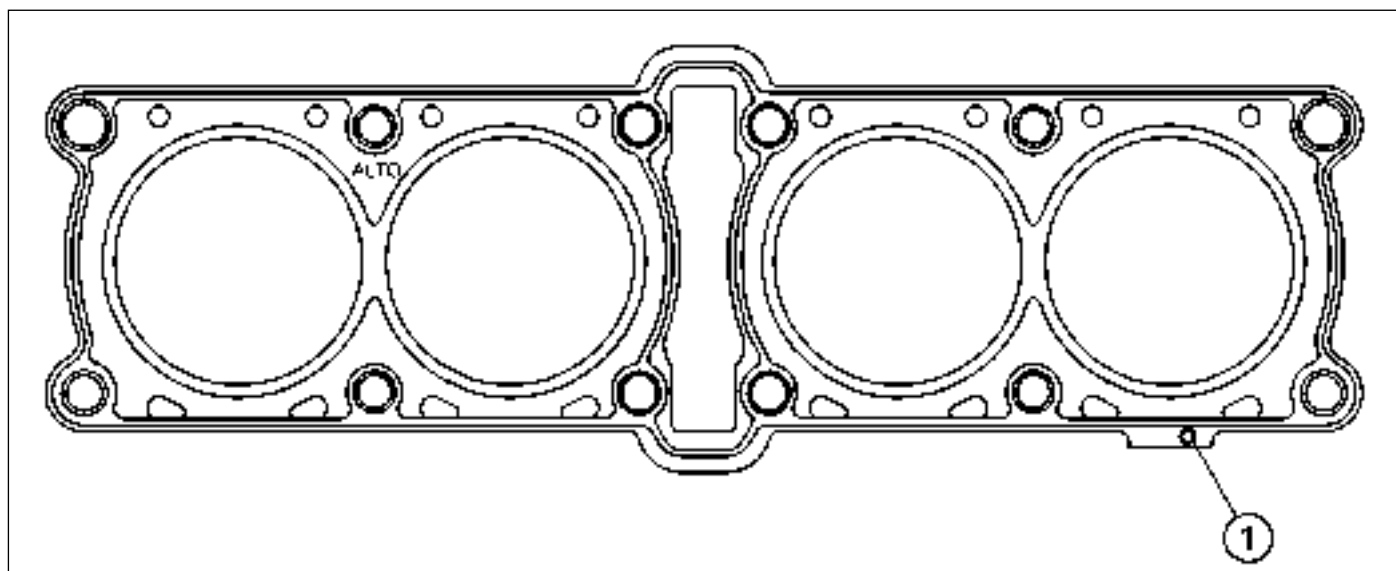
Piston/cylinder plane projection	Type of gasket
0.37 - 0.57 mm	Thick=> 1.45 mm
0.17 - 0.37 mm	Medium=> 1.30 mm
0.07 - 0.27 mm	Thin=> 1.20 mm

The gaskets are different for the presence of the holes (1) shown in picture. Refer to the table below to choose the right one.

Holes numbers	Compressed thickness	Part N°
2	1.20 ± 0.05 mm	8B0087757
NONE	1.30 ± 0.05 mm	8A0087757
1	1.45±0.05 mm	800087757



K
12 Nm clamping

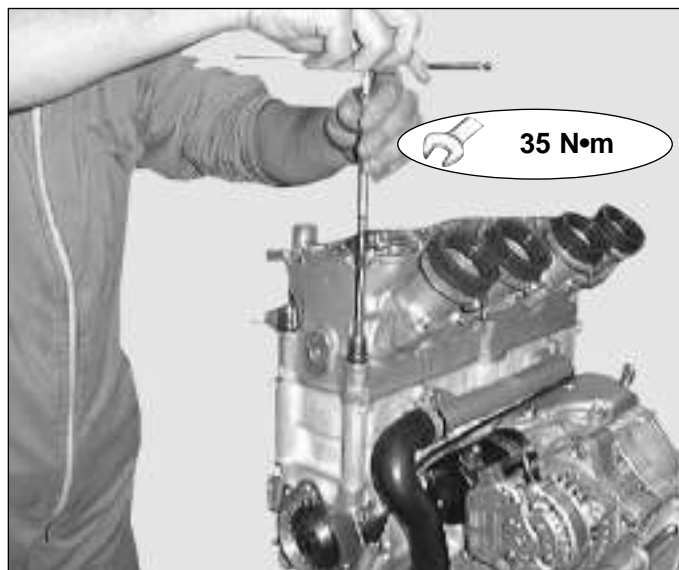


The gasket must be assembled with the letters ALTO on the superior facade and the protrusion towards the march gear.

Insert the centering bushes between the head and the cylinder. Insert the washers on the encarcement if necessary with the help of a screw driver to guide them onto the internal encarcements.

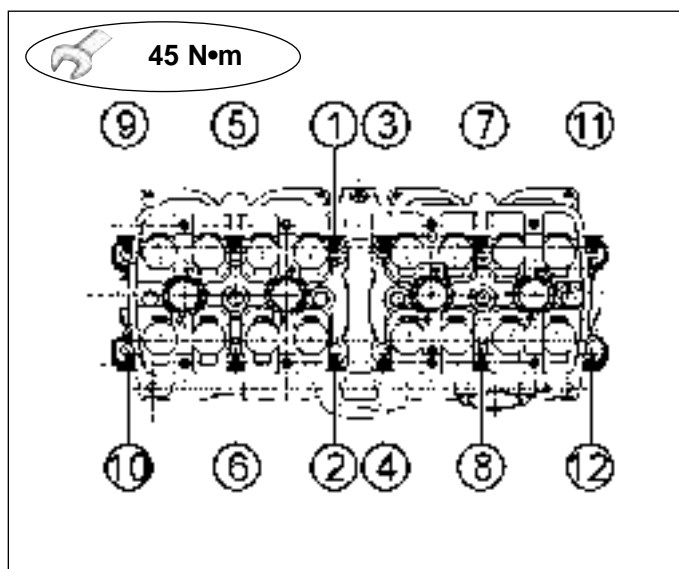
Lubricate with antibinding grease of the HSC MOLIKOTE type only on the nut threads.

Do not apply grease on the encarcement threads, which must be well cleaned and degreased



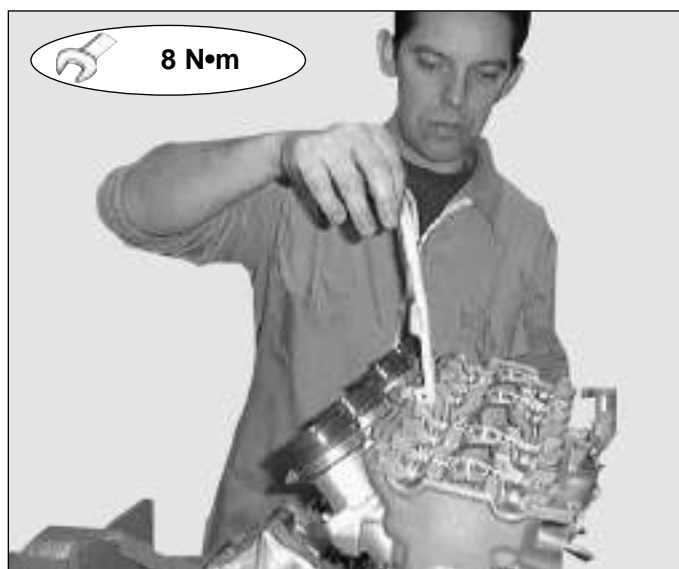
Screw the bolts with a brugle key and press them at a 35 Nm.

Tighten the bolts beginning with the internal ones towards the external ones following the outline indicated in the figure at 45 Nm.



Retrieve the distribution chain.

Insert the fixed sliding block with its screws and, after having carefully degreased it, tighten it at a torque of 8 Nm. with 242 LOCTITE



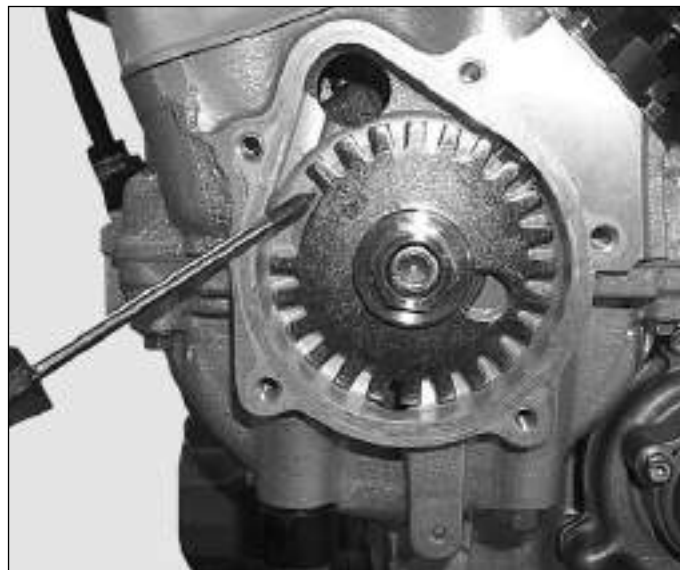


Engine F4 STRADA MY 2000

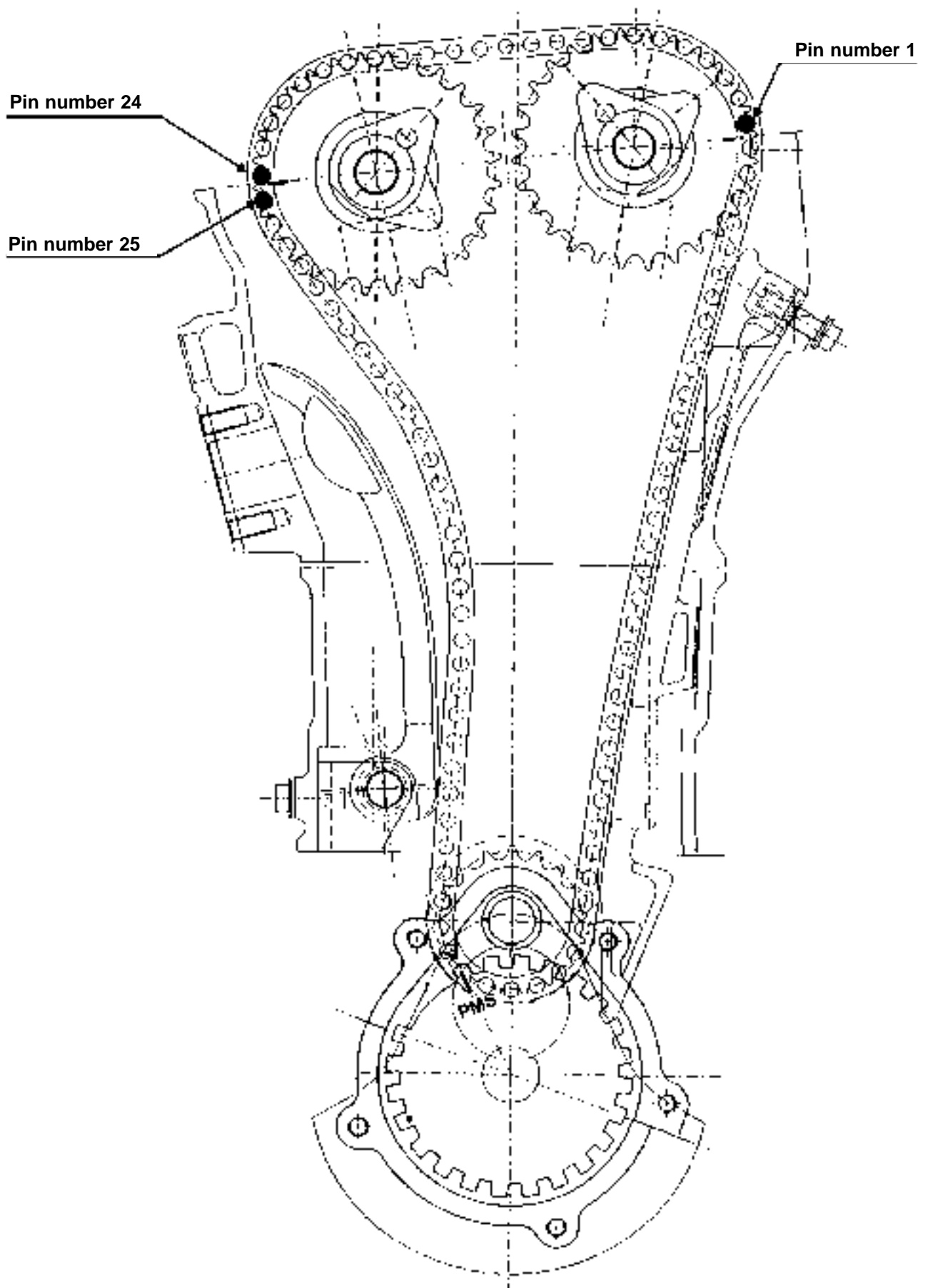
Continue with the setting as follows:

be sure that piston n° 1 is the MSP in burst phase; in this position "T" notch on the phonic wheel is in line with the reference notch on the bedplate.

Remove the copper thread from distribution chain, keep the chain tightened.



C





Engine F4 STRADA MY 2000

Insert the inlet camshaft so that the phase notch on the conveyer wheel is parallel to the head plane and facing the outside.

Insert the exhaust camshaft with the notch placed between the 24th and 25th chain distribution gudgeon, beginning to count from gudgeon after the inlet camshaft notch.

Check the correct position of all the O Rings under the head stands.



Position the n°2 and n°3 stands, referring to the numbers towards the inlet end;

Position the n°1 and n°4 stands,

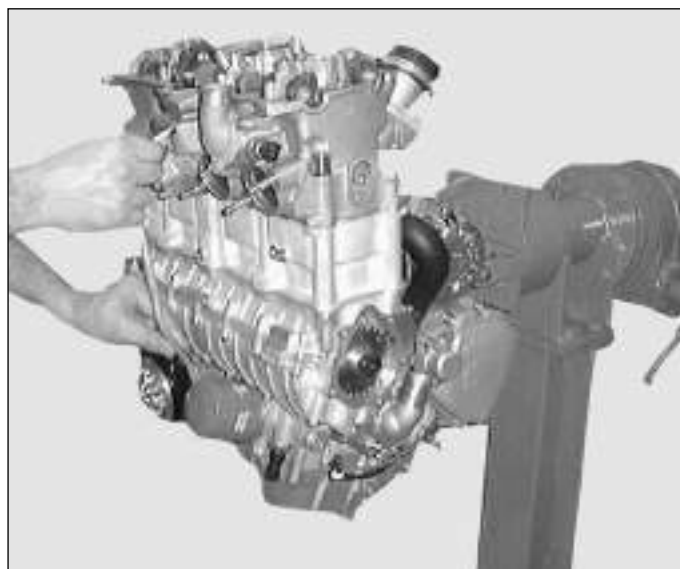
Bring the screws together manually hexagonally embedded.



Before tightening stand screws be sure that the chain tensioner is assembled.



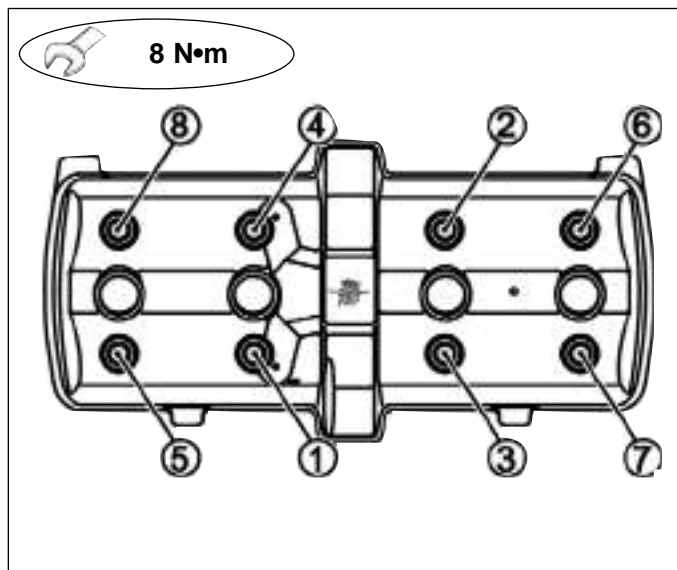
Do not tighten the stand screws if the reaction springs are charged. Appropriately turn the camshaft so that the stand springs of which are to be tightened are uncharged and that the cams are positioned on the base radius.



Progressively move the internal hexagonal screws close. Tighten the screws at a torque of 12 Nm., always beginning from n°2 and n°3 stands.

Check to be sure that the valve cap gaskets are in good condition.

Apply a layer of gasket 5552 silicone on the semi moons on the head in correspondence with the camshaft.



Position the valve cap.

Manually position the screws, thus tighten at 8 Nm.

Place the adduction oil tube at the head greasing the O-Rings.

Dismounting cylinder head pieces

In order to carry out this procedure the following tools are necessary:

tool n° 94796 to disassemble valves

tool n°95179 to remove semi cones

tool n° 94798 to take out rubber holdings



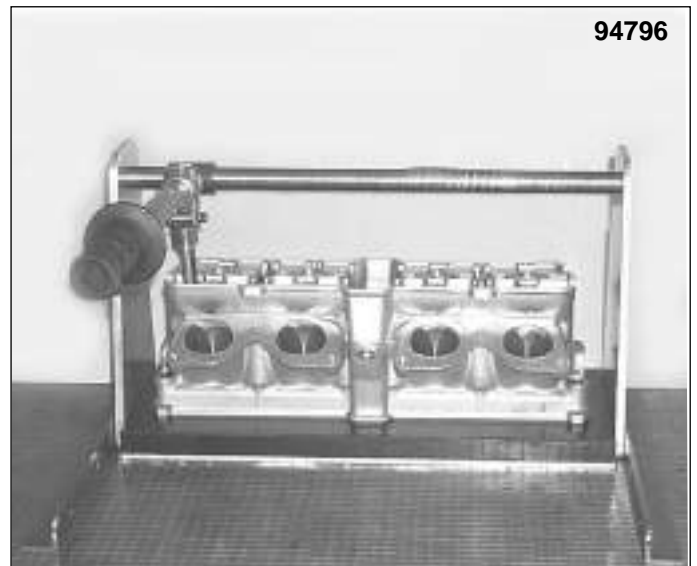
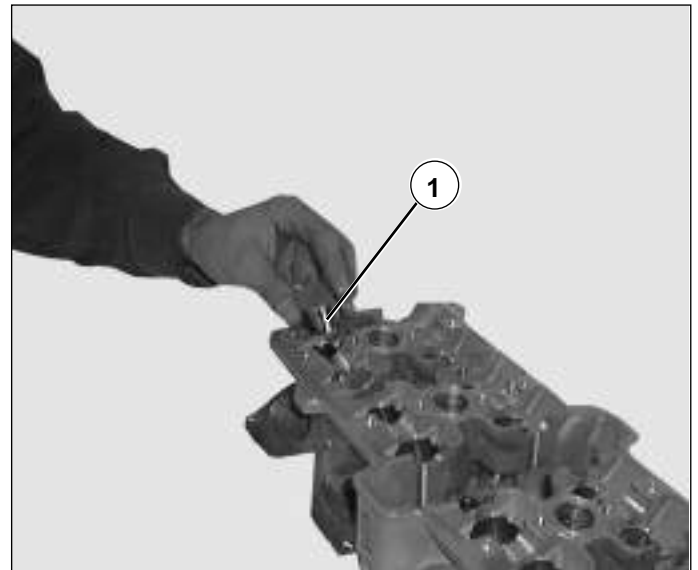
Each piece relative to the same valve (cup, spring, semi cone, etc.) must be reassembled onto the same valve from which it came off.

Remove the cylinder head as indicated the paragraph "cylinder assay removal".



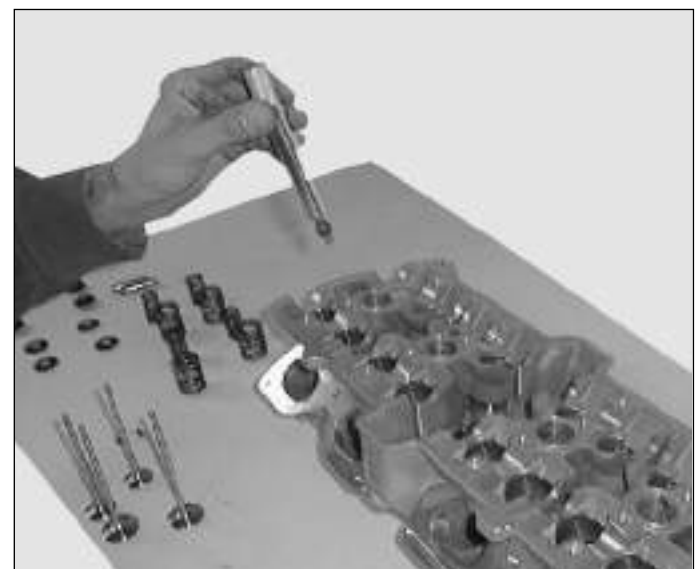
Valve removal

- A) Take out the cups (1) with the help of a magnet and number them with a marker so as to reassemble them in the same position.
- B) Remove the tablets (2) of play adjustment with a magnet and place them inside the relative cup so as to reassemble them in the same position. To remove the semi cones (3) exclusively use tool n° 95179 so as to avoid bending the valves:
- C) Assemble the head on tool n° 94796
- D) Hammer on the superior disk with a rubber hammer to unblock the semi cones
- E) Press the springs on the superior disk
- F) Take out the semi cones with a magnet
- G) Slowly release the disk pusher.



Then remove in the following order:

- A) Semicones
- B) The 2 coaxial springs (4 and 5);
- C) If necessary remove the rubber holdings using tool n°94798
- D) Remove the inferior disk more grazingly (6)
- E) Slide the valve out of the combustion chamber



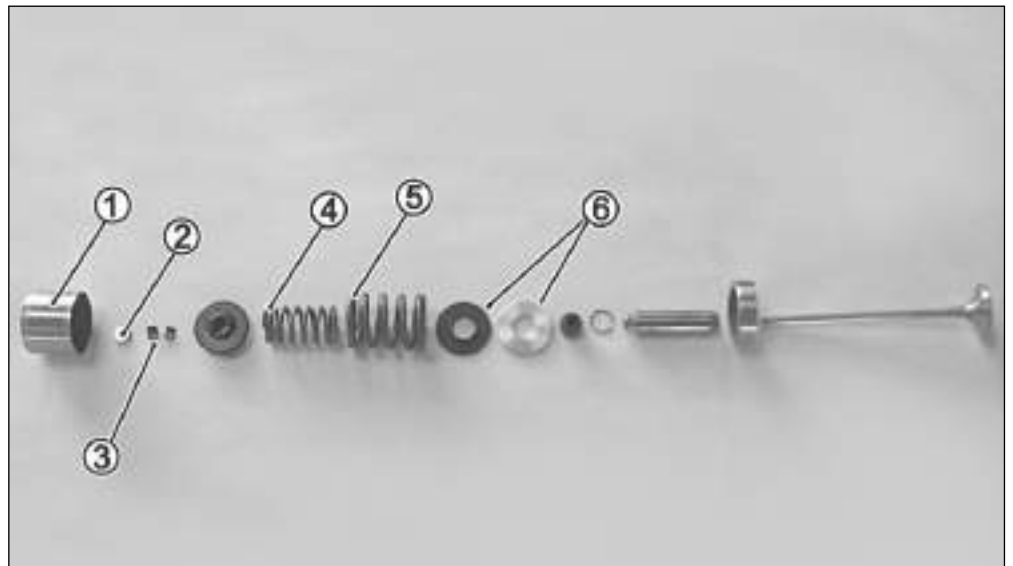


Engine F4 STRADA MY 2000

94798



C



Maintenance of the valve slot

Check the stroke surface [A] between the valve [B] and the slot [C] : no traces of pitting or cracks must appear. Measure the external diameter [D] of the stroke surface on the valve slot.

If this should appear to be too elevated it is possible to repair the slot.

External diameter of the stroke surface of the valve slot

Standard : exhaust $24.6^{+0}_{+0.3}$ mm
inlet $28.6^{+0}_{+0.3}$ mm

Measure the width of the stroke [E] with a varnished gauge or with Prussian blue.

If it should turn out to be too wide, too thin or irregular it will be necessary to repair it.

Area thickness of the stroke

standard : exhaust, inlet $1^{+0}_{-0.3}$ mm [E]

The repair must be carried out by milling the slots using the appropriate monocutting milling machines at 78° (1), 45° (2) and 17° (3).

Then proceed with the grinding of the valves and verification of the holding.

Remove the minimum quantity of material from the slot.

Inlet max 0.5 mm (vertical)

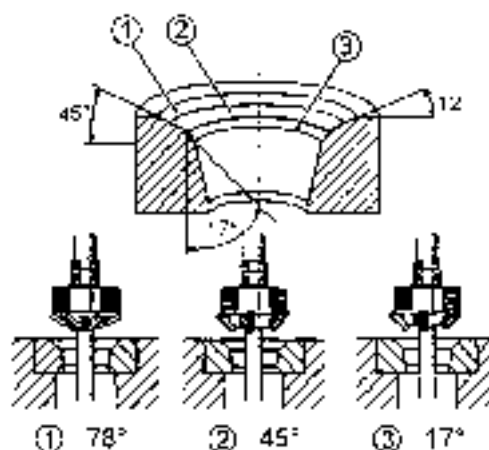
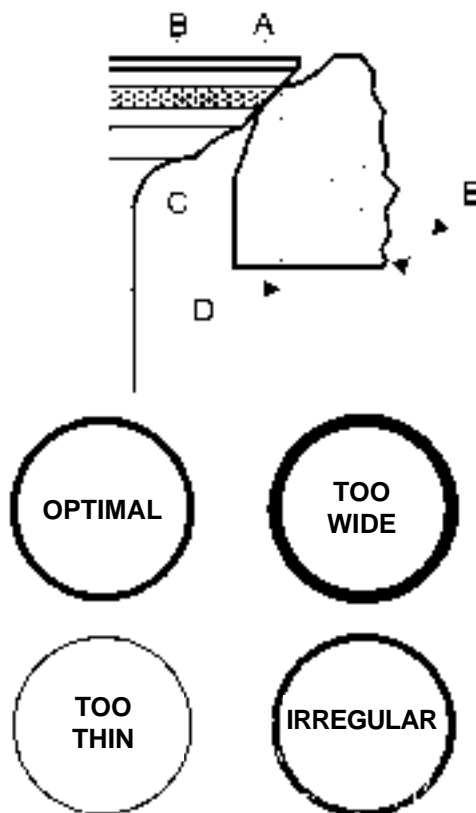
Exhaust max 0.5 mm (vertical)

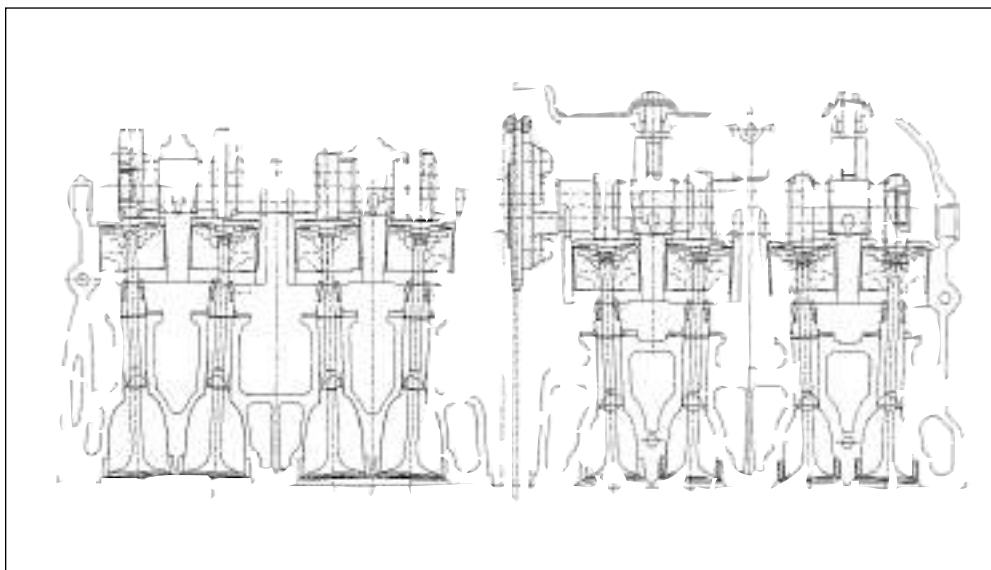


Verify that there is no leakage filling the inlet and exhaust of the gas canalization. If so, check the quality of repair with Prussian blue.



When reassembling never use calibrated tablets of a thickness inferior to 1.6 mm.





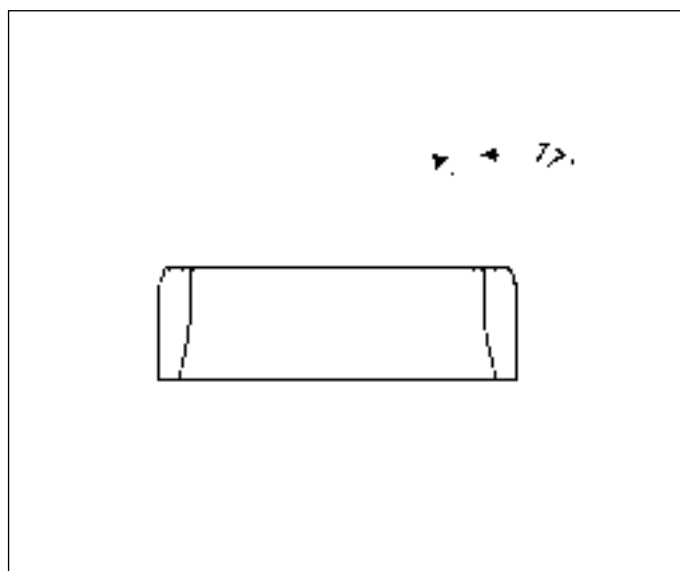
Substitution of the valve slot

The following tools are necessary for this procedure:
prick-puncher n°95319 for inlet slot
prick-puncher n°95318 for exhaust slot

Proceed as follows:

- Remove the worn slots carefully milling them so as not to damage the head lodging
- Check the lodging diameter on the head and choose the oversized valve slot considering that the **assembling interference should be 0.10÷0.15 mm.**
- Valve slots are furnished with an increased replacement part of 0.03 mm on the external diameter.
- Slowly and evenly heat the head at a max temperature of 180°C and cool the new slots with dry ice.
- Place the slots perfectly in frame into its lodging, using the special n°95319 prick-puncher (INLET) and n°95318 (EXHAUST)
- Let cool and proceed with the milling of the slots and grinding the valves referring to the following quotients:

Ø A	$28.60^{+0.3}_{-0}$
Ø S	$24.6^{+0.3}_{-0}$
[E]	$1^{+0}_{-0.3}$





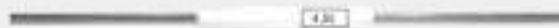
Valve guide check and maintenance

In order to carry out this procedure the following tools are necessary:

Control tampon n°95429
Tampon n°95320

valve stem-valve guide play: **0.01÷0.03 mm inlet**
0.02÷0.04 mm exhaust
coupling limit: **0.08 mm inlet**
0.1 mm exhaust
internal guide Ø limit: **4.55 mm**

95429



Proceed with an accurate visual check of the valve guide.

In order to determine the coupling wear between guide and valve stem it is necessary to measure the play using a control tampon and micrometer.

NOTE The control tampon 95429 (Ø 4.55) must not pass.

NOTE In the case of substituting the guide valve it is necessary to check and if necessary also substitute the valve.

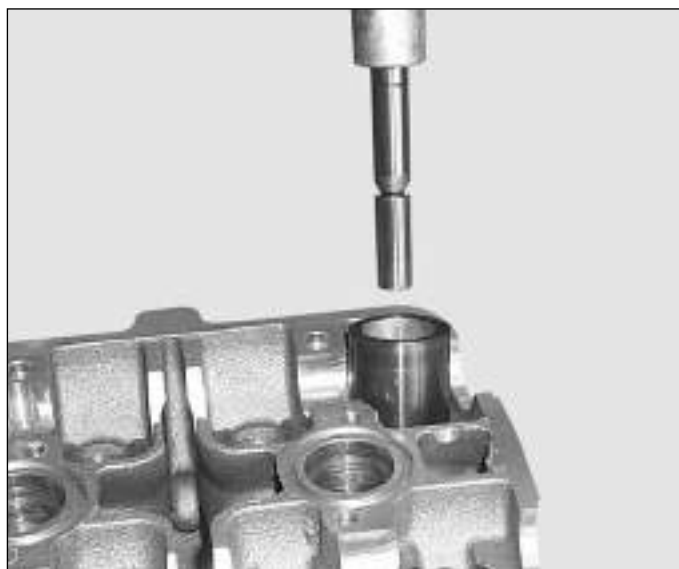
95320



Removal of the valve guide

After having removed the valves and rubber holdings as described in the relative paragraph, continue as follows:

Slowly and evenly heat the cylinder head up to 100°. Using tampon n° 95320 slide out the valve guide. Continue with a visual check of the slot to verify its State.



Guide valve installation

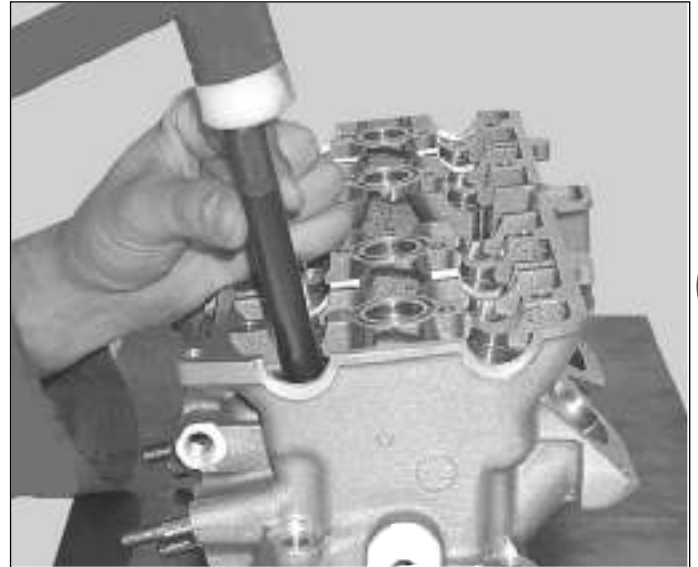
Assemble an oversized valve guide as follows:

Oil the external valve guide surface.

Slowly and evenly heat the cylinder head up to 150°. If necessary cool the valve guides with (N2) nitrogen liquid; or dry ice.

Insert the valve guide using the special n°95320 tampon up to the stroke and let rest until the temperature has stabilized.

Check to be sure the valve slides freely in the valve guide otherwise coat it with a 4.5 H7 reamer or broach N°8000 A2625.



Valve

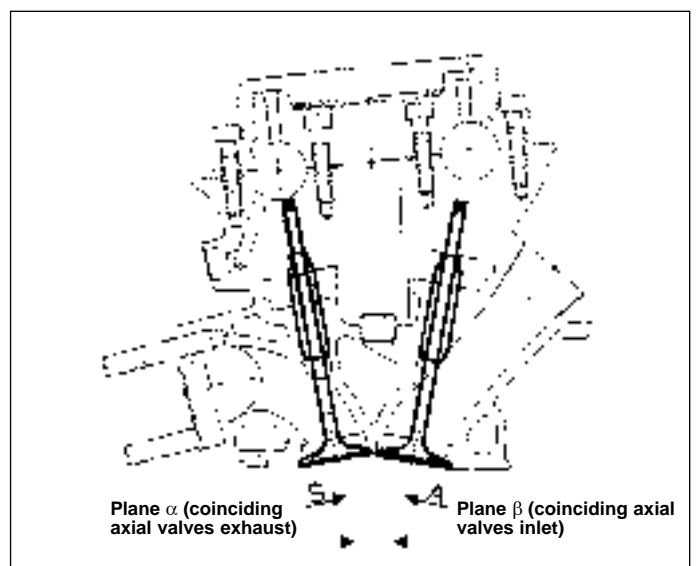
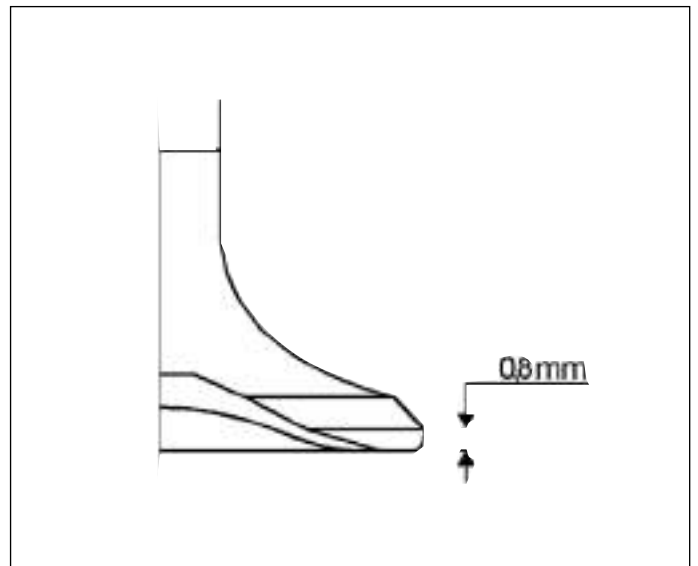
The stem diameters must not fall below:

4.485^{-2/100} mm inlet

4.475^{-2/100} mm exhaust

The minimum distance of the holding position at 45° on the valve plane must not be lower than 0.8 mm (see figure).

Check to be sure that the stem and the surface in contact with the valve slots are in good condition. No traces of pitting, cracking, deformations or traces of wear should appear. Verify that the stem is perfectly rectilinear.



Valve-guide valve coupling

Coupling play at assembly must be:

0.01 ÷ 0.03 mm inlet.

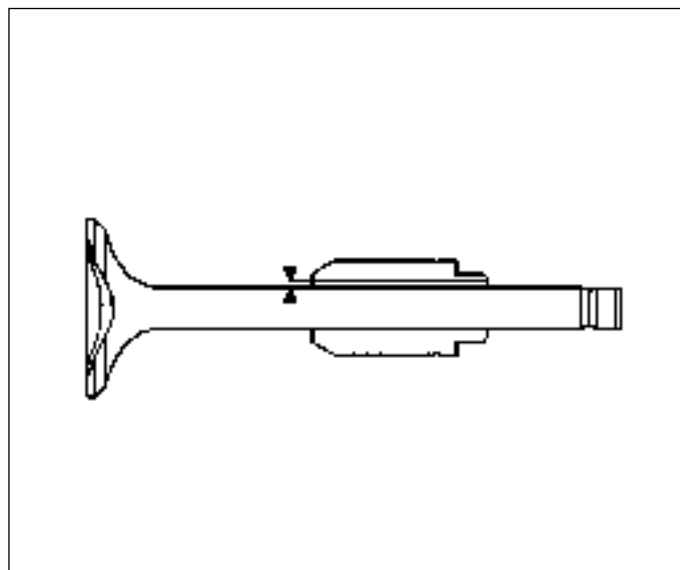
0.02 ÷ 0.04 mm exhaust

The maximum coupling limit permitted is even to

0.08 mm inlet

0.10 mm exhaust

If a major play should result, substitute valve and valve guide.



Springs

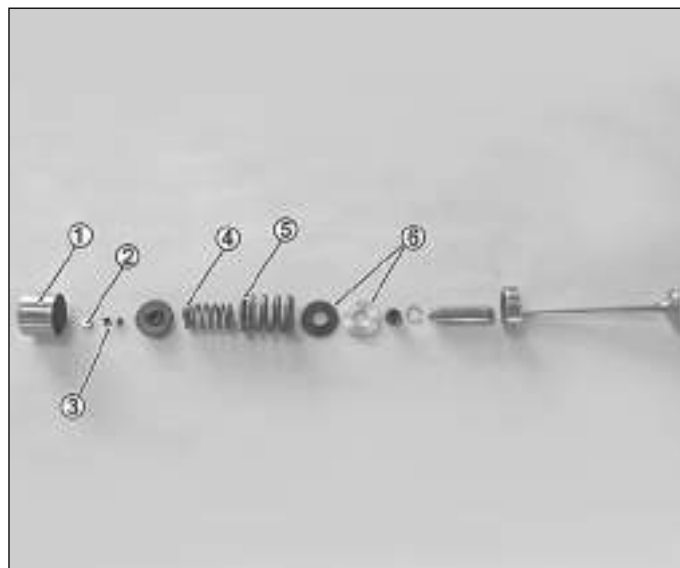
Check to be sure that the free value of length is not inferior to the suggested limit and in such case substitute the springs:

Internal spring l = 30.5 mm.

Service limit: 30 mm

External spring l = 32.6 mm.

Service limit: 32.1 mm



Valve reassembly

A) Carefully degrease the guide

B) Insert the inferior basement disk (6) and be sure that it is in beat.

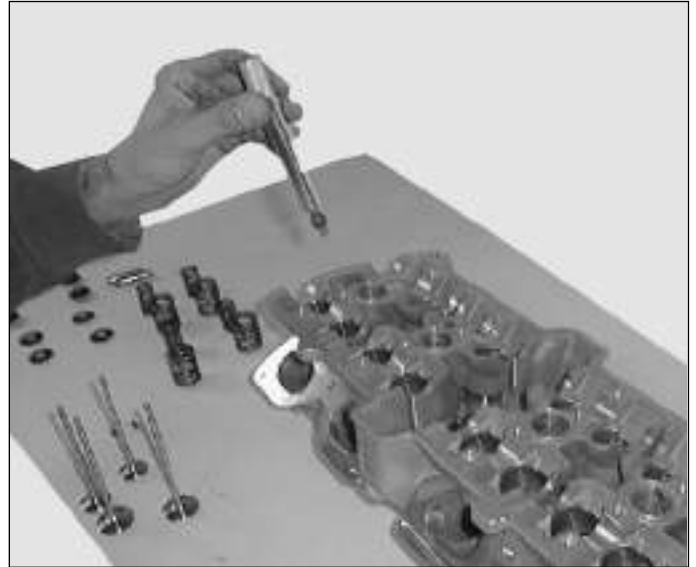
C) Assembly the rubber holdings, always new, on the valve guide using tool n°95581;

D) Sprinkle the valve stem with oil.

95581



Assembling the valve.



Insert in the order of:

- A) Insert the two coaxial springs
- B) Slide the semi cones into the superior disk slot and thus place the disk on the springs
- C) Assemble the head on the disassembling valve tool n°94796 and compress the spring with tool n° 95180 until the semi cones are inserted
- D) Using a rubber hammer strike a slight blow on the valve so as to place the semi cones.

NOTE Before placing the semi cones be sure that the head is not resting on a plane in order to avoid distorting the valve. Place it onto two bases which allow the valve to move.



- E) Insert the tablet of the correct thickness and lubricate its surface
- F) Make sure it easily turns in its slot
- G) Insert the cup after lubricating the slot

Insert the cylinder head as described in the paragraph "Head assay assembly".



Regulating valve play

Verify that the spark plugs have been disassembled.



Should this procedure be carried out with the head assembled on the motor, block the spark plug holes with clean rags and assemble plate n°95191 to avoid the pieces accidentally falling into the chain distribution opening.

A) Rotate the drive shaft until completely unwinding the springs relative to the valves on which intervening (MSP in burst phase).

B) Measure valve play with a thickometer.

Inlet valve play	Exhaust valve play
0.15 ÷ 0.24 mm	0.20 ÷ 0.29 mm

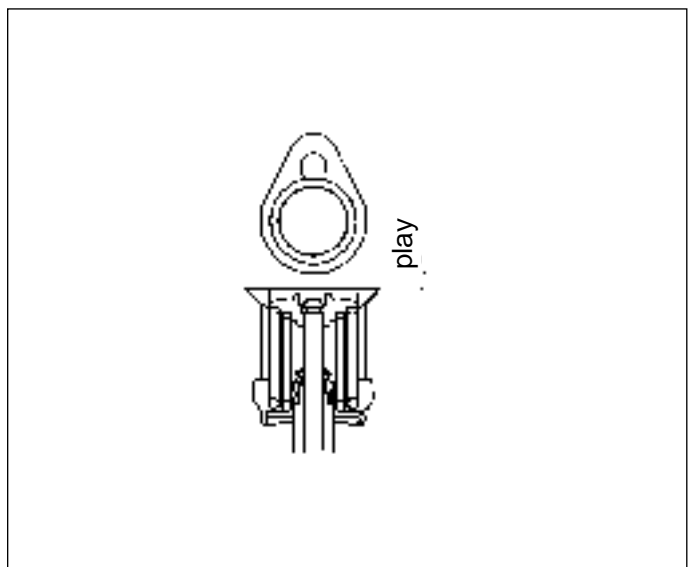
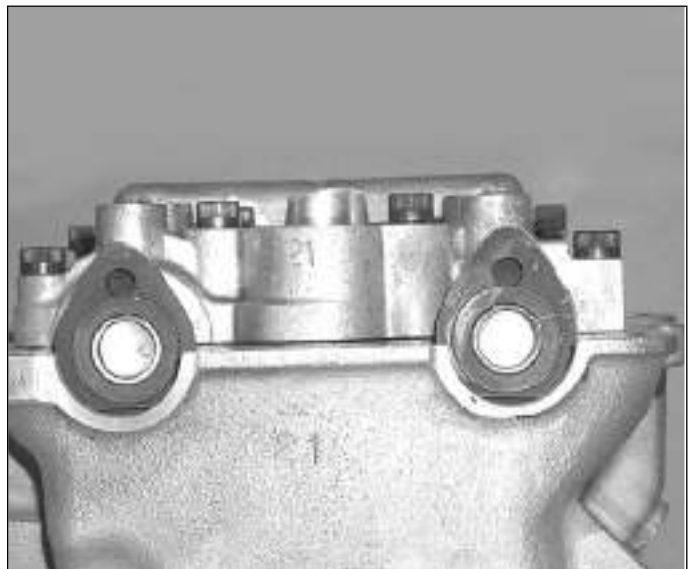
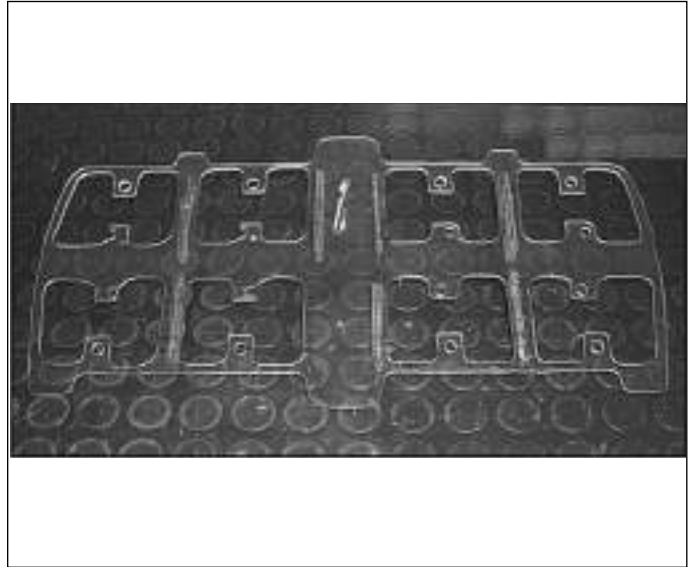
C) Calculate the D difference between the compared play and optimal play shown on the chart

D) Read the value of S thickness on the tablet;

E) Choose a new tablet with an S+D thickness.



During reassembly never use a tablet with a thickness less than 1.6 mm.



Chain tensioner

Remove the central screw-cap and withdraw the spring and the pin.

Remove the screws fixing the chain tensioner to the head.

Remove the chain tensioner.

Disassembly the chain tensioner and check the correct working of each part.

The internal pin must run clearly and the inner spring must give a quick response.

Replace the assembly in case of malfunction.

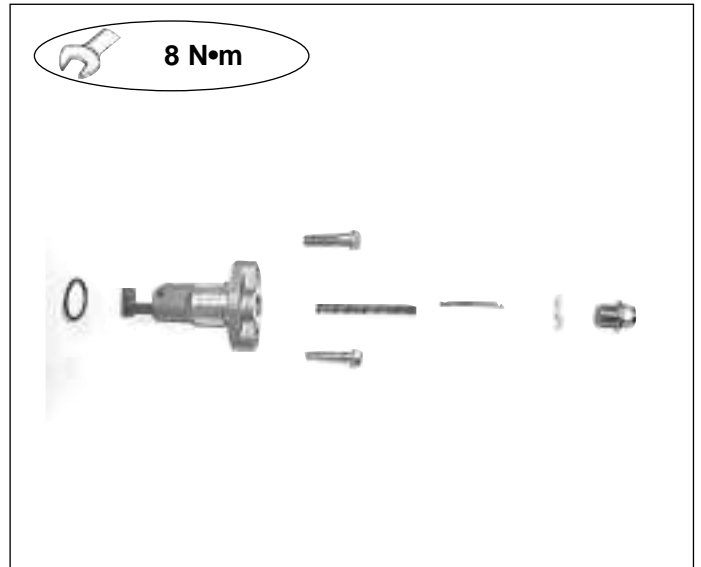
If everything works properly lubricate the parts and install the assembly with the chain tensioner in the minimum extension position (all in the main body)

Install the chain tensioner body locking the 2 socket head screws using a T wrench with a 8 Nm torque

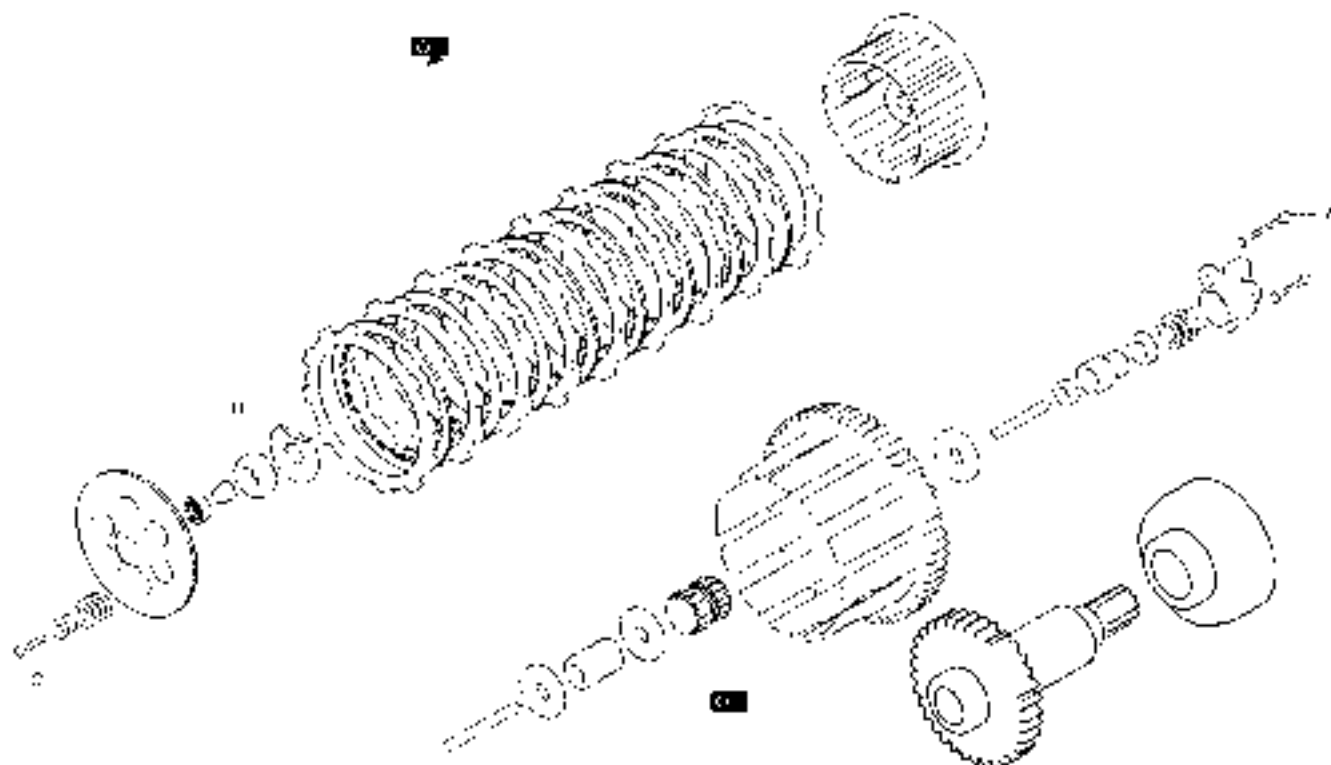
Install in this order: the pin in the spring, the spacer and the screw cap.

Lock the screw cap by hand till you feel the tensioner extend, then lock it with a 8 Nm torque

Acting this way the chain tensioner is adjusted.



CLUTCH



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	100	10							
	Kg·m										
	ft·lb										
Thread blockers			Strong								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

The clutch release occurs using a postponing return group composed of a small thrust piston placed on the left side of the motor and operated by a hydraulic system.

This small piston pushes a command rod which makes the disk pusher plate function.

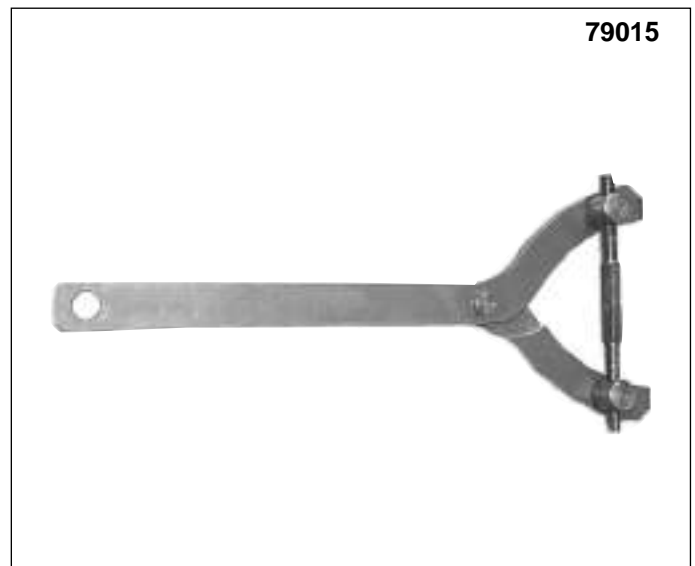
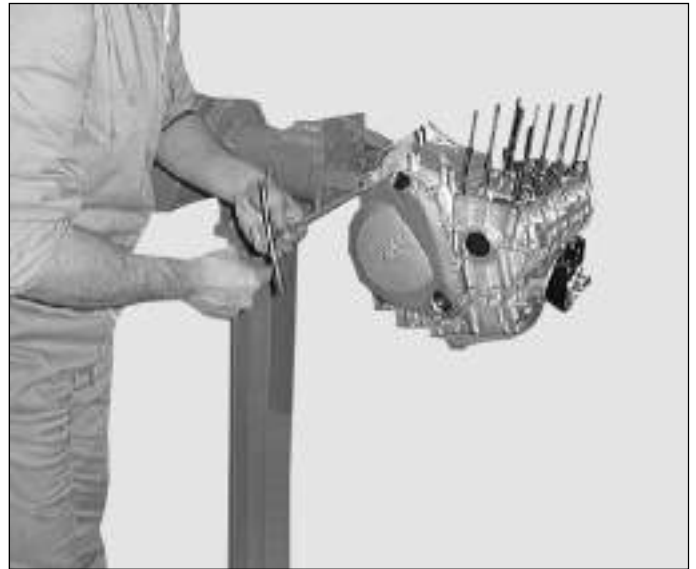
Clutch disassembly

In order to carry out this function the following special tool is necessary:

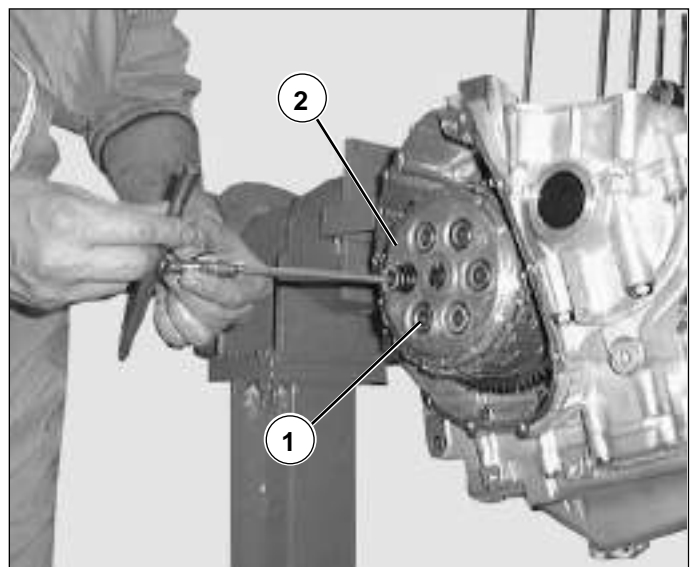
Utensil n° 79015

Remove the 11 screws which fasten the clutch cap to the bedplate.

Remove the clutch cap together with the gasket which will be substituted during reassembly.



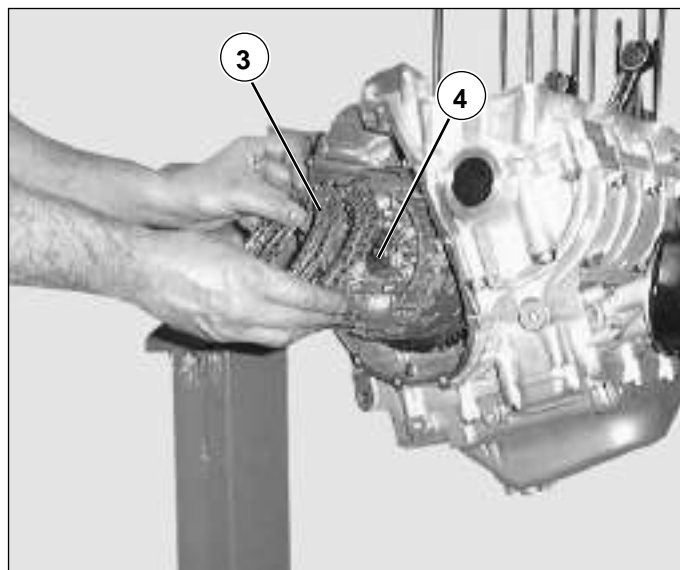
Remove the 6 disk pusher plate tightening screws (1) together with the relative springs (2).



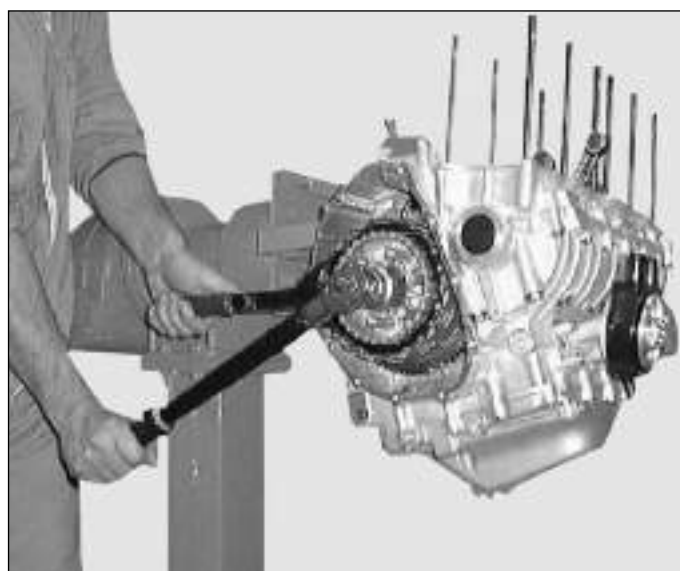
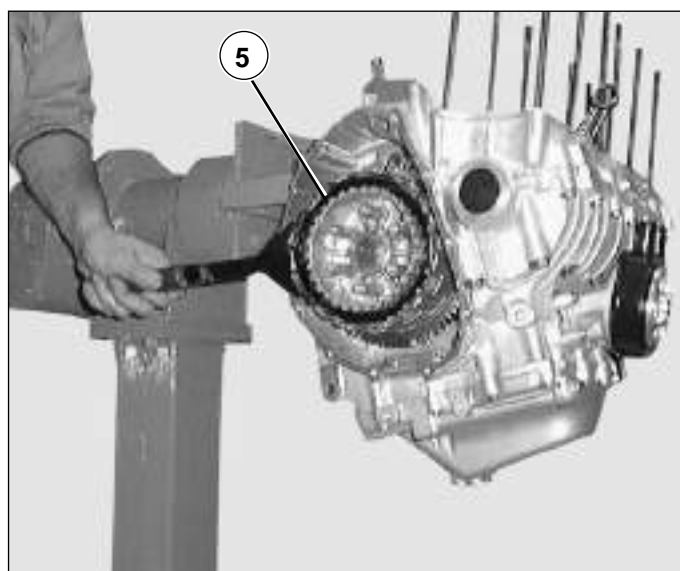


Engine F4 STRADA MY 2000

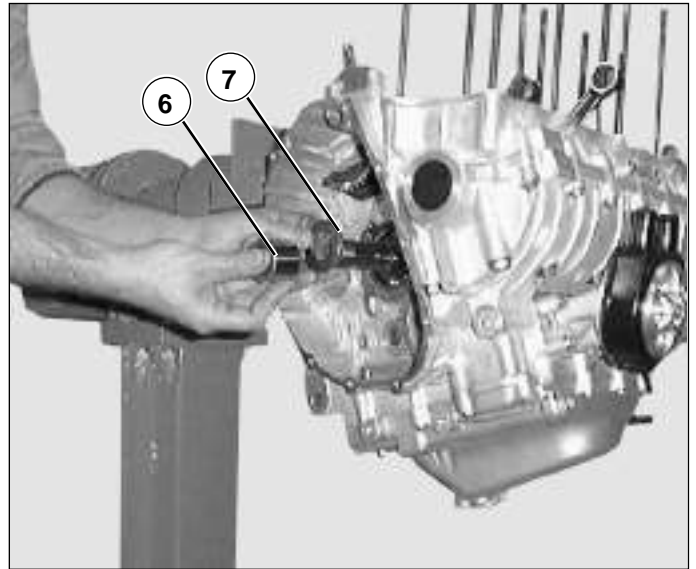
Remove the disk pusher plate.
Manually remove all of the attrition disks (3) that you can.
Straighten the nut washer (4).



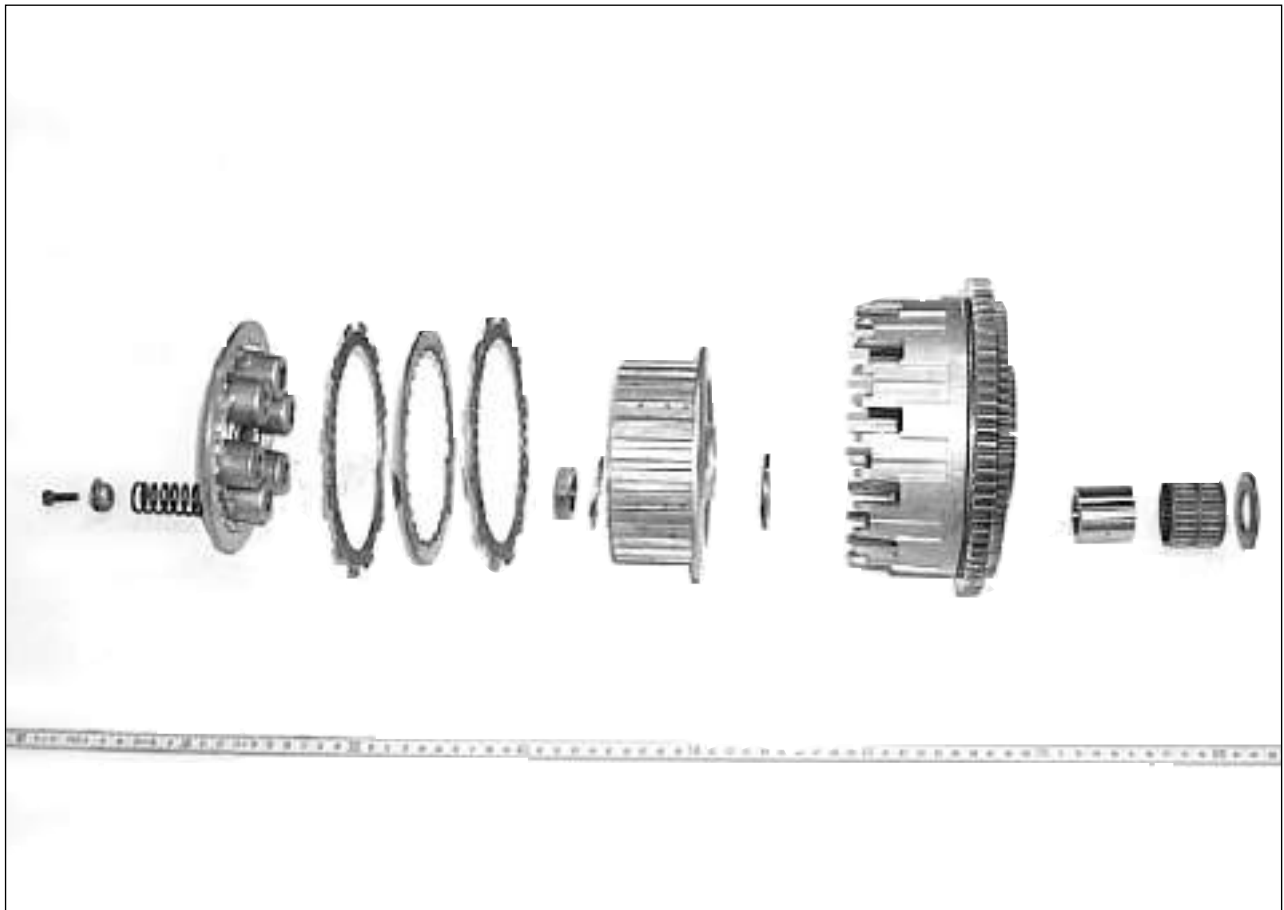
Unscrew the nut using tool n°79015 to hold the clutch hup still and remove it (5).



Remove the clutch block and then the separator (6) and the grazer washer (7).



Disassemble the clutch block following the sequence in the figure.



Clutch overhauling

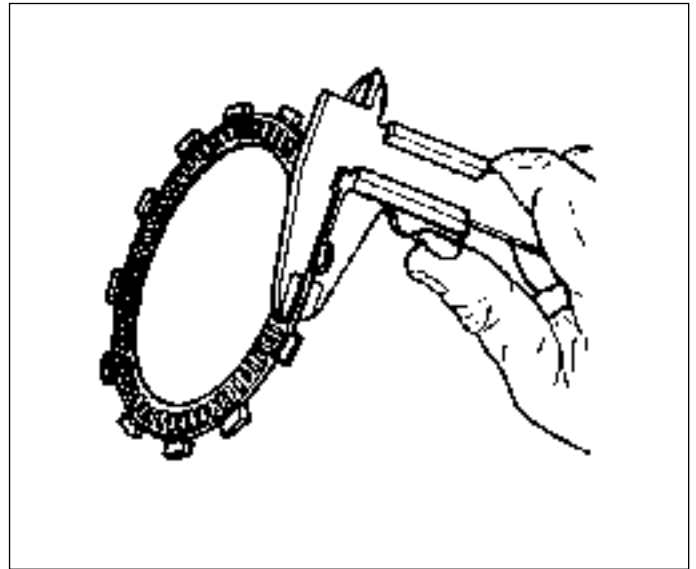
Check the rod for straightness and wear.

Check the friction plates for wear. **The standard thickness is 3 mm**

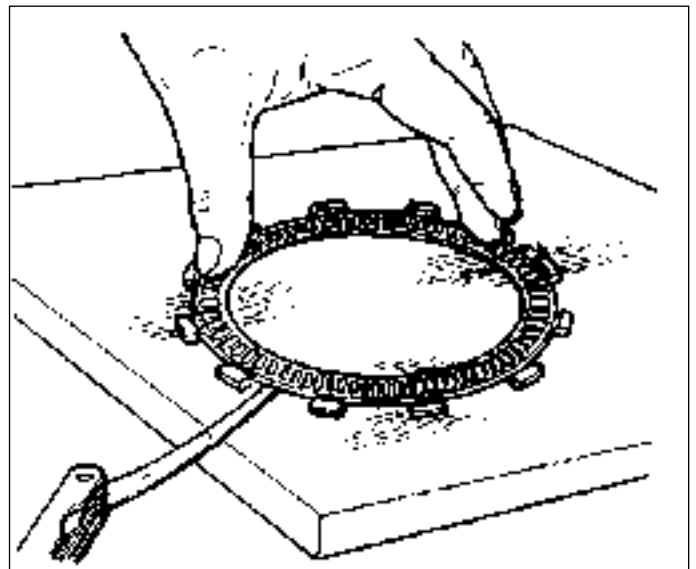
Wear limit : **2.8 mm**.

No signs of burning, grooves or other damages are allowed.

Replace the whole plates group even if only one is damaged.



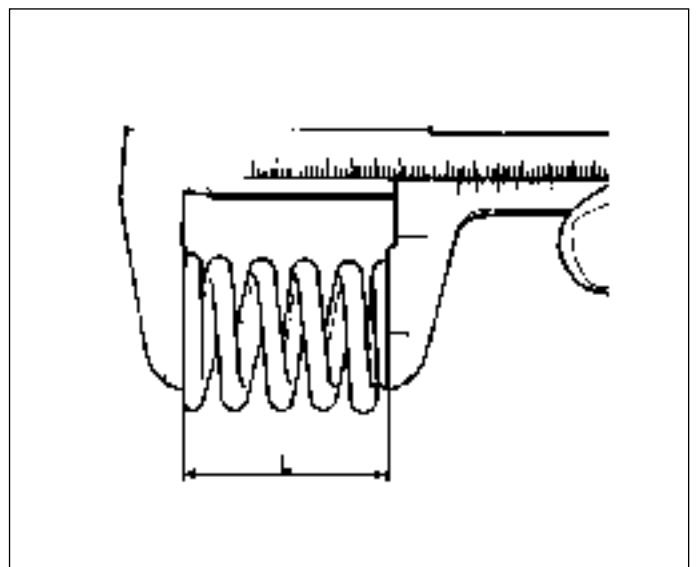
Put the plate on a table and check the deformation.



Measure the length "L" of the springs with a gauge.

Service limit: **34.4 mm**

Replace the springs exceeding the service limit.



Clutch reassembly

Assembling clutch block.

Assemble the disks alternating the 9 garnished ones with the 8 smooth ones beginning with a garnished disk.

Assemble the block respecting the 3 grippings particularly verifying the one with the drive shaft.

Insert the grazing washer and the separator.

Insert the clutch hub.

Insert the safety washer and nut.

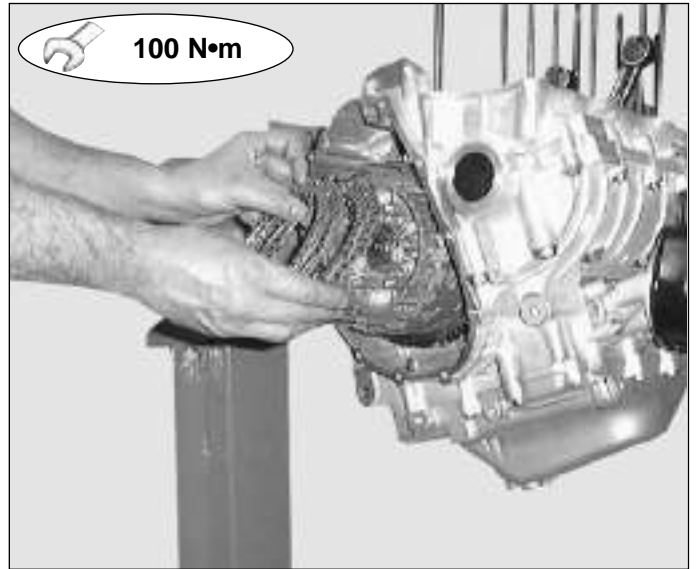


It is recommended that a new safety washer and nut be used during reassembly.

Tighten the nut at 100 Nm using a strong thread blocker and bend the safety washer.



The first 8 garnished disks must be assembled in the same clutch dome groove. The last disk must be rotated a pace further than the proceeding ones.



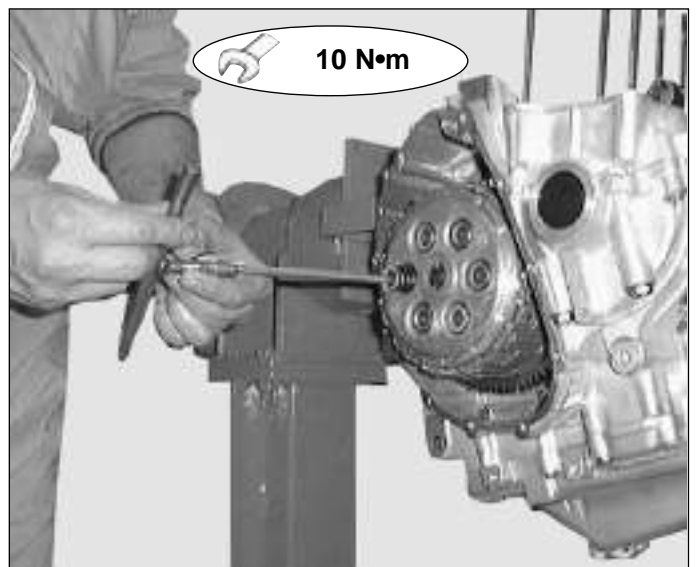
Assemble the disk pusher plate tightening the screws with springs as 10 Nm.

Substitute the cap gasket.

Aline the centering pins.

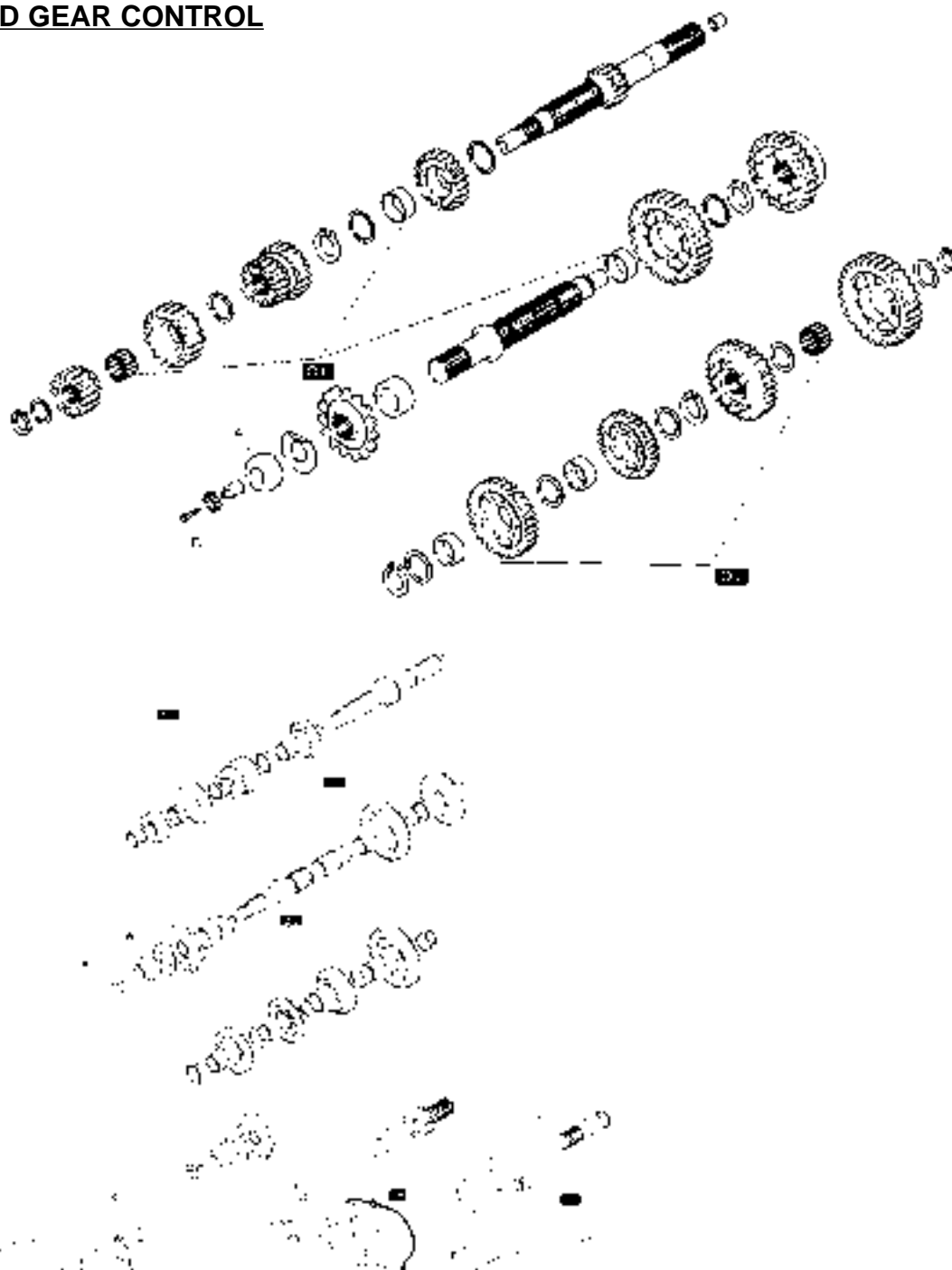
Position the cap and manually bring screws close.

Tighten the screws at 8 Nm.





GEAR AND GEAR CONTROL



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	100	8	8	6	12	25				
	Kg·m										
	ft·lb										
Thread blockers		Strong	Medium			Medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Disassembling gear group

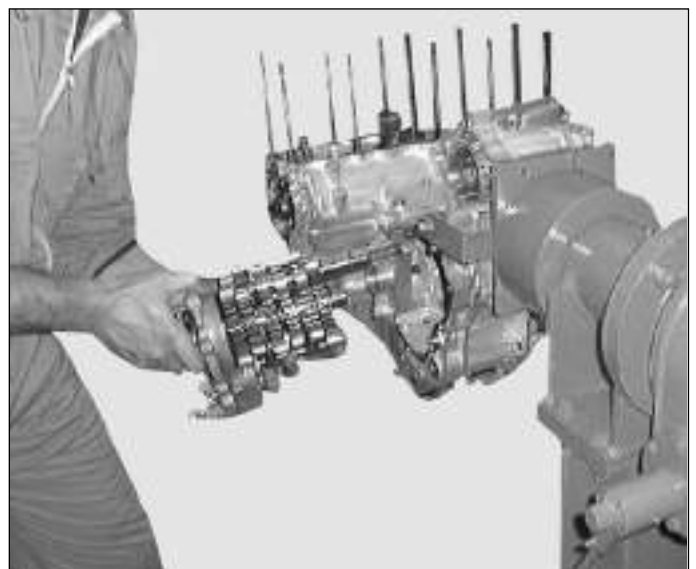
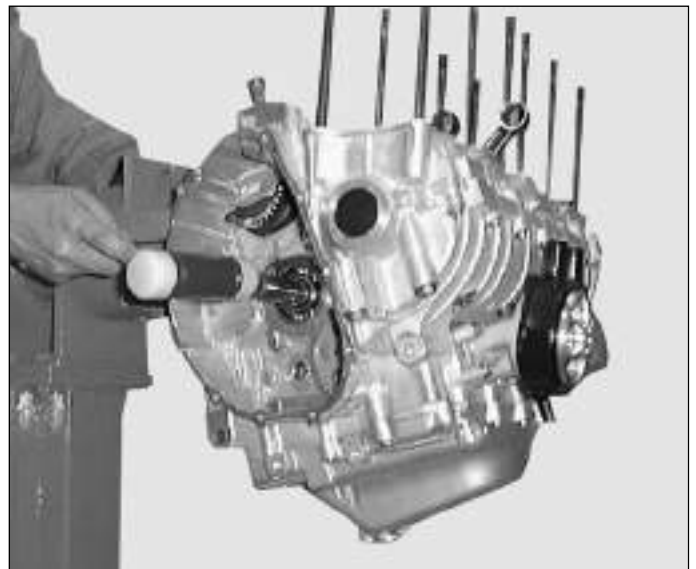
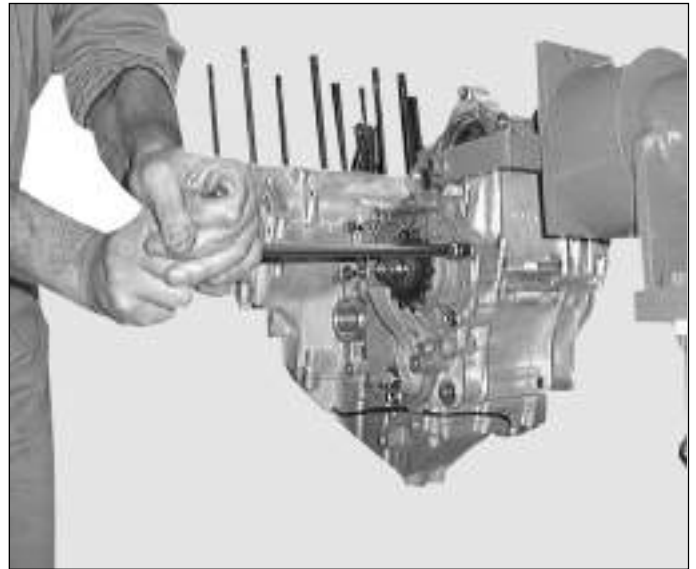
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.



Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear of irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

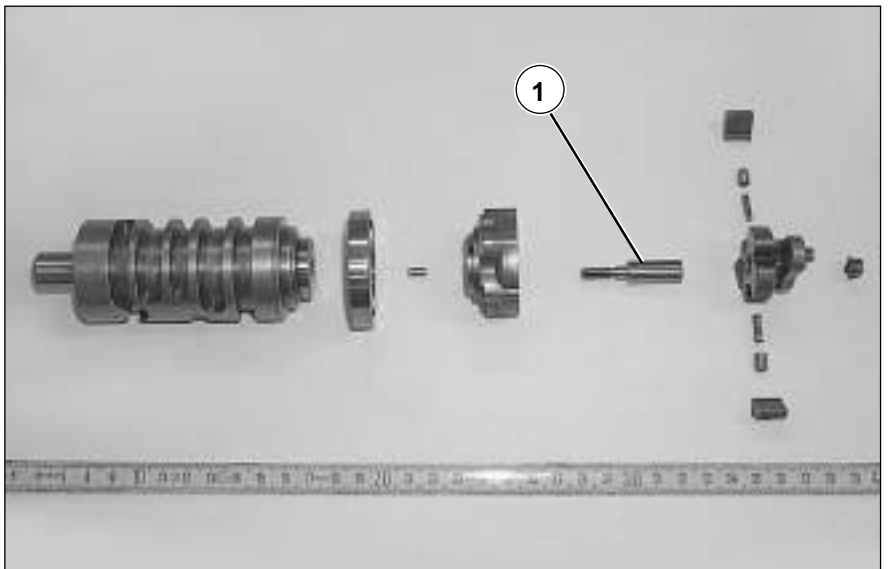
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

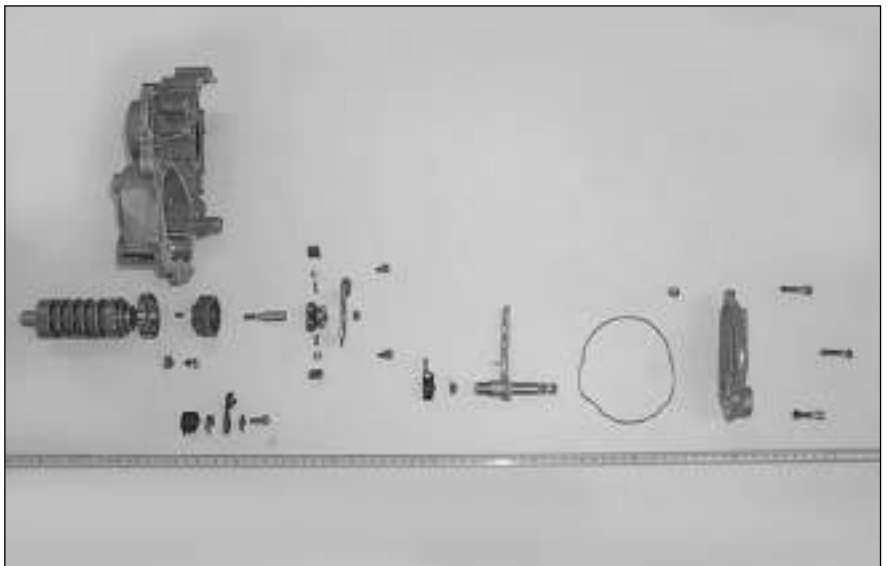
Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.



Verify the gear locker pawl free movement.

Reassemble the various parts by acting in the opposite way.



Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly.

Lock all the screws at a 10 Nm torque but the screw 1, needing a 12 Nm torque.

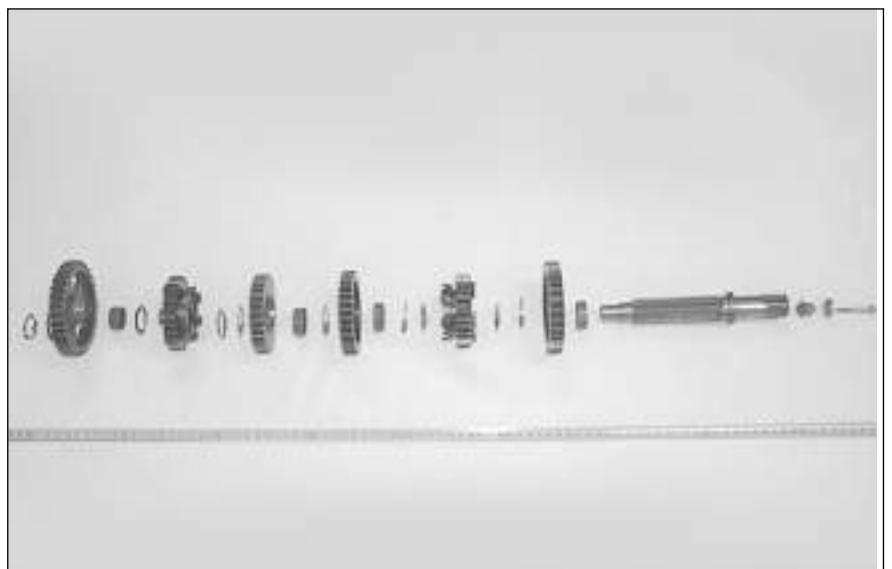
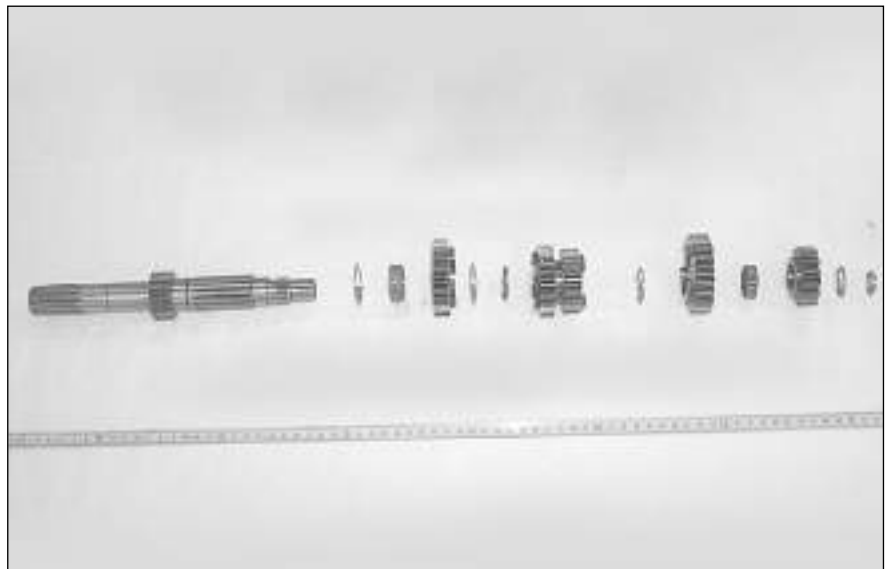


Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.





Gear group revision

In order to carry out the following procedure the following special tool is necessary:

Motor simulation utensil n° 94792

Disassemble the gear group from the motor and reassemble it on the special utensil n° 94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.

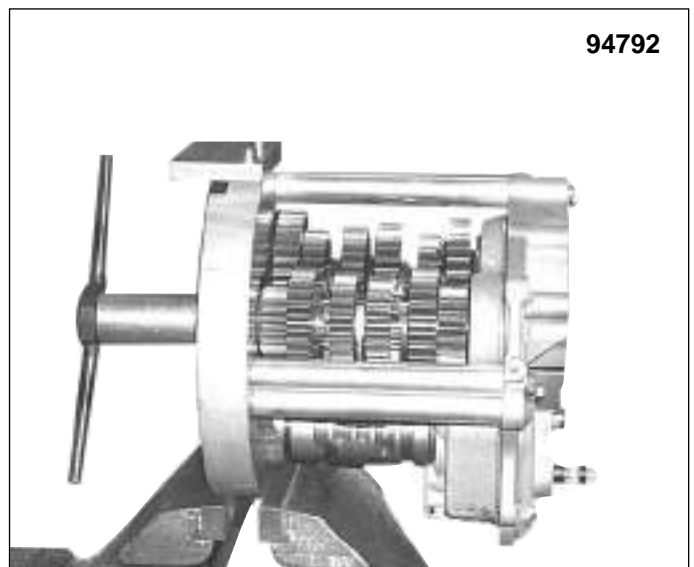
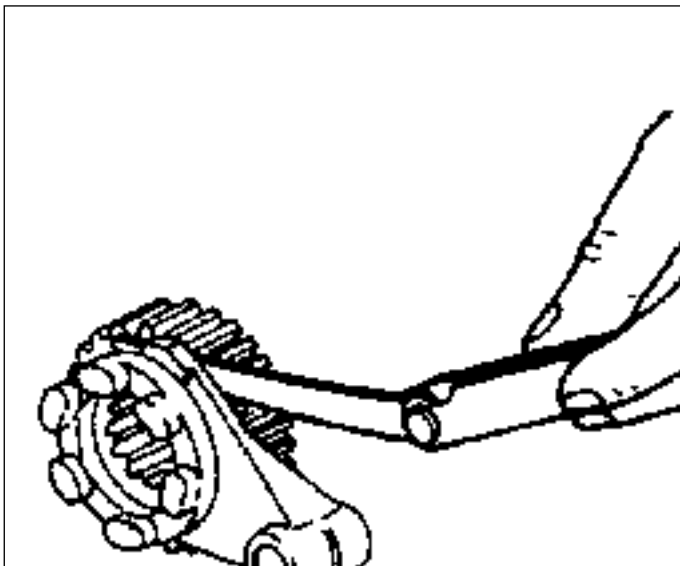
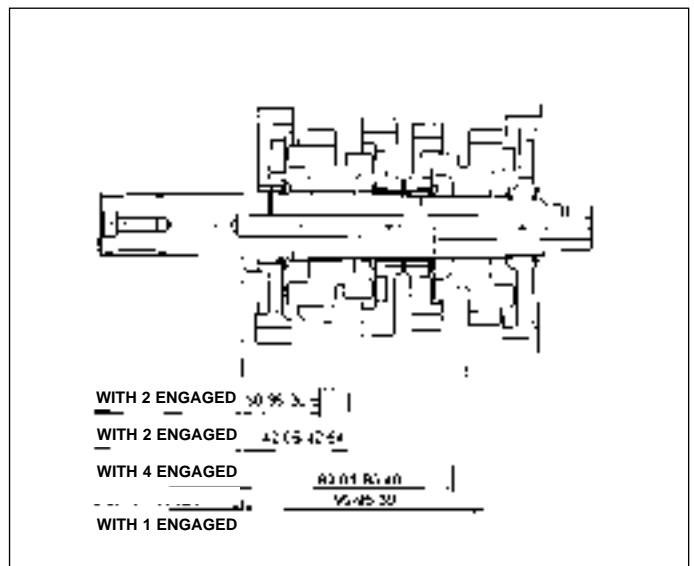
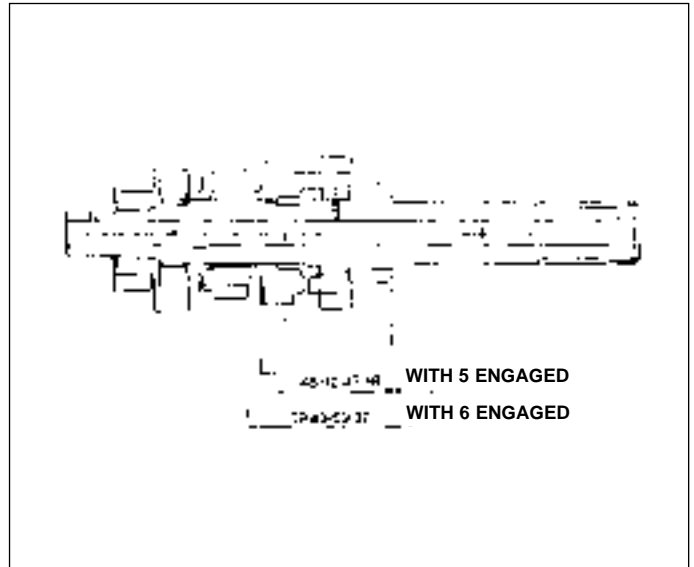
Gear selection forks

Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm Primary
	4.6 mm Secondary
Fork limits	4.65 mm Primary 5-6 gear
	3.65 mm Secondary 1-2, 3-4 gear

The fork must be able to move without force. Grippage of the gears must flow without impediments and without excessive attritions.



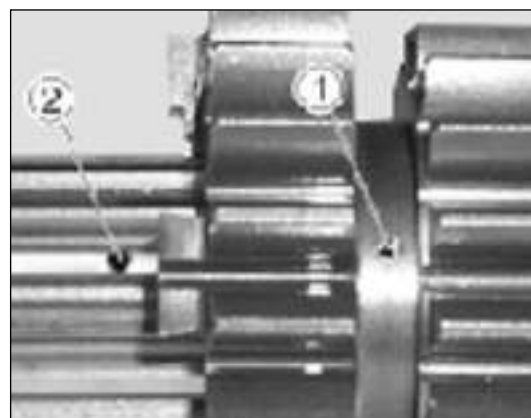
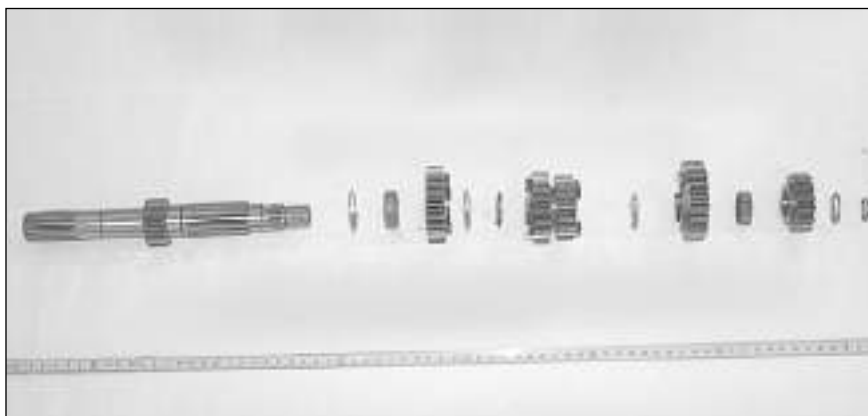
94792

Installation

To execute this operation you need the following special tools:

n° 94792 gearbox tool

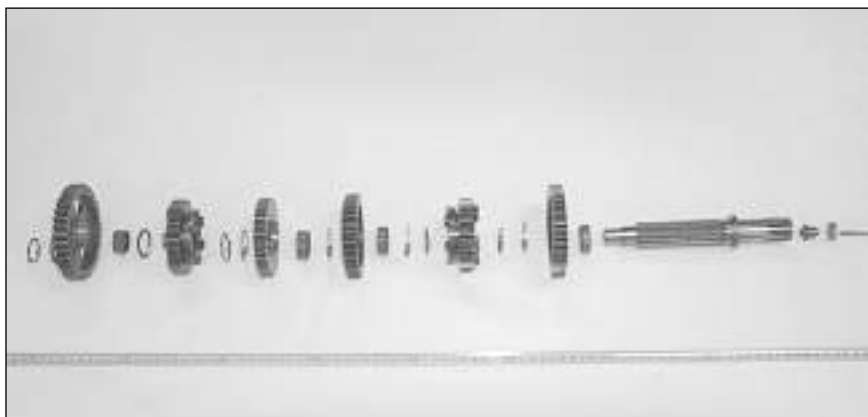
There are 3 holes (1) at 120° on the fork slide of the sliding gear. These holes must be perfectly aligned, at reassembly, with the ones (2) on the shaft, in the gear engagement position.



Reassembly the various parts by acting in the opposite way.
Install the 2 shafts on the n° 94792 engine simulation tool.
Install a shift pedal and check the gear box is correctly working.



Always install a new washer under the pinion at reassembly.



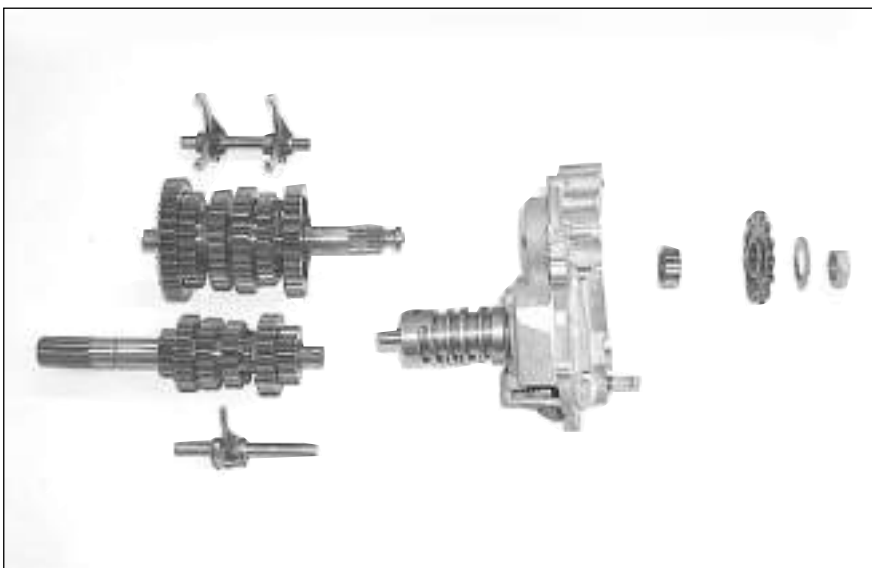
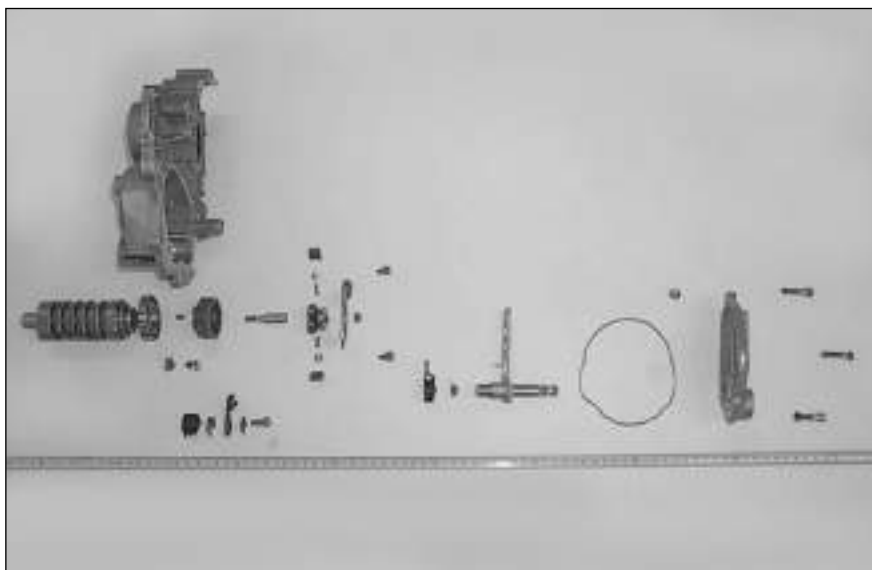
All the gears must be inserted and uninserted without stumbling.

In case of stumbling, verify that the axial play has been correctly restored.

With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to **0.2 ÷ 0.3 mm** placing it on both ends of the coupling.

The fork must be free.

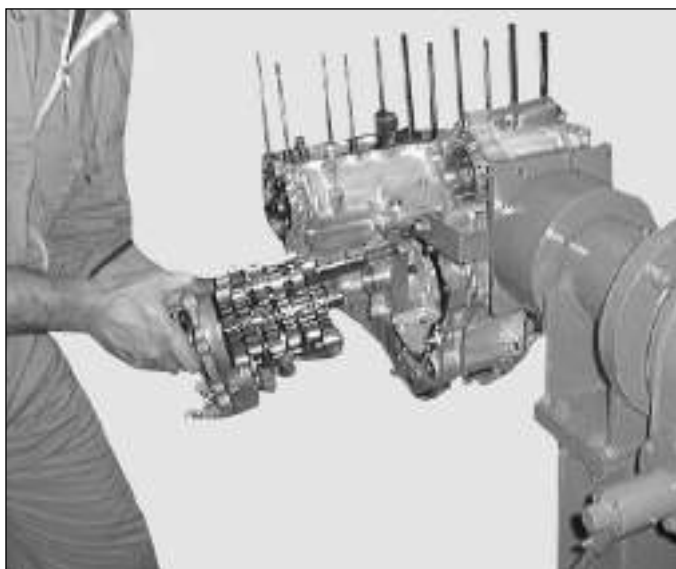
Assemble the gasket on the internal end.



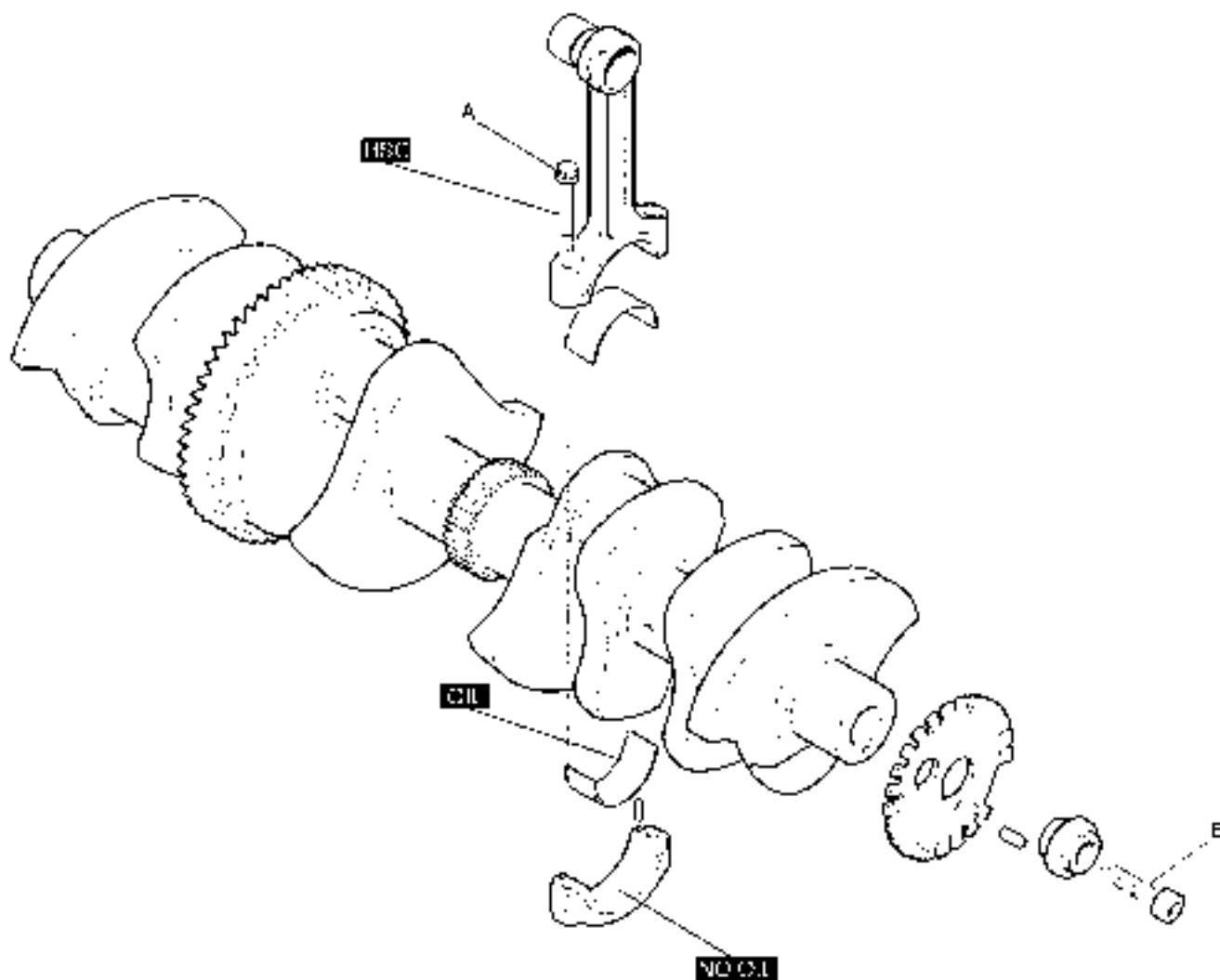
Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.



Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.



MOTOR SHAFT

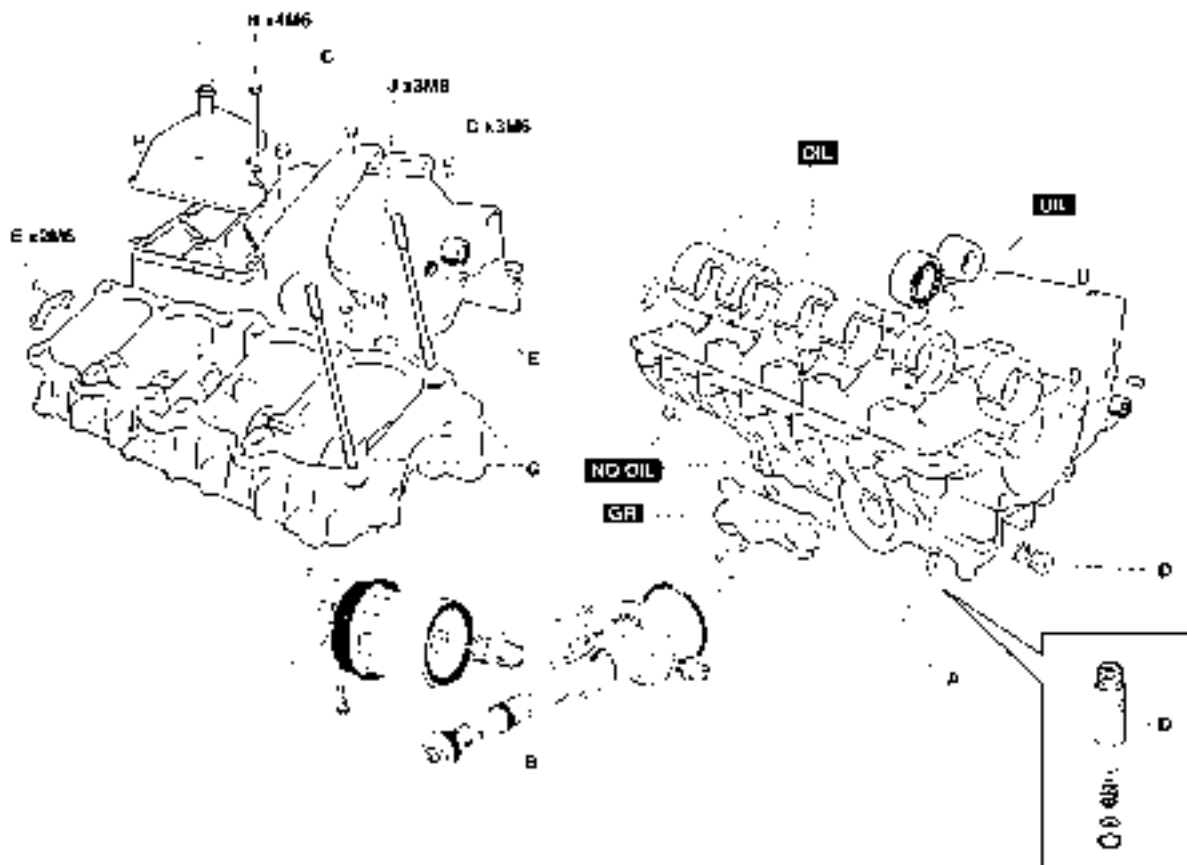


		A*	B	C	D	E	F	G	H	I	J	K
Tightening torque	N·m	25 + 55°	25									
	Kg·m											
	ft·lb											
Thread blockers			Medium									

* See text.

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

BEDPLATE



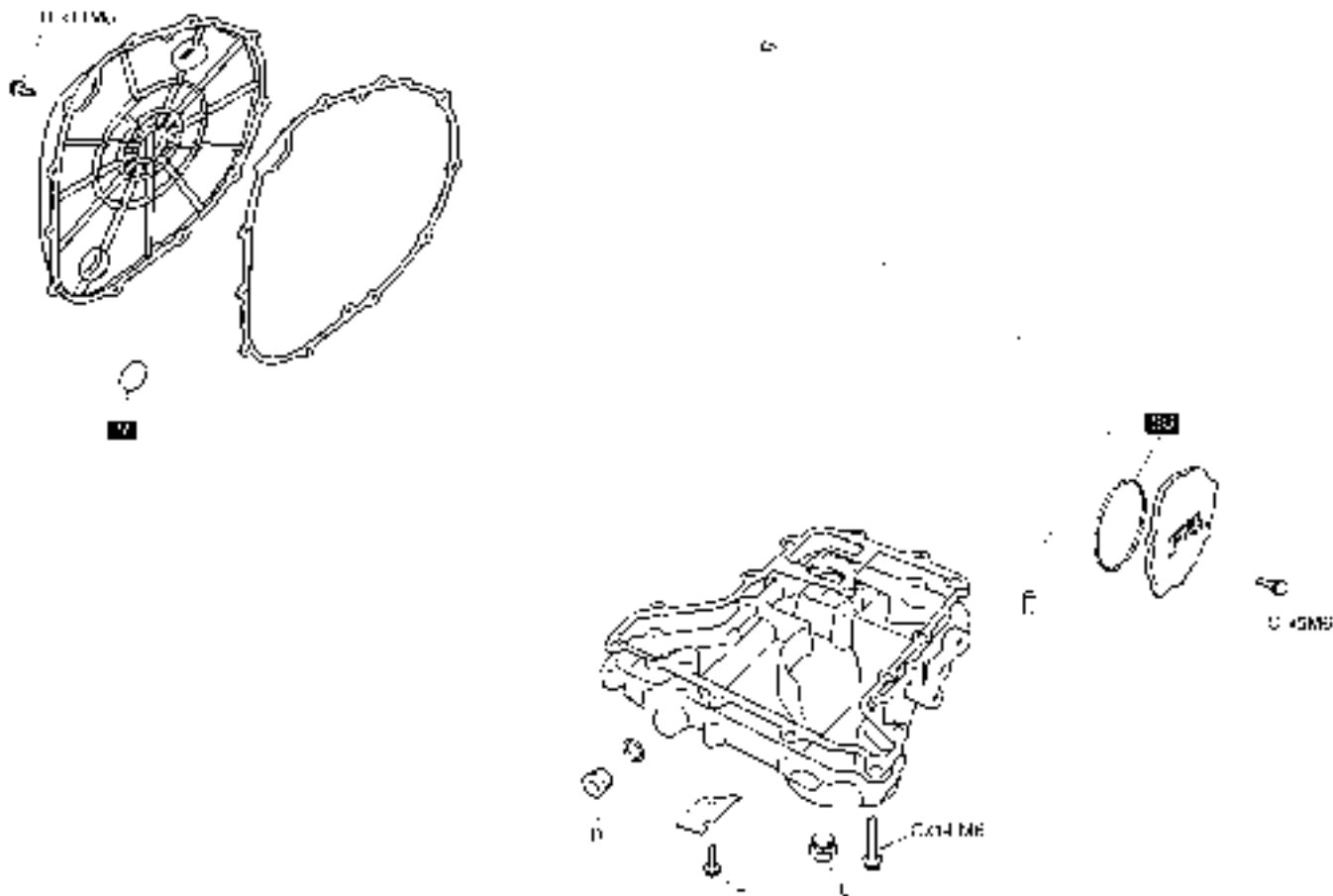
		B	C	D	E	F*	F*	G	H	I	J	K
Tightening torque	N·m		10	25	10	10+50°	10+60°	22	8	14	25	30
	Kg·m											
	ft·lb											
Thread blockers				Medium	Medium			Medium				Medium

* Matriculation up to 545 / • Matriculation from 546 (see text).

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



CAPS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N.m			10	25	10			8		35
	Kg.m										
	ft-lb										
Thread blockers					Medium	Medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Oil cup

Remove the oil cup by means of the 6 mm tightening screws.

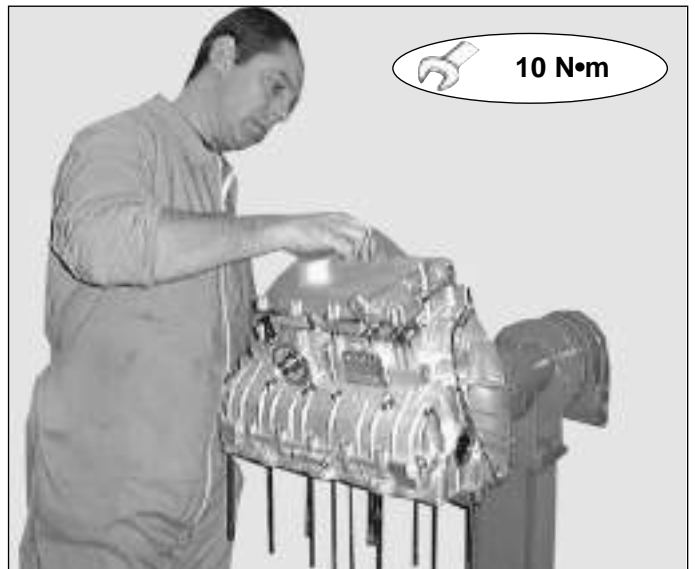
Always substitute the gasket during reassembly.

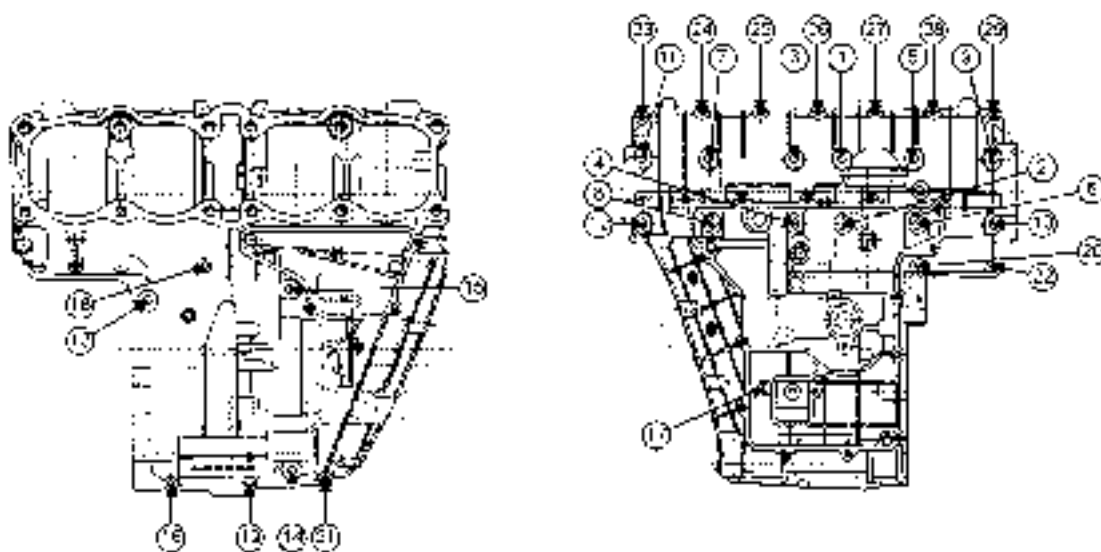
Check to be sure that the oil inlet filter is integral with no cracks or slits; clean it with compressed air at a low pressure blown from the inside towards the outside.

To remove the oil inlet filter unscrew the tightening screws. At reassembling tighten the 2 screws at 8 Nm and block them with 242 LOCTITE after having carefully degreased them.

Position the gasket and manually bring the screws closer.

Tighten the cup screws at 10 Nm.





Disassembly

Remove the oil filter exchanger with heat relative bearing.

Remove as follows as indicated in the relative paragraphs:

- A) The head
- B) The cylinder group
- C) The pistons
- D) The clutch
- E) The gear

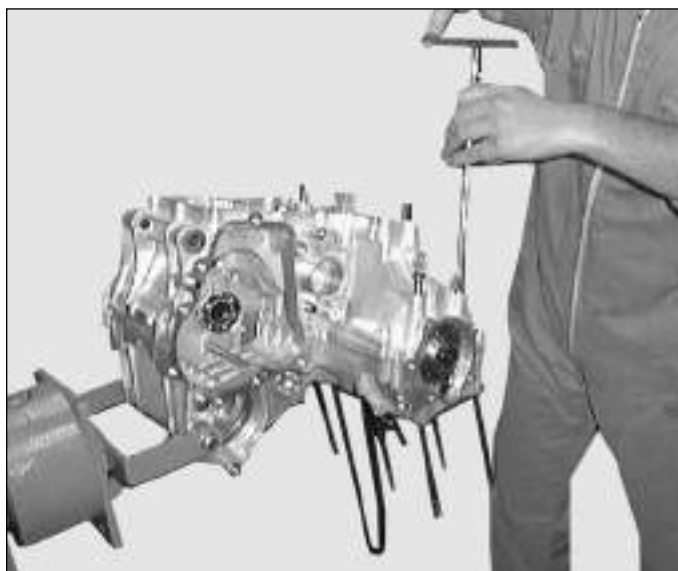
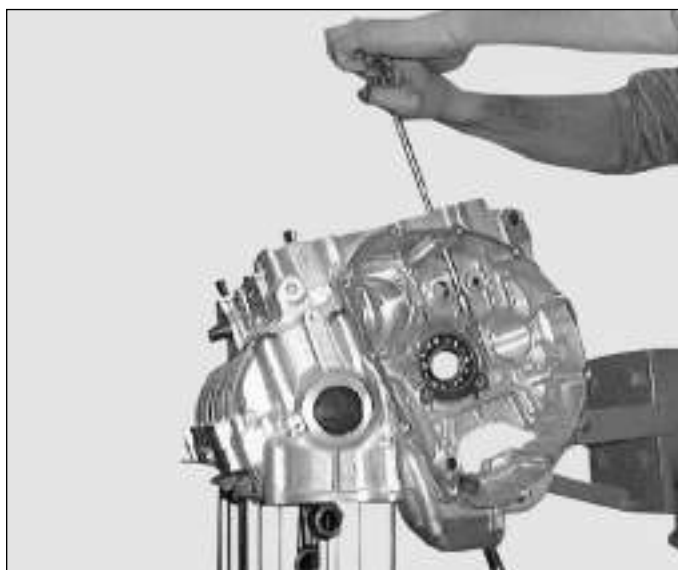
Remove:

F) The screws including the one for the blow-by cap.

NOTE Remember to unscrew the screw inside the carter indicated in the picture at the right.

G) The size 8 screws.

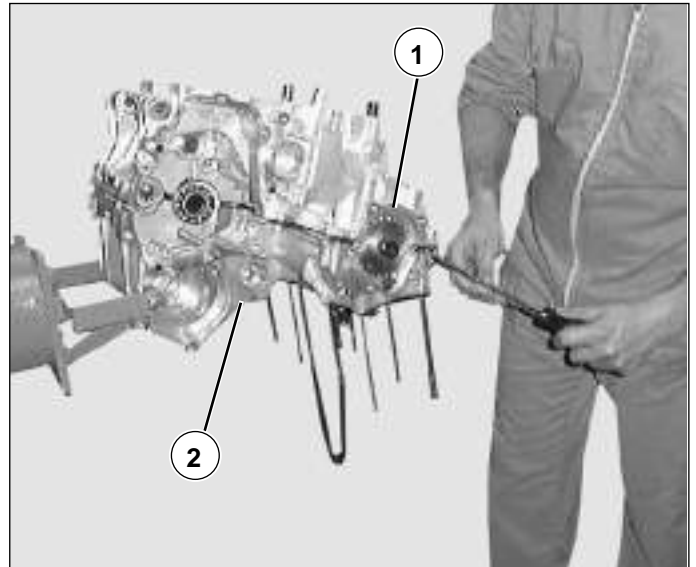
NOTE All the screws are of the same length or visually different; it is therefore impossible to confuse them during reassembly.



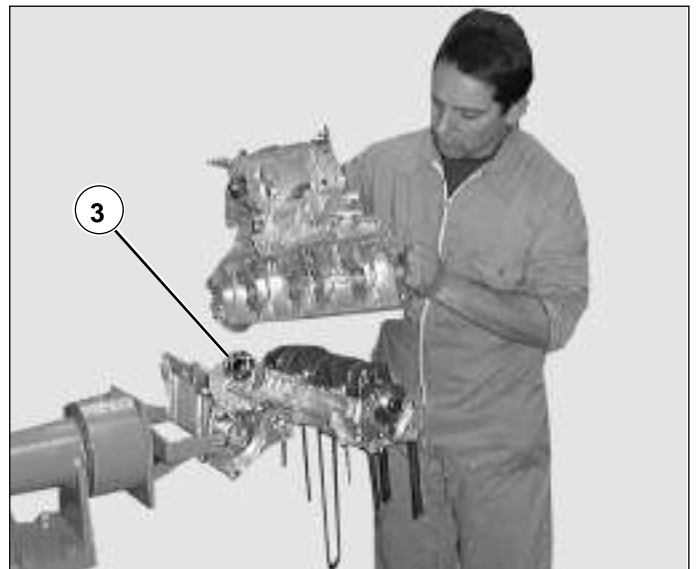


Engine F4 STRADA MY 2000

H) Separate the two carters (1 and 2) by manipulating the protrusions.



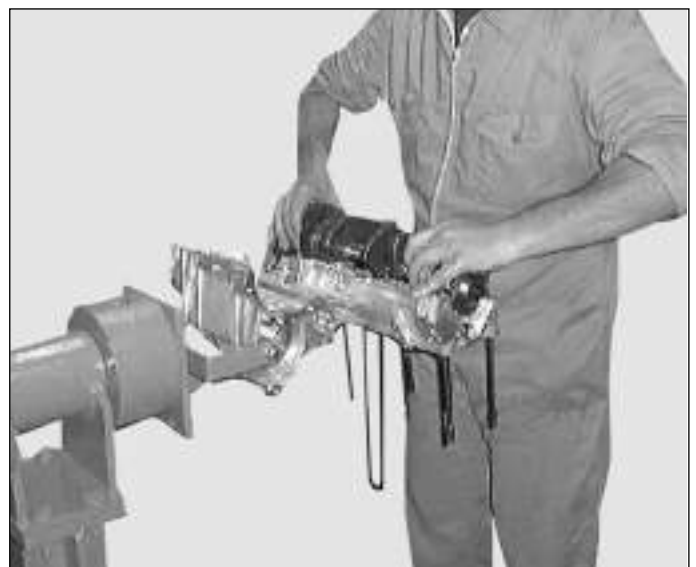
I) If necessary remove the bearings (3).



L) Slide the motor shaft out.

In the event that the bushings should be temporarily removed (4) it is a good idea to identify the bearing number and its carter with a number using a marker. For example the bushing removed from the n°1 bearing of the superior carter (starting from the left) will be identified by the mark S1.

For the couplings refer to the groups they belong to shown on the chart.



SELECTION TABLE FOR F4 BEARINGS

SELECTION TABLE FOR F4 BEARINGS					
		BEDPLATE SLOT DIAMETER			
		A	38.103 38.111	B	38.112 38.119
BENCH PIN DIAMETER	A	34.981 34.988	1.546/1.551 BLUE	1.550/1.555 YELLOW	
	B	34.989 34.997	1.542/1.547 RED	1.546/1.551 BLUE	
FUNCTIONING PLAY 0.012/0.038					

Revision

Once you have disassembled the motor shaft and in case there should be any doubt substitute the bench bushings as well as the connecting rod.

Verify the motor shaft wear tolerance.

The function **play** of the **bench bearings** must be between **0.012 ÷ 0.038 mm**.

Service limit is **0.06 mm**.

The function play of the **connecting rod bearing** must be between **0.036 ÷ 0.061 mm**.

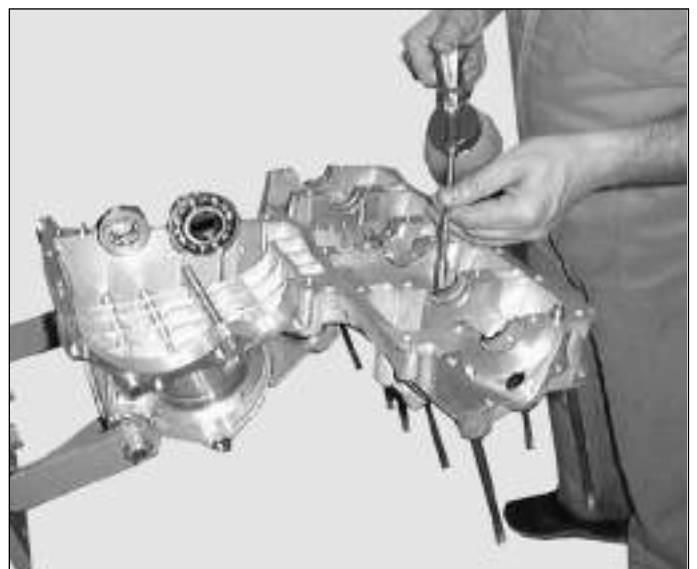
With a service limit of **0.08 mm**.

Reassembly

Carefully degrease and clean from any paste residues
Position the bushings into the carter without lubricating.



After having positioned them put oil on each bush.



Laterally lubricate the n° 5 support as it carries out the function of the motor shaft centering.



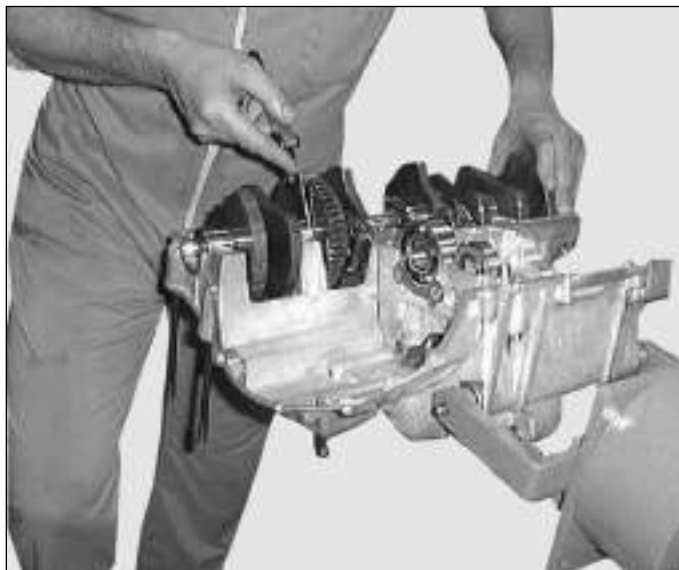
Put the new cap on the right side after having put the silicone type paste on the cap's surface, between cap and carter bearing.



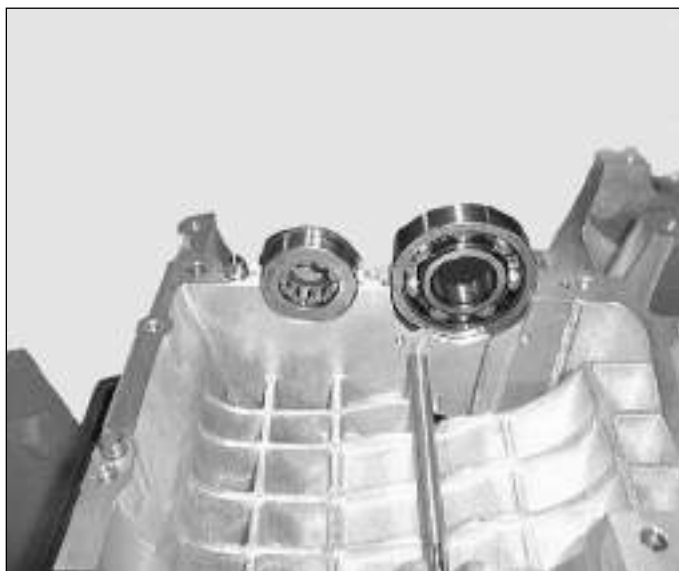
Assembly the motor shaft.



Verify with a thick meter that the motor shaft has an **axial play** of **0.2 mm** as regards the bench bearings. In case there should be different values contact the manufacturer.

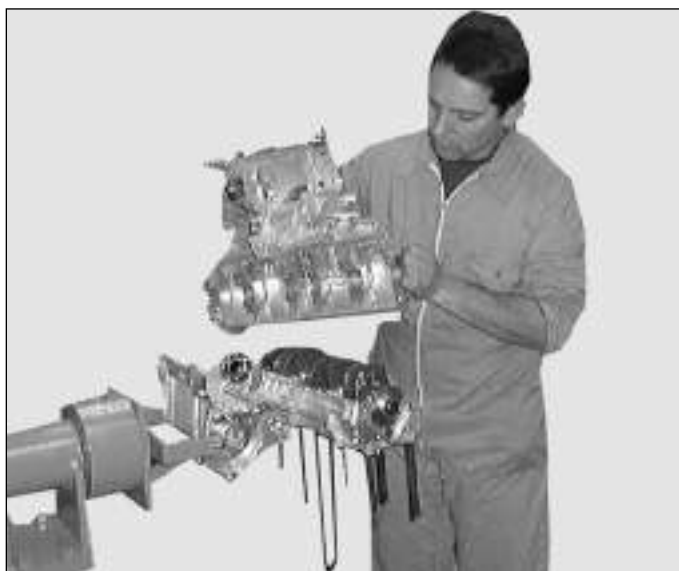


Reassemble the bearing on the inferior semi carter with the locks facing each other and turned inward the bedplate.

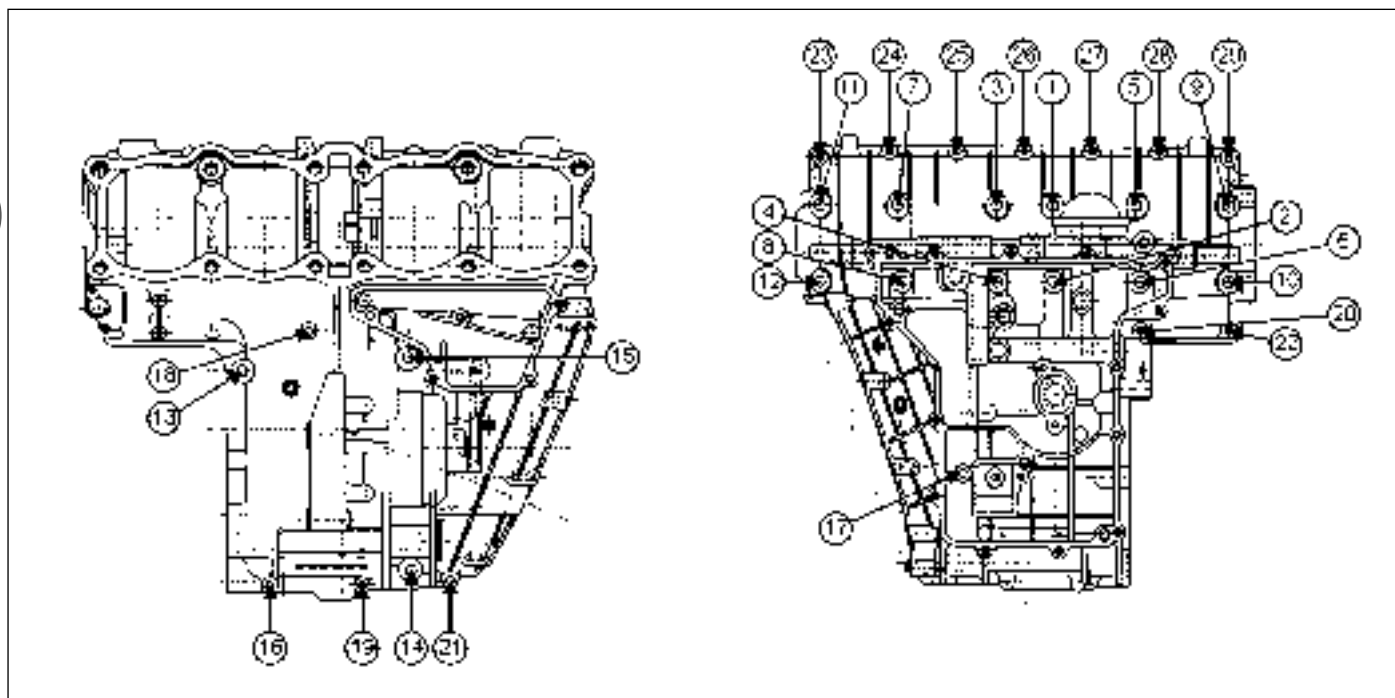


Be sure that the centering bushes are installed on the inferior semi carter. Spread a layer of the 1215 THREEBOND type garnish on the stroke points of the two semi carters.

Couple the two semi carters carefully beating them with a plastic hammer until completely closed.




Bedplate tightening screws



Insert the 12 number 8 screws bringing them together at a coupling of 10 Nm, thus tighten them at a 50° angle up to the n°545 motor matriculation. Tighten, though, at an angle of 60° starting from the n°546 motor matriculation. Insert the remaining number 6 screws manually and tighten them at a 10 Nm coupling.

 **Tighten all the screws inversely to the order they were disassembled.**

Install the heat exchanger with the O-Ring and lock the support screws at a 10 Nm torque, the exchanger aluminium screw at a 14 Nm torque. Always replace the aluminium seal washer at reassembly.

 **It is possible to update the S Series 2000 motor with the oil exchanger screw and its relative antiunscrewing mechanism assembled, starting from the S2002 motor. See relative paragraph in the index dedicated to the S2002 motor.**

Substitute oil filter

Take an oil filter out of (black version) the new motor oil filter kit (Part. code n° 8000A1428) of new furnishing. Exclusively us MV Agusta components.

Before assembling the filter lubricate the gasket holding.

Using the appropriate tool, code 99010 and a dynamometric key proceed by tightening the filter. Tightening couple: 15 Nm.

Take the new motor oil filter clamp and the relative screw out of the oil filter kit (Part. Code n° 8000A1428) of new furnishing. Insert the clamp bringing it in beat on the posterior edge of the oil filter.

Position the clamp blocker in contact with the screw on the bedplate. Place clamp screw without tightening it.

Mark the screwing point on the screw as well as on the clamp with a marker.

Carry out the final tightening of the screws by making 2 turns and 1/4 beyond the already obtained position (see phase 13).

Mark the final tightening position on the filter as well as on the clamp with a marker. Be sure that the final distance between the screw and clamp blocker falls between 0,5 and 1 mm.



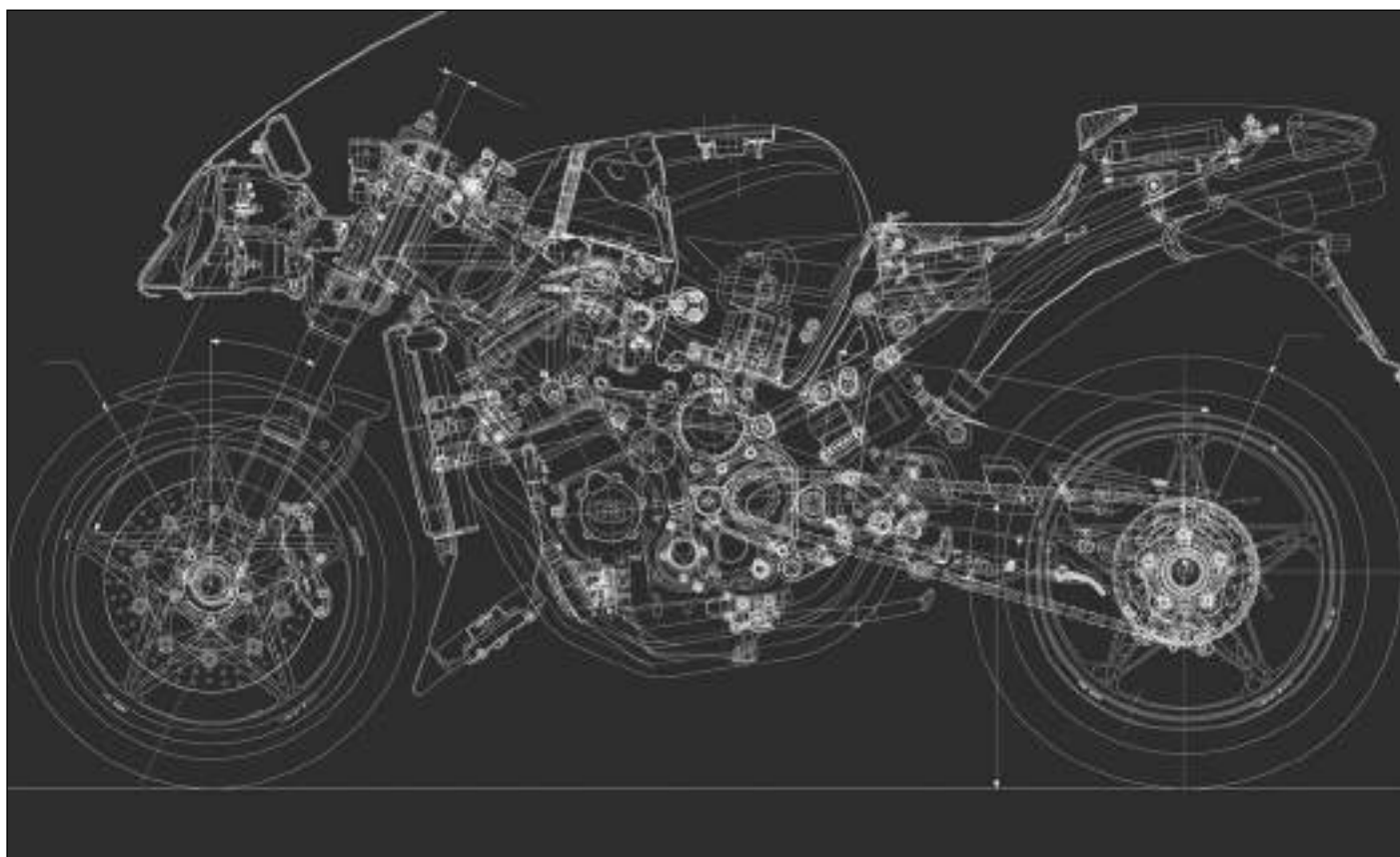


Engine F4 STRADA MY 2000

C



Engine F4 S MY 2002



D

SECTION D

Revision 1



SUMMARY

CLAMPING TORQUES TABLE	PAGE 3
MAINTENANCE TABLE	PAGE 5
CO REGULATION	PAGE 10
DISTRIBUTIO CONTROL UNITS	PAGE 12
CYLINDER AND PISTON GROUP	PAGE 32
CLUTCH	PAGE 38
GEAR AND GEAR CONTROL	PAGE 44
ELECTRICAL COMPONENTS	PAGE 52
MOTOR SHAFT	PAGE 54
BEDPLATE	PAGE 55
CAPS	PAGE 56

NOTE For the sub-groups not listed, refer to “F4 Serie Oro” model.



Engine F4 S MY 2002

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	150	14.25	Weak
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	150	14.25	Weak
Gear selection drum tightening screws	12 If M6 thread 12 If M6 thread	1.2 2.5	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening M6 screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	



Engine F4 S MY 2002

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws	10+60°	1.0+60°	
Bearing exchange screws	10	1	
Exchanger steel screws	15	1.5	
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate thread with Molikote HSC Plus



Engine F4 S MY 2002

MAINTENANCE TABLE

Slip		Pre-delivery	A		B		C	
Frequency	km	0	1000	6000	12000	18000	24000	30000
Procedure								
Cooling liquid level	C	•	•	•	•	•	•	•
Cooling liquid substitution	S		Substitute every 2 years				•	
Motor oil level	C	•	Check every 1000 km					
Motor oil	S	6000 km or 12 months	•	•	•	•	•	•
Motor oil filter	S		•	•	•	•	•	•
Valve play	C		•	Check every 12000 km				
Distribution chain	S							•
Mobile distribution block	C/S				•		•	
Chain tightening block	C/S				•		•	
Spark plugs			Substitute every 12000 km					
	S				•			
Minimum synchronizing regime	C		•	•		•		•
Fluttering body: synchronization, minimum, CO control	C/P		•	•		•		•

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions



Engine F4 S MY 2002

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter Exhaust.....	$24.6^{+0.3}_0$ mm	
Inlet.....	$28.6^{+0.3}_0$ mm	
Sealing face thickness Exhaust.....	$0.9^{+0}_{+0.3}$ mm	limite 1.5 mm
Inlet.....	$0.7^{+0}_{+0.3}$ mm	limite 1.3 mm
Stem-guide clearance Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	$4.5^{+0}_{+0.012}$ mm.....	4.55 mm
Valve stem Exhaust.....	$4.5^{-0.02}_{-0.035}$ mm.....	4.460 mm
Inlet.....	$4.5^{-0.01}_{-0.025}$ mm.....	4.470 mm
Valve spring Internal.....	33.8 mm.....	33.5 mm
External.....	37.9 mm.....	37.5 mm
Valve-cam clearance Exhaust.....	0.20 ÷ 0.29	
Inlet.....	0.15 ÷ 0.24	



ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.014 ÷ 0.046 mm	0.10 mm
Piston-pin play.....	0.002 ÷ 0.010 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	1 $\begin{matrix} -0.01 \\ -0.03 \end{matrix}$ mm.....	0.96 mm
2 nd	1 $\begin{matrix} -0.01 \\ -0.030 \end{matrix}$ mm.....	0.96 mm
Oil scraper.....	2 $\begin{matrix} -0.010 \\ -0.025 \end{matrix}$ mm.....	1.95 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	38.8 mm



ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

- Heat the motor to the usual functioning temperature (of regime);
- Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;
- Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

<i>Cylinder compression control (280 rpm-min)</i>		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- carbon deposits on the walls of the combustion chamber and on the piston ceiling;
- the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- The seat of one or more valves is damaged and the valves do not maintain the compression pressure;
- One or more valves have null functioning play;
- The piston, cylinder play is excessive;
- The cylinder head is twisted and/or the head gasket is damaged;
- Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.

CO REGULATION

Attention: CO regulation is of vital importance for the correct functioning of the motor.

Prior to carrying out the CO regulation accurately check:

- That there are no cracks or damage of the rubber tubes of the vacuum meter line
- That gas does not seep out of the exhaust pipe joints
- That the gas tube links are correctly inserted in the tank lodgings and that the tubes are neither bent nor crashed

A) Verify and if necessary regulate the butterfly valve opening to minimum using Magneti Marelli MDST software. The butterfly valve angle must be of 1.7 degrees. Fluctuation between 1.7 and 1.9 are allowed; fluctuation between 1.5 and 1.7 are not allowed.

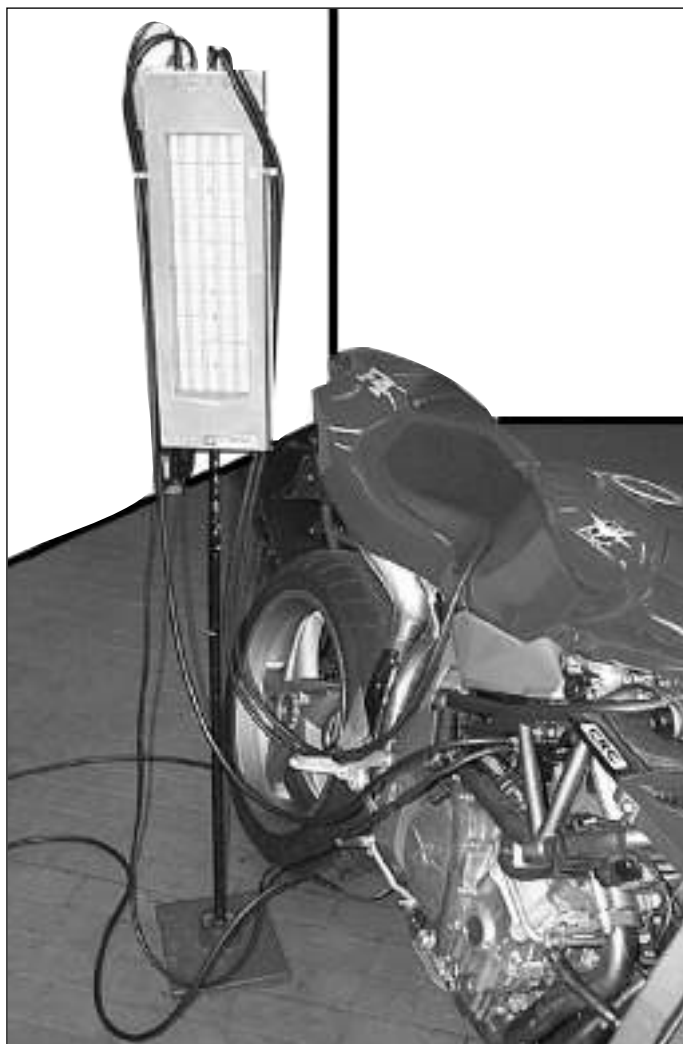
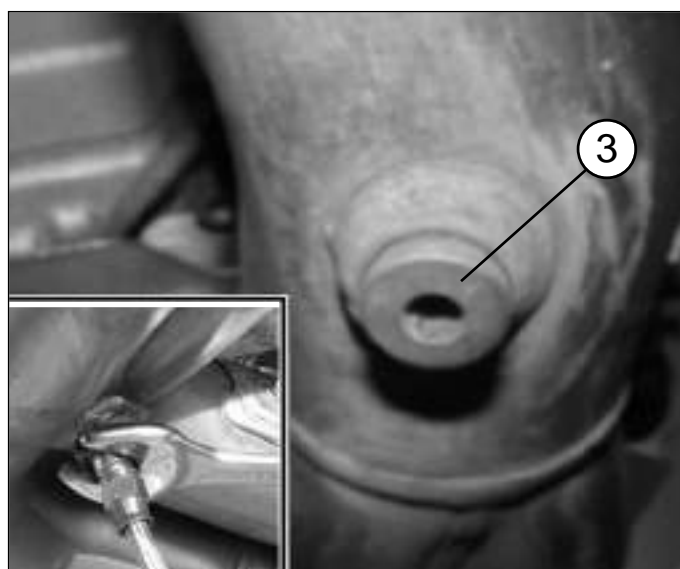
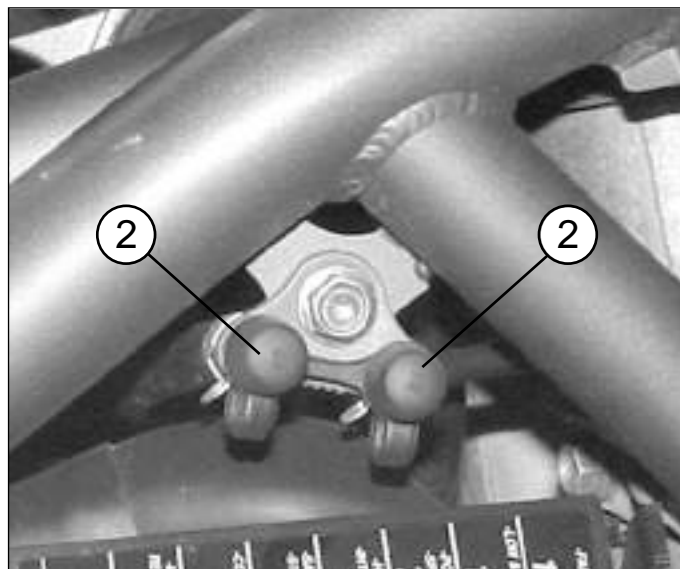
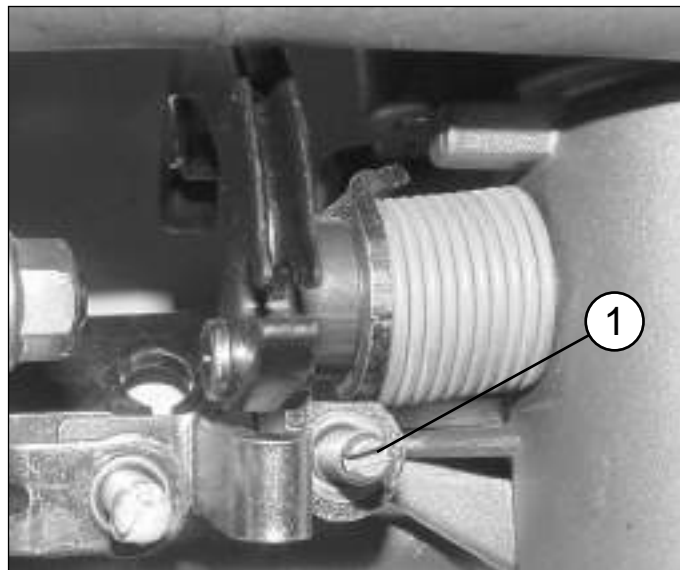
If required, You can intervene exclusively operating on the specific screw (1) placed on the opening gudgeon of the fluttering body.

NOTE Operate only on the right screw (the smaller one).

B) Verify the correct functioning of the water temperature sensors and environmental air and pressure and the battery tension using Magneti Marelli MDST software.

C) Wait with the motor at minimum speed for the culling vents to start up.

D) Connect the vacuometer to the sockets (2) and the CO tester to the socket (3) after having unscrewed the cap with a number 5 hexagonal closure.



E) Balance the cylinder depression by means of the bypass screws (1) Of the fluttering body trying to get close to the inserted vent at following CO levels and minimum functioning:

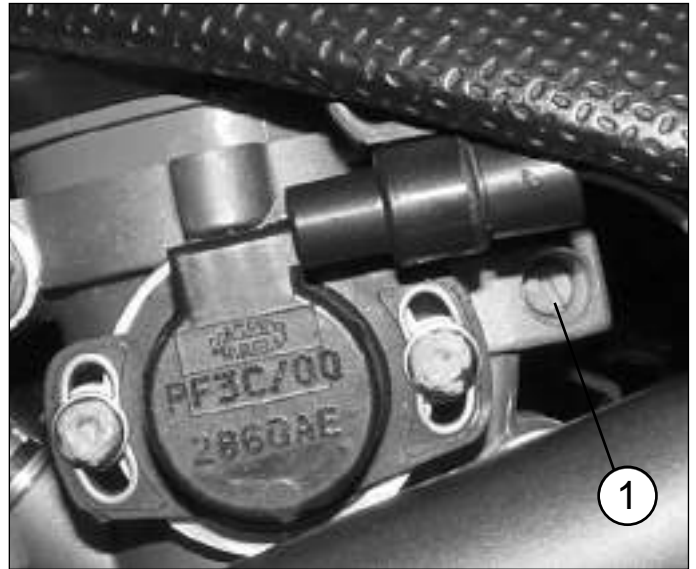
Bypass opening 1 1/4 - 1 1/2 turns

CO 3.5 +- 0.5%

Minimum RPM 1150 +- 50

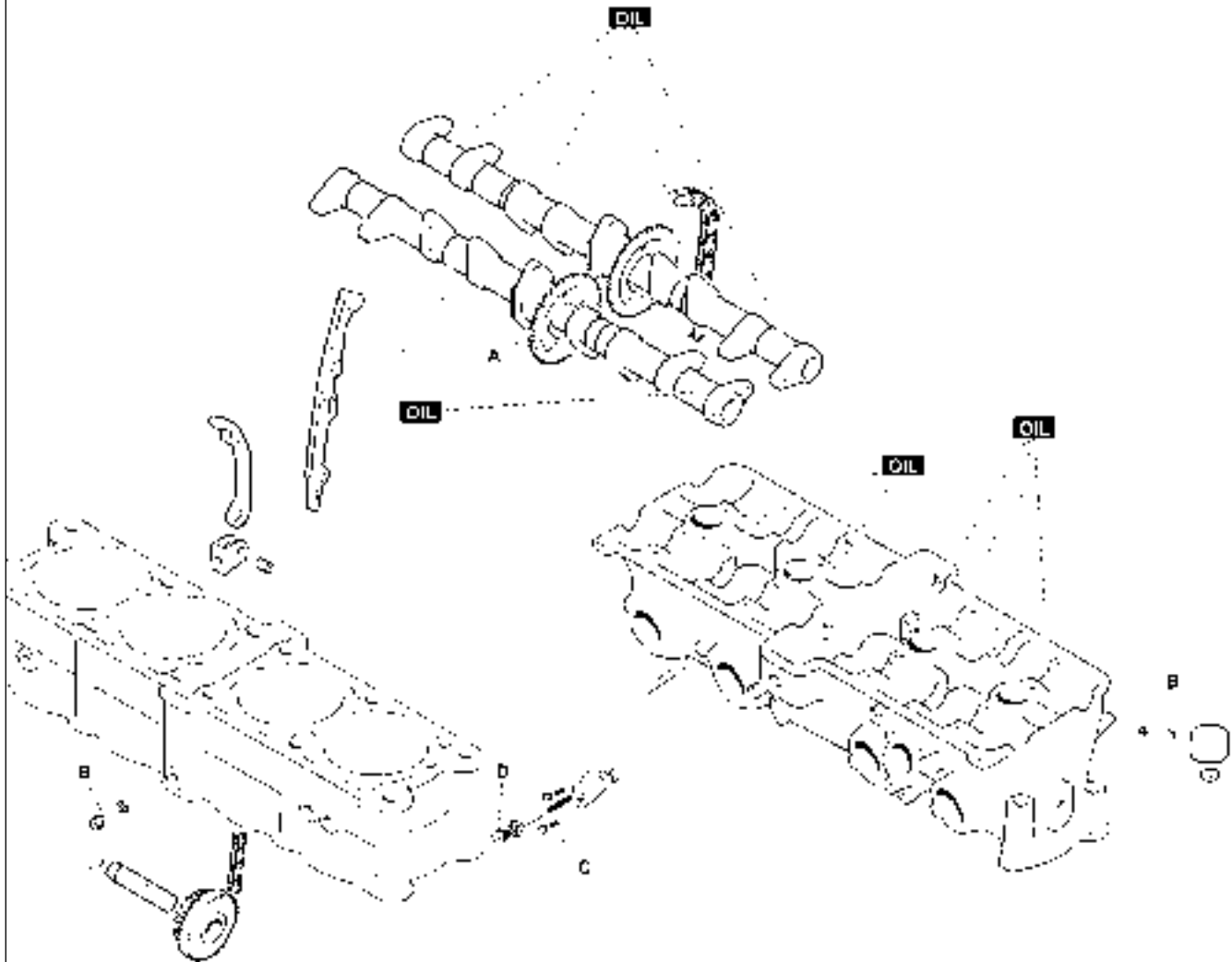
F) Disconnect the vacuumeter, speed up the engine and verify the throttle goes back to the value previously defined, wait for the CO value stabilisation and verify CO and rpm values are in the given clearance.

G) If the values are out of range check the vacuumeter line for air infiltration, reconnect the vacuumeter and repeat the operation starting from the E) point.





DISTRIBUTIO CONTROL UNITS



		A	B	C	D	E	F	G	H	I	L
Clamping Torques	N·m	12	8	8	12						
	Kg·m										
	ft·lb										
Thread blockers		Strong	Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

In order to facilitate the detachment of the stands use a rubber hammer or delicately the end part of a flat screwdriver.

Slightly rotate without force the unloaded end of the gearshaft shifting it from its slot; by doing so, the tension on the distribution chain will loosen.

Release the distribution chain.

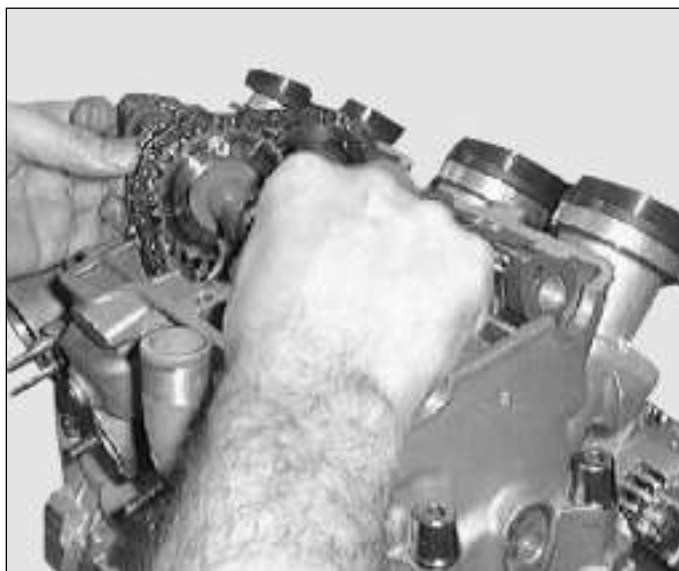
First remove the unloaded end of the gearshaft. Fasten the distribution chain with copper thread in order to retrieve it during the following procedure.

Remove the inlet end of the camshaft.

Remove the first link block for the distribution chain by using the tightening screws.

In case it should be necessary to substitute the distribution chain at the expected mileage (see the programmed maintenance chart), it is advisable also to substitute the gears on the camshaft (EXHAUST n° 98931 - INLET n° A0780).

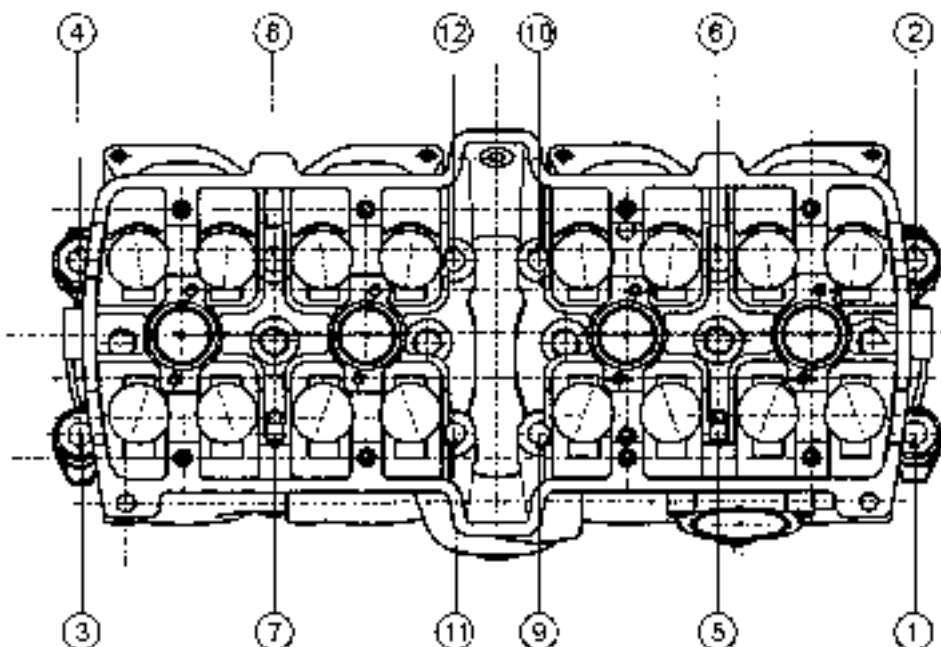
In this case carefully degrease and use LOCTITE 648 on new n° 62726 screws locking them at 12Nm.



Remove the 12 tightening nuts from the head beginning from the external ones proceeding towards the internal ones, following the sequence indicated in the figure.



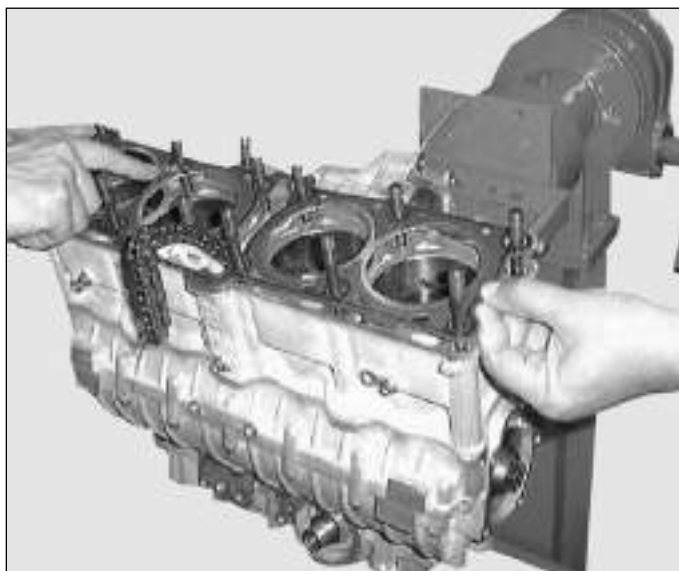
On each encarcement there is a washer. Be carefully no to let it fall into the motor, you may block the holes with clean rags.



Remove the head and place it onto a clear place

Remove the gasket which will be substituted during reassembly.

Avoid placing the head upside down.



Inspection of the head group

Remove carbon deposits from the combustion chambers. Clean away eventual encrustments from the canalizations of the cooling liquid. Check to be sure that there are no cracks and that the holding surfaces are free of crevices, runs or any other kind of damage.

Verify the planarity of the stroke surfaces.

Verify the perfect state of the spark plug threads

Head assy assembly

To execute this operation you need the following special tool:

- A) n° 94793 piston / cylinder plane distance measuring tool

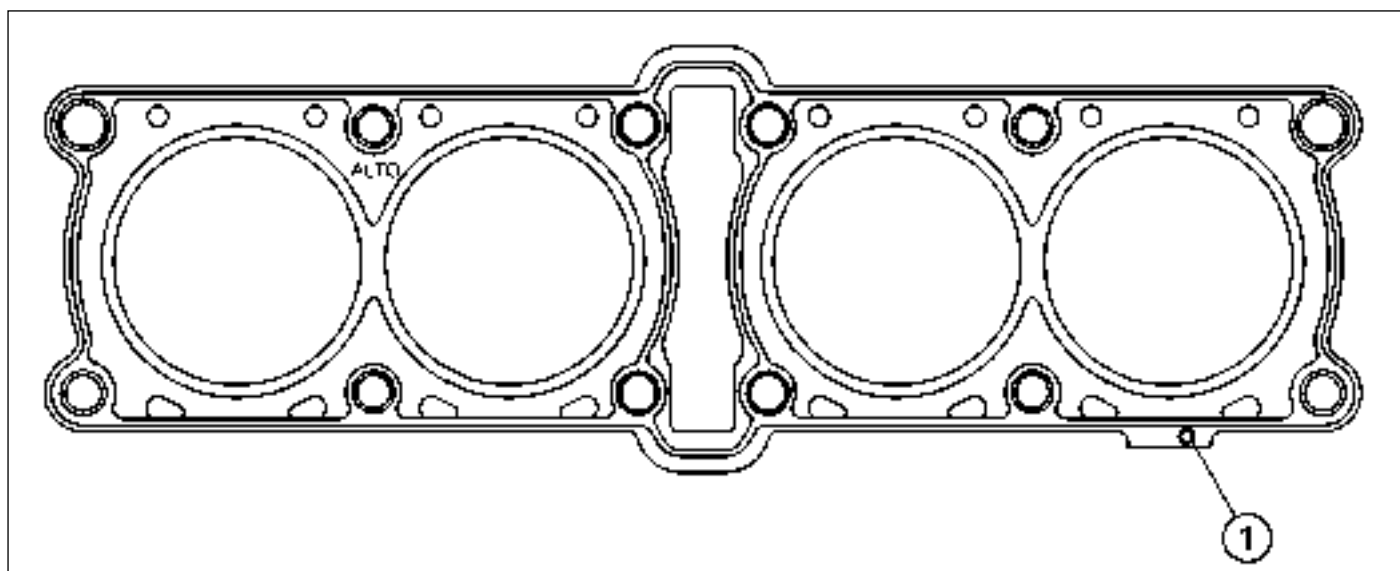
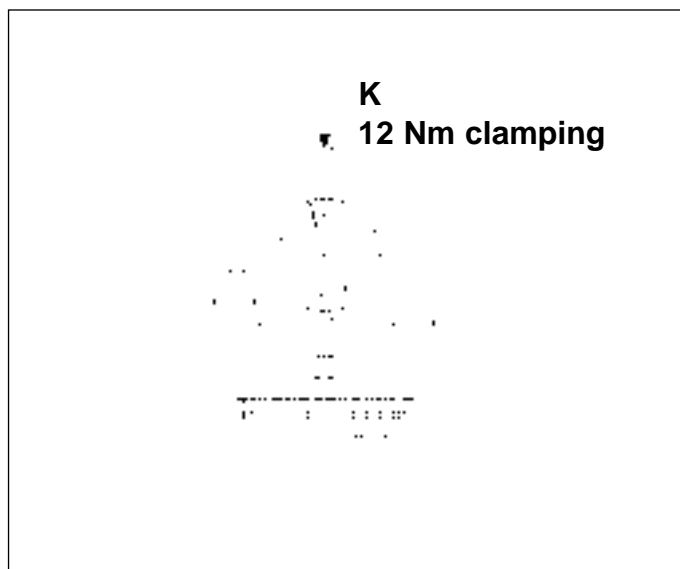
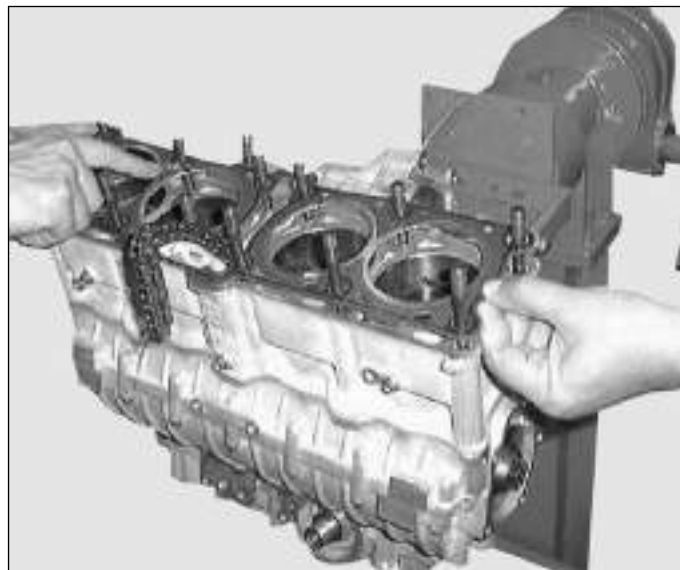
Place the new gasket on the cylinder plane.
The gasket is of the same thickness of the one installed before if no parts replacement occurred.

If replacement is necessary you'll need to measure the piston / cylinder plane distance with the n° 94793 tool, tightening the head nuts at 12 Nm. The choice is made following table below:

Piston/cylinder plane projection	Type of gasket
0.55 - 0.7 mm	Thick=> 1.45 mm
0.39 - 0.54 mm	Medium=> 1.30 mm
0.23 - 0.38 mm	Thin=> 1.20 mm

The gaskets are different for the presence of the holes (1) shown in picture.
Refer to the table below to choose the right one.

Holes numers	Compressed thickness	Part N°
2	1.20 ± 0.05 mm	8B0098679
NONE	1.30 ± 0.05 mm	8A0098679
1	1.45±0.05 mm	800098679





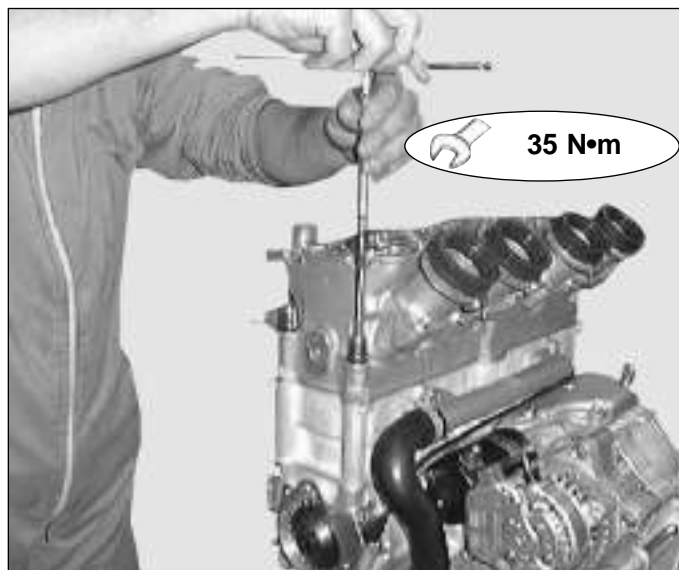
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The gasket must be assembled with the letters ALTO on the superior facade and the protrusion towards the march gear.

Insert the centering bushes between the head and the cylinder. Insert the washers on the encarcement if necessary with the help of a screw driver to guide them onto the internal encarcements.

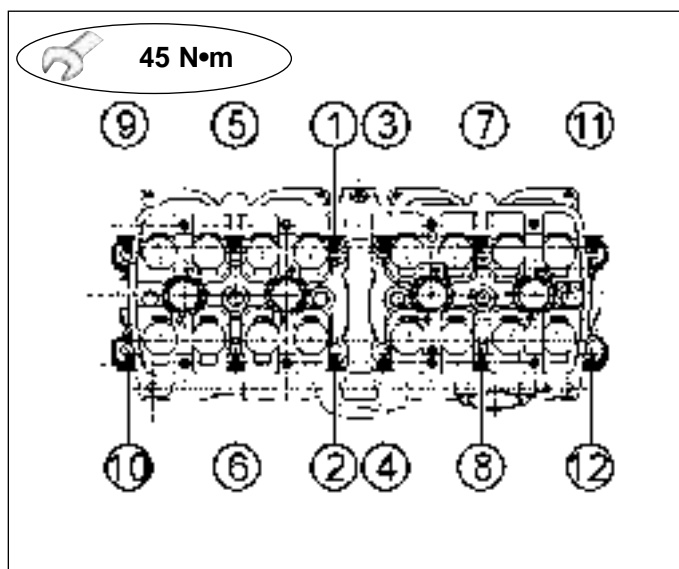
Lubricate with antibinding grease of the HSC MOLIKOTE type only on the nut threads.

Do not apply grease on the encarcement threads, which must be well cleaned and degreased



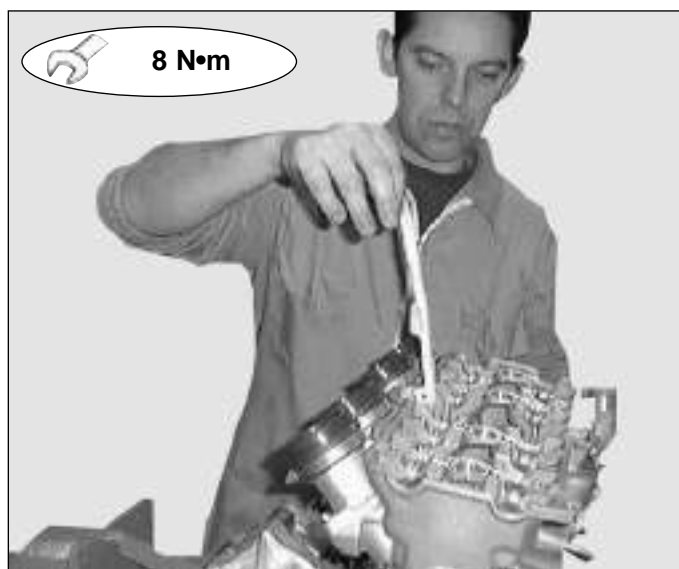
Screw the bolts with a brugle key and press them at a 35 Nm.

Tighten the bolts beginning with the internal ones towards the external ones following the outline indicated in the figure at 45 Nm.



Retrieve the distribution chain.

Insert the fixed sliding block with its screws and, after having carefully degreased it, tighten it at a torque of 8 Nm. with 242 LOCTITE



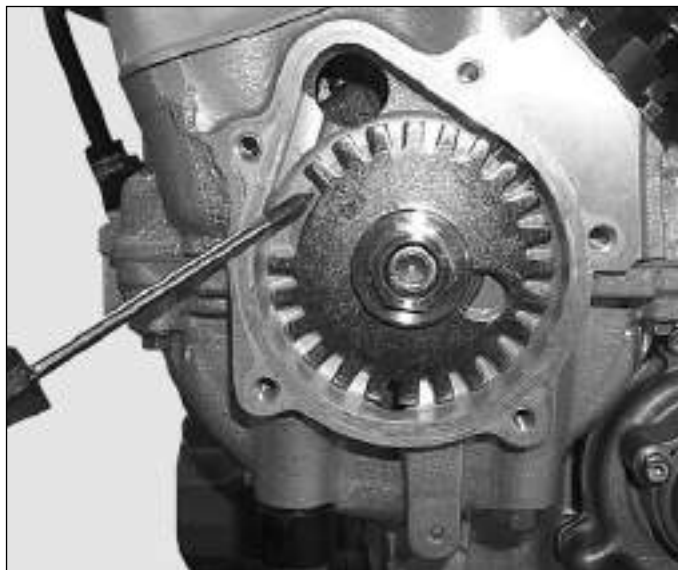


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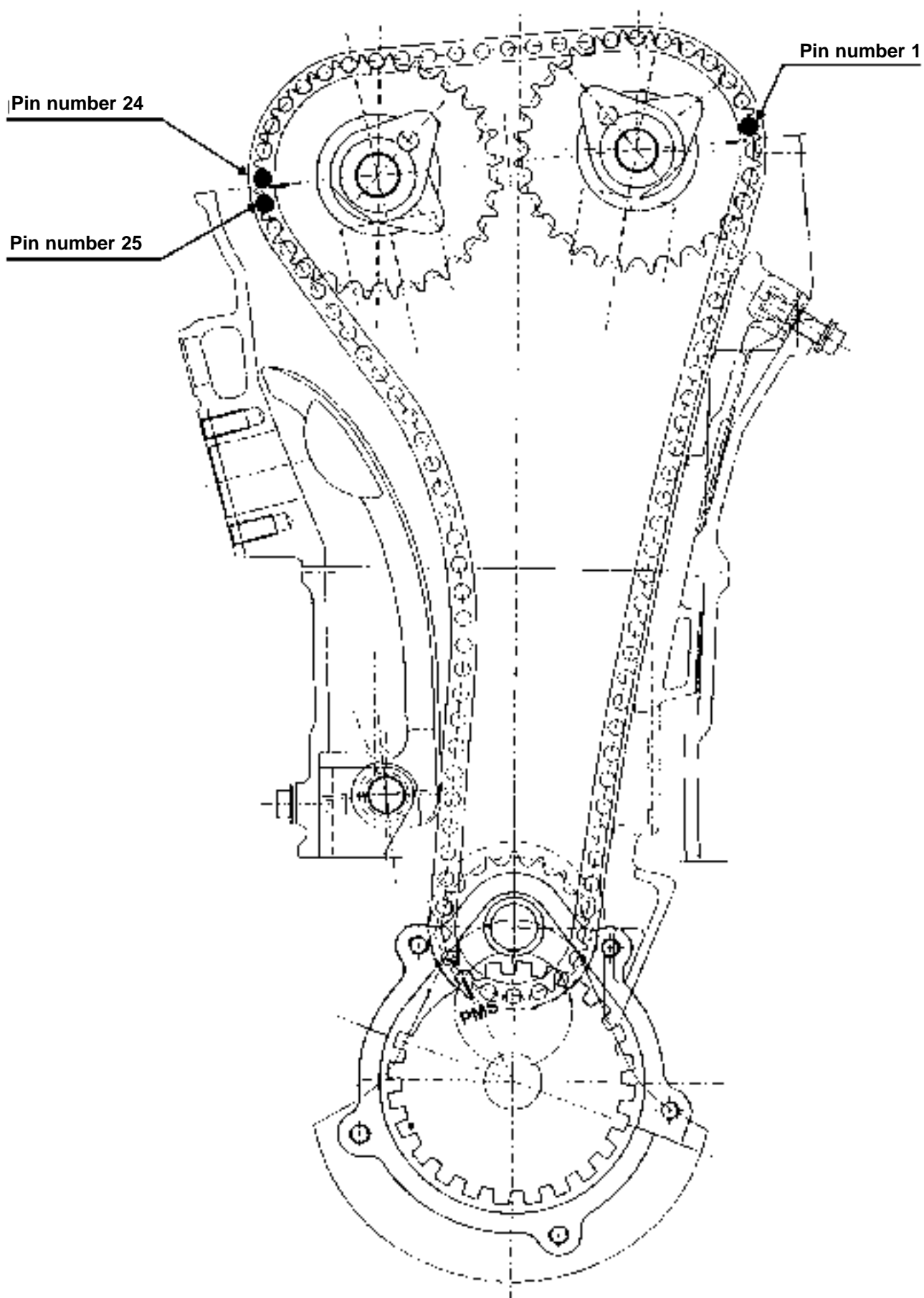
Continue with the setting as follows:

be sure that piston n° 1 is the MSP in burst phase; in this position "T" notch on the phonic wheel is in line with the reference notch on the bedplate.

Remove the copper thread from distribution chain, keep the chain tightened.



D





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Insert the inlet camshaft so that the phase notch on the conveyer wheel is parallel to the head plane and facing the outside.

Insert the exhaust camshaft with the notch placed between the 24th and 25th chain distribution gudgeon, beginning to count from gudgeon after the inlet camshaft notch.

Check the correct position of all the O Rings under the head stands.



Position the n°2 and n°3 stands, referring to the numbers towards the inlet end;

Position the n°1 and n°4 stands,

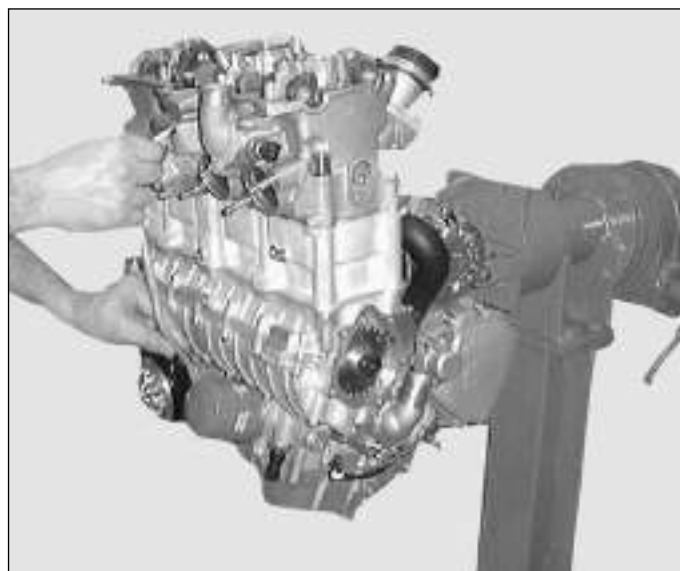
Bring the screws together manually hexagonally embedded.



Before tightening stand screws be sure that the chain tensioner is assembled.



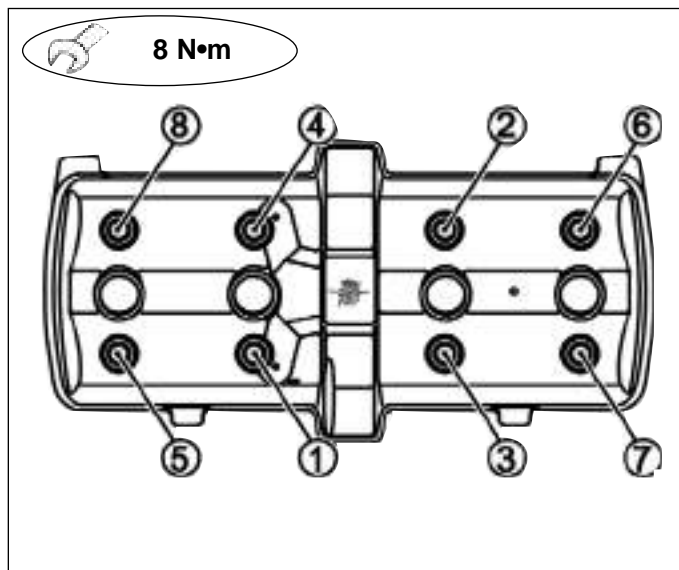
Do not tighten the stand screws if the reaction springs are charged. Appropriately turn the camshaft so that the stand springs of which are to be tightened are uncharged and that the cams are positioned on the base radius.



Progressively move the internal hexagonal screws close. Tighten the screws at a torque of 12 Nm., always beginning from n°2 and n°3 stands.

Check to be sure that the valve cap gaskets are in good condition.

Apply a layer of gasket 5552 silicone on the semi moons on the head in correspondence with the camshaft.



Position the valve cap.

Manually position the screws, thus tighten at 8 Nm.

Place the adduction oil tube at the head greasing the O-Rings.

Dismounting cylinder head pieces

In order to carry out this procedure the following tools are necessary:

tool n° 94796 to disassemble valves

tool n°95179 to remove semi cones



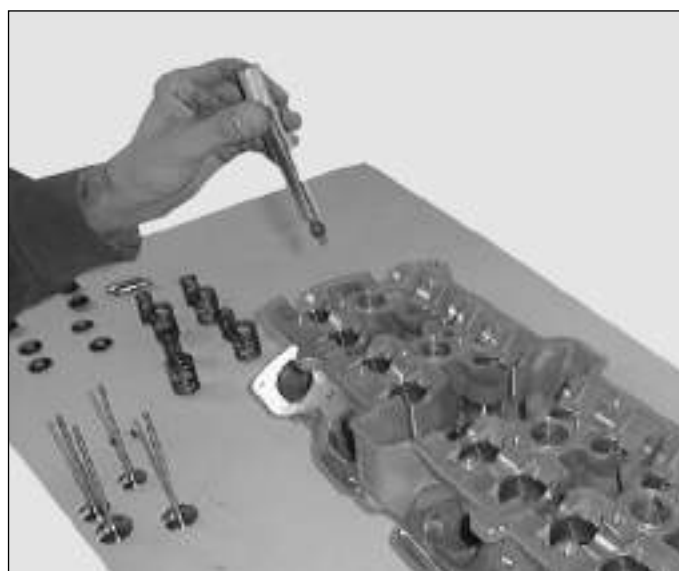
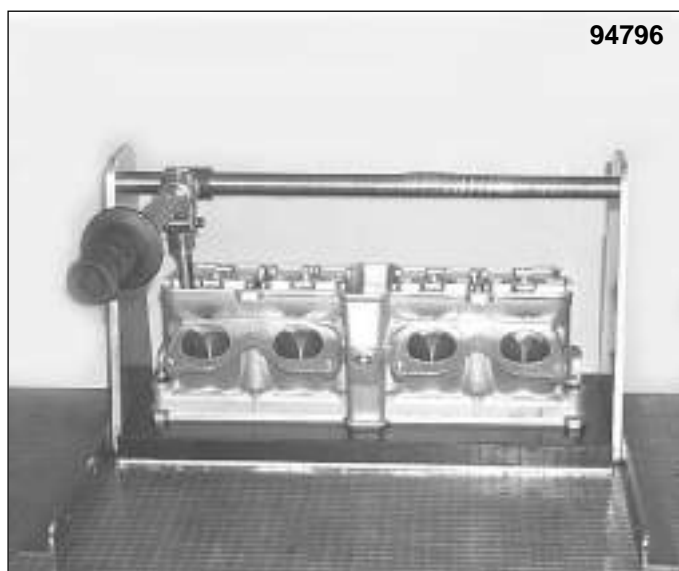
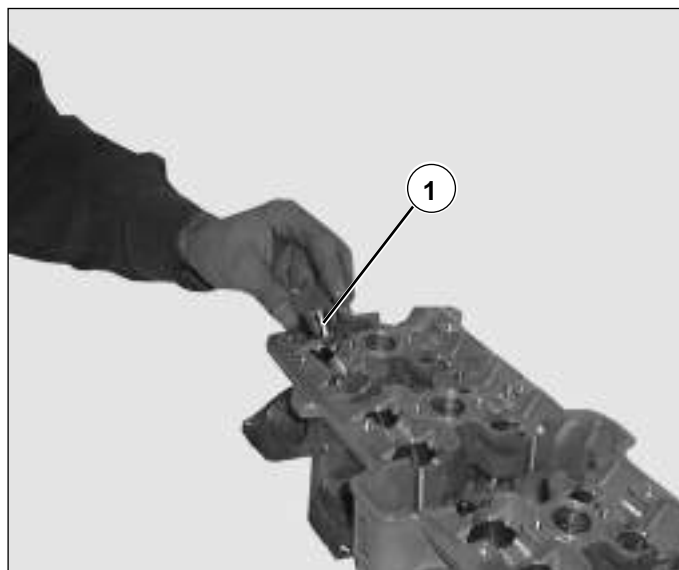
Each piece relative to the same valve (cup, spring, semi cone, etc.) must be reassembled onto the same valve from which it came off.

Remove the cylinder head as indicated the paragraph "cylinder assay removal".



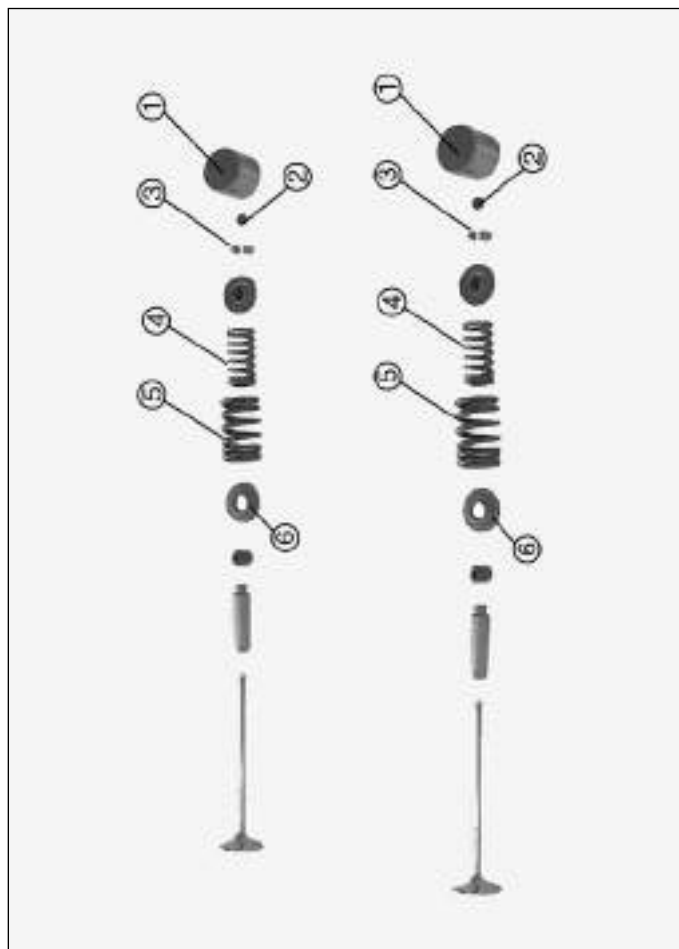
Valve removal

- A) Take out the cups (1) with the help of a magnet and number them with a marker so as to reassemble them in the same position.
- B) Remove the tablets (2) of play adjustment with a magnet and place them inside the relative cup so as to reassemble them in the same position. To remove the semi cones (3) exclusively use tool n° 95179 so as to avoid bending the valves:
- C) Assemble the head on tool n° 94796
- D) Hammer on the superior disk with a rubber hammer to unblock the semi cones
- E) Press the springs on the superior disk
- F) Take out the semi cones with a magnet
- G) Slowly release the disk pusher.



Then remove in the following order:

- A) Semicones
- B) The 2 coaxial springs (4 and 5);
- C) If necessary remove the rubber holdings;
- D) Remove the inferior disk (6);
- E) Slide the valve out of the combustion chamber.



Maintenance of the valve slot

Check the stroke surface [A] between the valve [B] and the slot [C] : no traces of pitting or cracks must appear. Measure the external diameter [D] of the stroke surface on the valve slot.

If this should appear to be too elevated it is possible to repair the slot.

External diameter of the stroke surface of the valve slot

Standard : exhaust $24.6^{+0}_{+0.3}$ mm
inlet $28.6^{+0}_{+0.3}$ mm

Measure the width of the stroke [E] with a varnished gauge or with Prussian blue.

If it should turn out to be too wide, too thin or irregular it will be necessary to repair it.

Area thickness of the stroke STD

standard : exhaust $0.9^{+0}_{+0.3}$ mm
inlet $0.7^{+0}_{+0.3}$ mm [E]

Value limit [E]: inlet 1.3 max
exhaust 1.5 max

The repair must be carried out by milling the slots using the appropriate monocutting milling machines at 78° (1), 45° (2) and 25° (3).

Ten proceed with the grinding of the valves and verification of the holding.



Remove the minimum quantity of material from the slot.

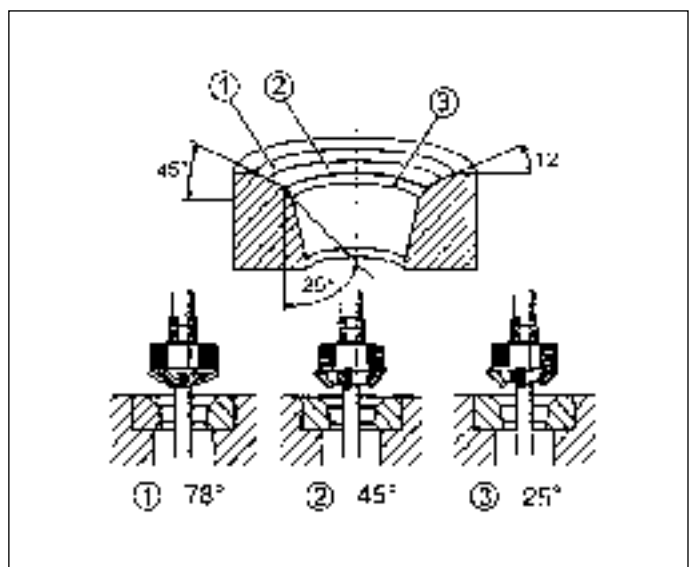
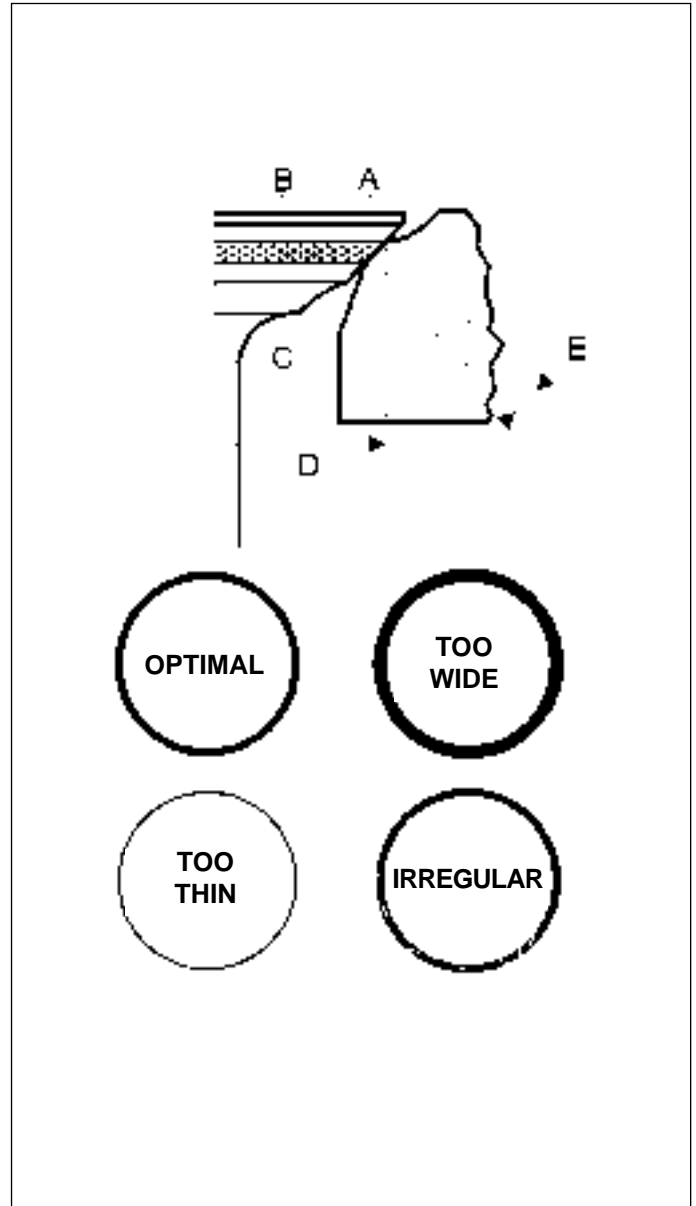
Inlet max 0.5 mm (vertical)
Exhaust max 0.5 mm (vertical)

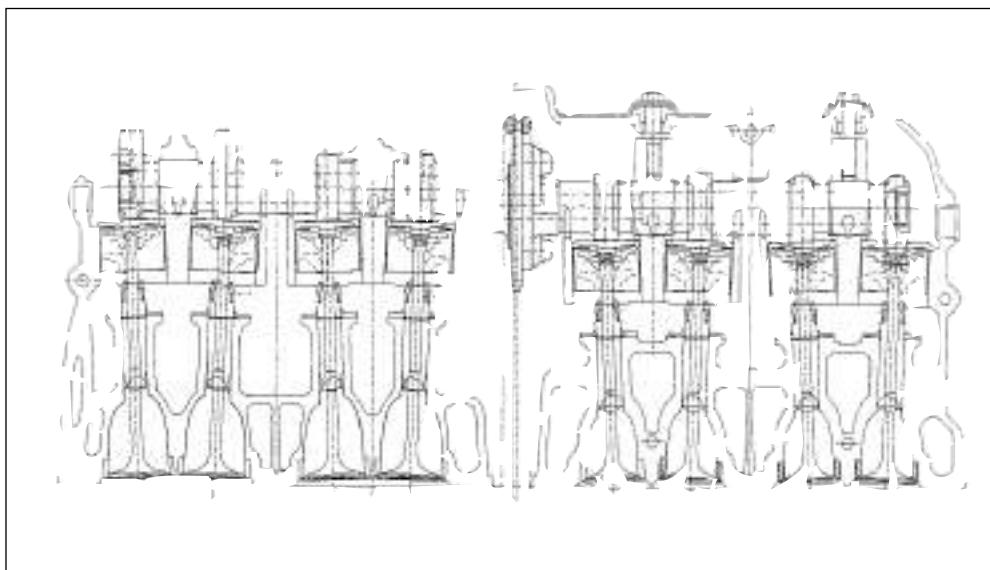
Verify that there is no leakage filling the inlet and exhaust of the gas canalization.

If so, check the quality of repair with Prussian blue.



When reassembling never use calibrated tablets of a thickness inferior to 1.6 mm.





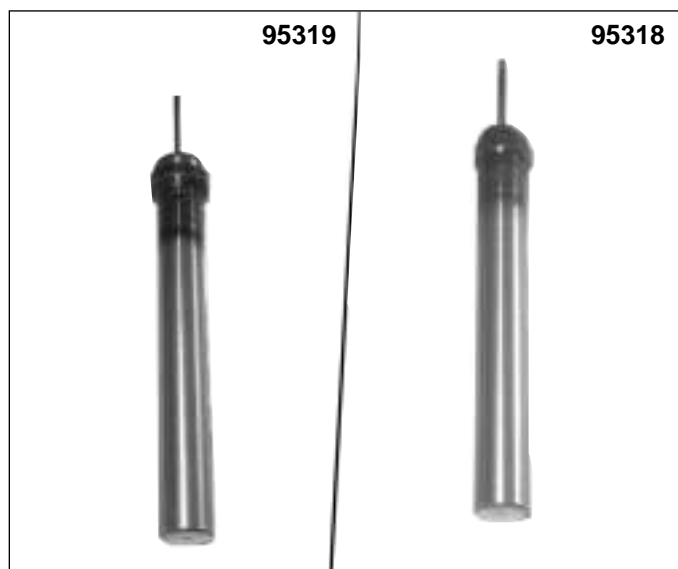
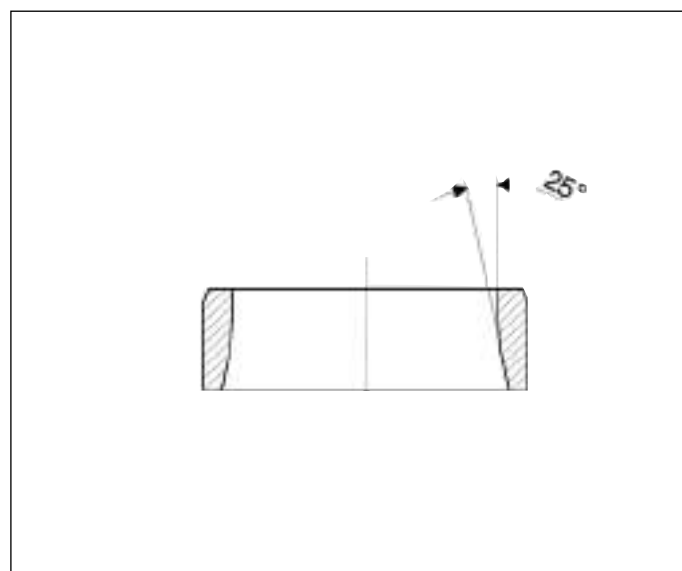
Substitution of the valve slot

The following tools are necessary for this procedure:
prick-puncher n°95319 for inlet slot
prick-puncher n°95318 for exhaust slot

Proceed as follows:

- Remove the worn slots carefully milling them so as not to damage the head lodging
- Check the lodging diameter on the head and choose the oversized valve slot considering that the **assembling interference should be 0,10÷0,15 mm**.
- Valve slots are furnished with an increased replacement part of **0.03 mm** on the external diameter.
- Slowly and evenly heat the head at a max temperature of 180°C and cool the new slots with dry ice.
- Place the slots perfectly in frame into its lodging, using the special n°95319 prick-puncher (INLET) and n°95318 (EXHAUST)
- Let cool and proceed with the milling of the slots and grinding the valves referring to the following quotients:

Ø A	28,60 $\begin{smallmatrix} +0.3 \\ -0 \end{smallmatrix}$
Ø S	24,6 $\begin{smallmatrix} +0.3 \\ -0 \end{smallmatrix}$
[E]	INLET 0.7 $\begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$ EXHAUST 0.9 $\begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$



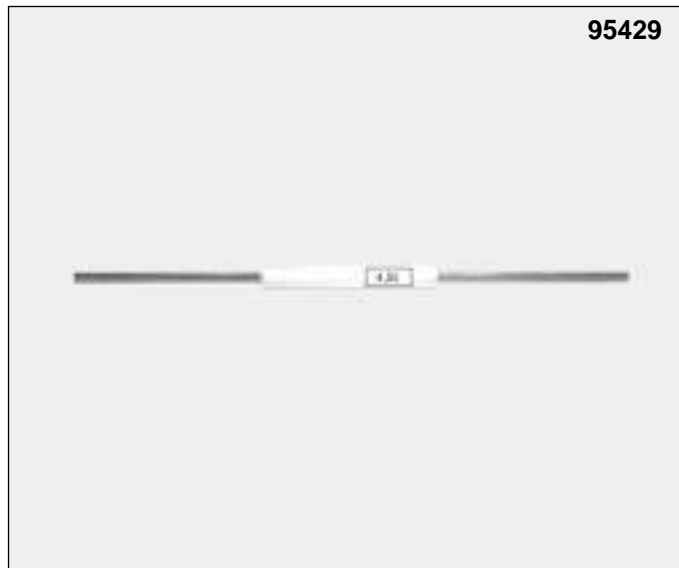
Valve guide check and maintenance

In order to carry out this procedure the following tools are necessary:

Control tampon n°95429
 Tampon n°95320

STD stem play
 Valve-guide valve: **0.01÷0.037 mm inlet**
0.02÷0.047 mm exhaust
 coupling limit: **0.08 mm inlet**
0.09 mm exhaust
 internal guide Ø limit: **4.55 mm**

95429



Proceed with an accurate visual check of the valve guide.

In order to determine the coupling wear between guide and valve stem it is necessary to measure the play using a control tampon and micrometer.

NOTE The control tampon 95429 (Ø 4,55) must not pass.

NOTE In the case of substituting the guide valve it is necessary to check and if necessary also substitute the valve.



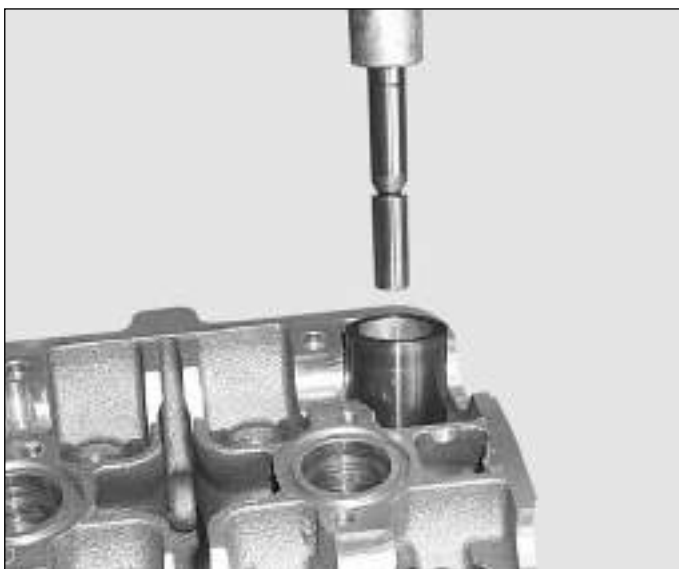
Removal of the valve guide

After having removed the valves and rubber holdings as described in the relative paragraph, continue as follows:

Slowly and evenly heat the cylinder head up to 100°. Using tampon n°- see sliding out guide-valve at the bottom of the page.

Continue with a visual check of the slot to verify its state.

For motors with progressive numbers from 4911 to 5951 included, use tool A2383 to slide guide-valves out and tool A2385 to assemble the spare part. For motors with progressive numbers higher than 5952 use tool A2385 to slide guide-valves out as well as to assemble the spare part.



Guide valve installation

Assemble an oversized valve guide as follows:

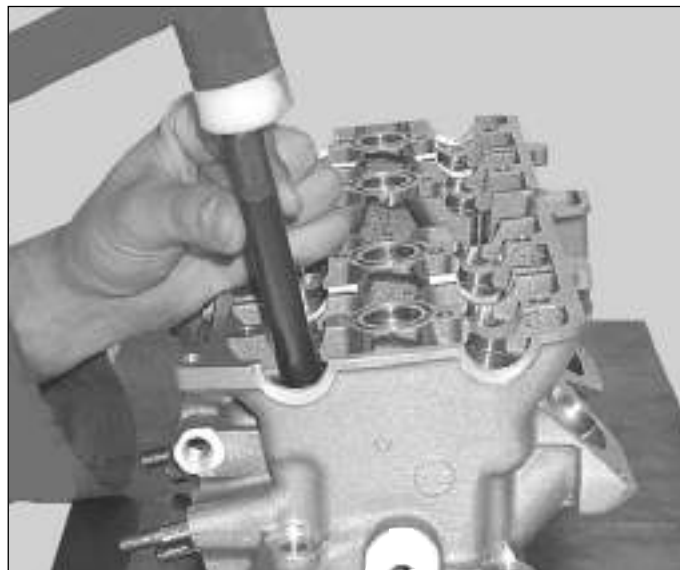
Oil the external valve guide surface.

Slowly and evenly heat the cylinder head up to 150°.

If necessary cool the valve guides with (N2) nitrogen liquid; or dry ice.

Insert the valve guide using the special tampon up to the stroke and let rest until the temperature has stabilized.

Check to be sure the valve slides freely in the valve guide otherwise coat it with a 4.5 H7 reamer or broach N°8000 A2625.



Valve

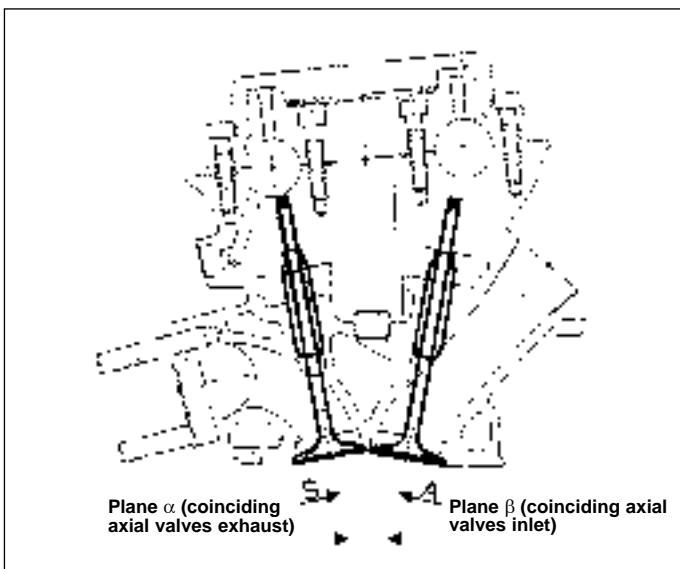
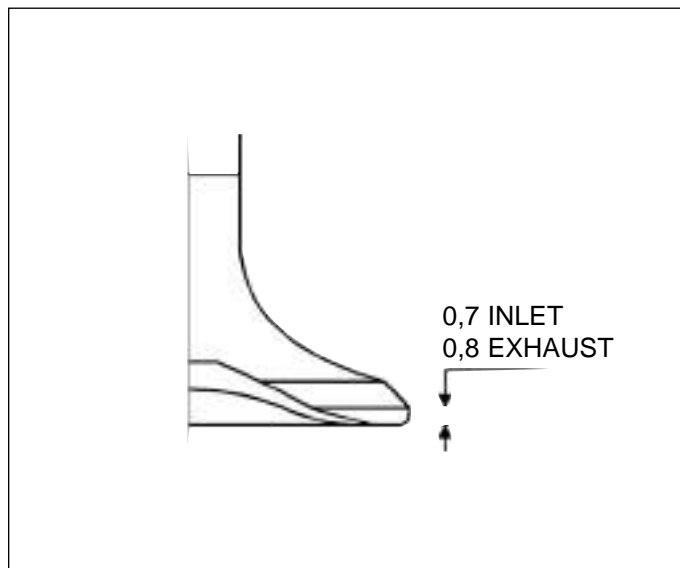
The stem diameters must not fall below:

4.470 mm inlet

4.460 mm exhaust

The minimum distance of the holding position at 45° on the valve plane must not be lower than 0.7 mm INLET - 0.8 mm EXHAUST (see figure).

Check to be sure that the stem and the surface in contact with the valve slots are in good condition. No traces of pitting, cracking, deformations or traces of wear should appear. Verify that the stem is perfectly rectilinear.



Valve-guide valve coupling

Coupling play at assembly must be:

0.01 ÷ 0.037 mm inlet

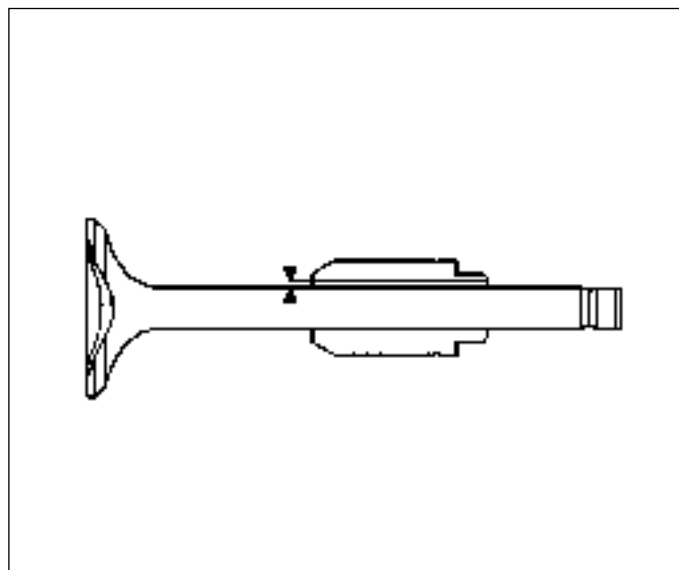
0.02 ÷ 0.047 mm exhaust

The maximum coupling limit permitted is even to

0.09 mm inlet

0.10 mm exhaust

If a major play should result, substitute valve and valve guide.



Springs

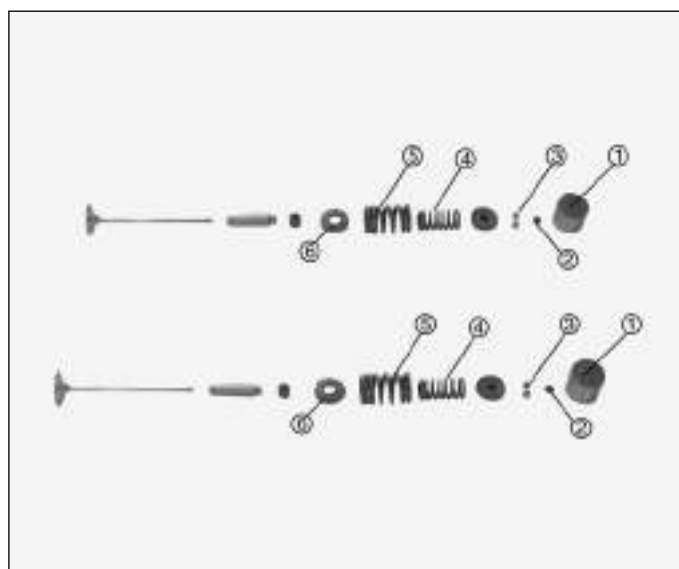
Check to be sure that the free value of length is not inferior to the suggested limit and in such case substitute the springs:

Internal spring l = 33,8 mm.

Service limit: 33,5 mm

External spring l = 37,9 mm.

Service limit: 37,5 mm

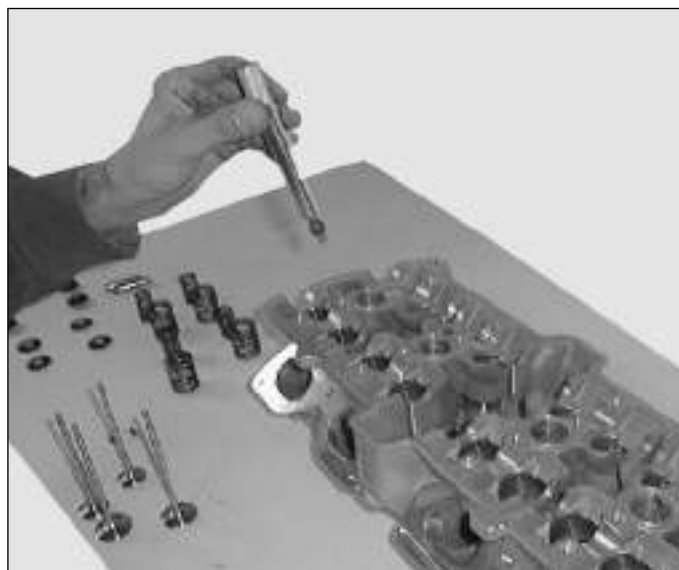


Valve reassembly

- A) Carefully degrease the guide
- B) Insert the disk (6) and make sure that it is in beat.
- C) Assembly the rubber holdings, always new, on the valve guide using tool n°95581;
- D) Sprinkle the valve stem with oil.
- E) Assembling the valve.

95581



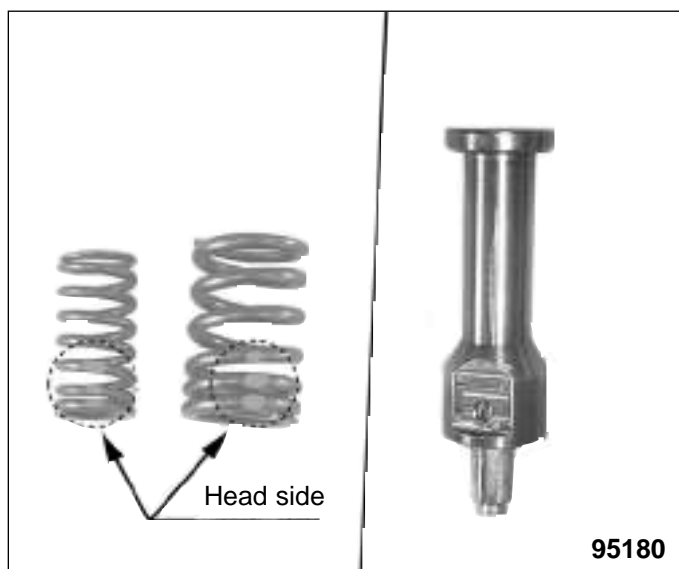


D

Execute the following procedures as indicated:

- A) Insert the two coaxial springs. These springs must be assembled with the spirals close together marked with a coloured mark sign downwards.
- B) Slide the semi cones into the superior disk slot and thus place the disk on the springs
- C) Assemble the head on the disassembling valve tool n° 94796 and compress the spring with tool n° 95180 until the semi cones are inserted (see figure).
- D) Using a rubber hammer strike a slight blow on the valve so as to place the semi cones.

NOTE Before placing the semi cones be sure that the head is not resting on a plane in order to avoid distorting the valve. Place it onto two bases which allow the valve to move.



- E) Insert the tablet of the correct thickness and lubricate its surface
- F) Make sure it easily turns in its slot
- G) Insert the cup after lubricating the slot

Insert the cylinder head as described in the paragraph "Head assay assembly".

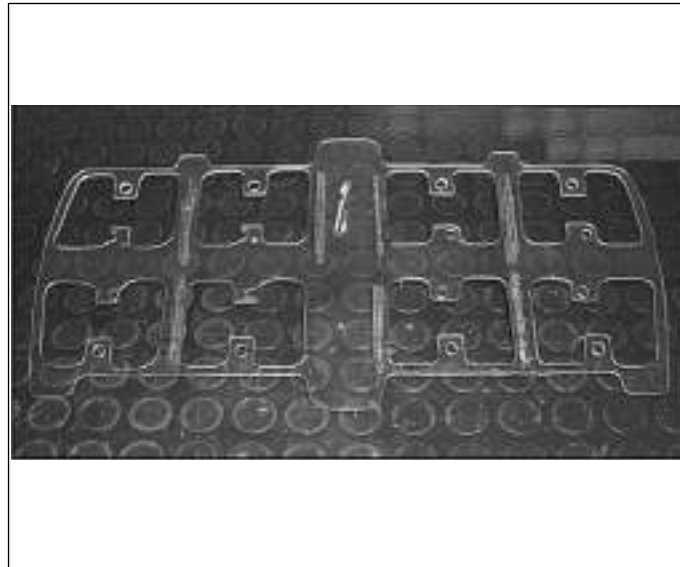


Regulating valve play

Verify that the spark plugs have been disassembled.



Should this procedure be carried out with the head assembled on the motor, block the spark plug holes with clean rags and assemble plate n°95191 to avoid the pieces accidentally falling into the chain distribution opening.



A) Rotate the drive shaft until completely unwinding the springs relative to the valves on which intervening (MSP in burst phase).

B) Measure valve play with a thickometer.

Inlet valve play	Exhaust valve play
0.15 ÷ 0.24 mm	0.20 ÷ 0.29 mm

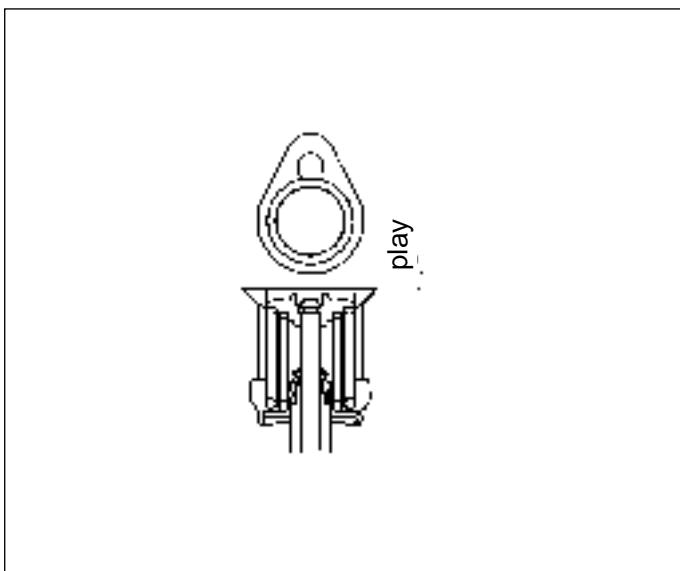
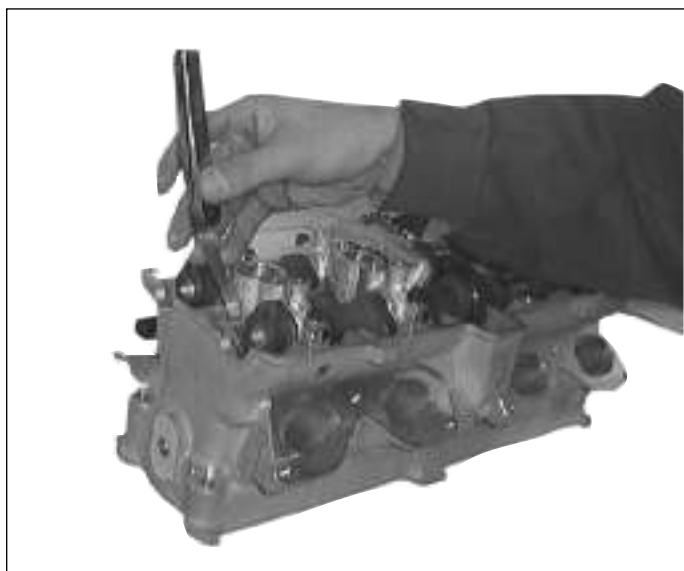
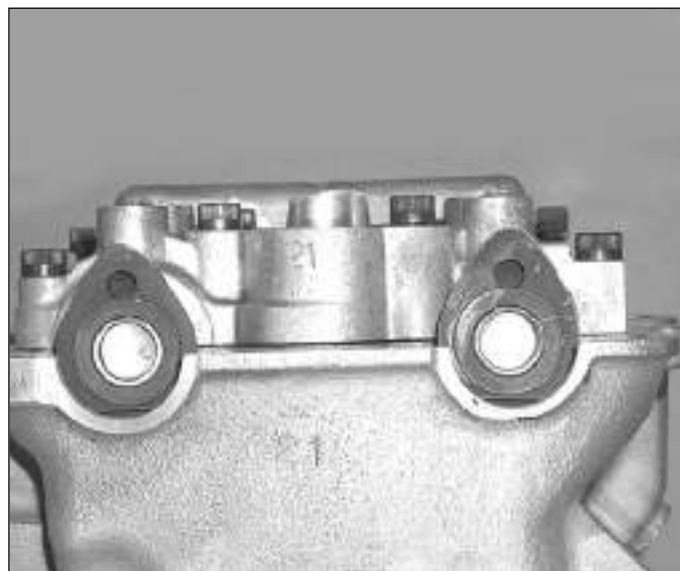
C) Calculate the D difference between the compared play and optimal play shown on the chart

D) Read the value of S thickness on the tablet;

E) Choose a new tablet with an S+D thickness.



During reassembly never use a tablet with a thickness less than 1.6 mm.



Chain tensioner

Remove the central screw-cap and withdraw the spring and the pin.

Remove the screws fixing the chain tensioner to the head.

Remove the chain tensioner.

Disassembly the chain tensioner and check the correct working of each part.

The internal pin must run clearly and the inner spring must give a quick response.

Replace the assembly in case of malfunction.

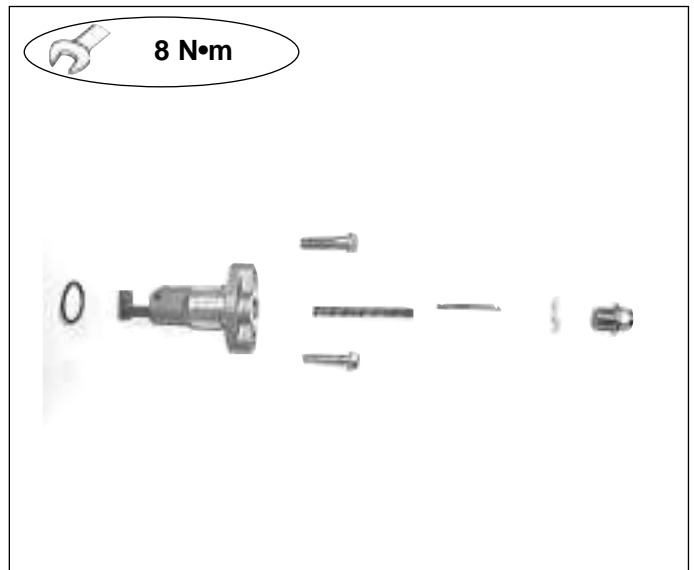
If everything works properly lubricate the parts and install the assembly with the chain tensioner in the minimum extension position (all in the main body)

Install the chain tensioner body locking the 2 socket head screws using a T wrench with a 8 Nm torque

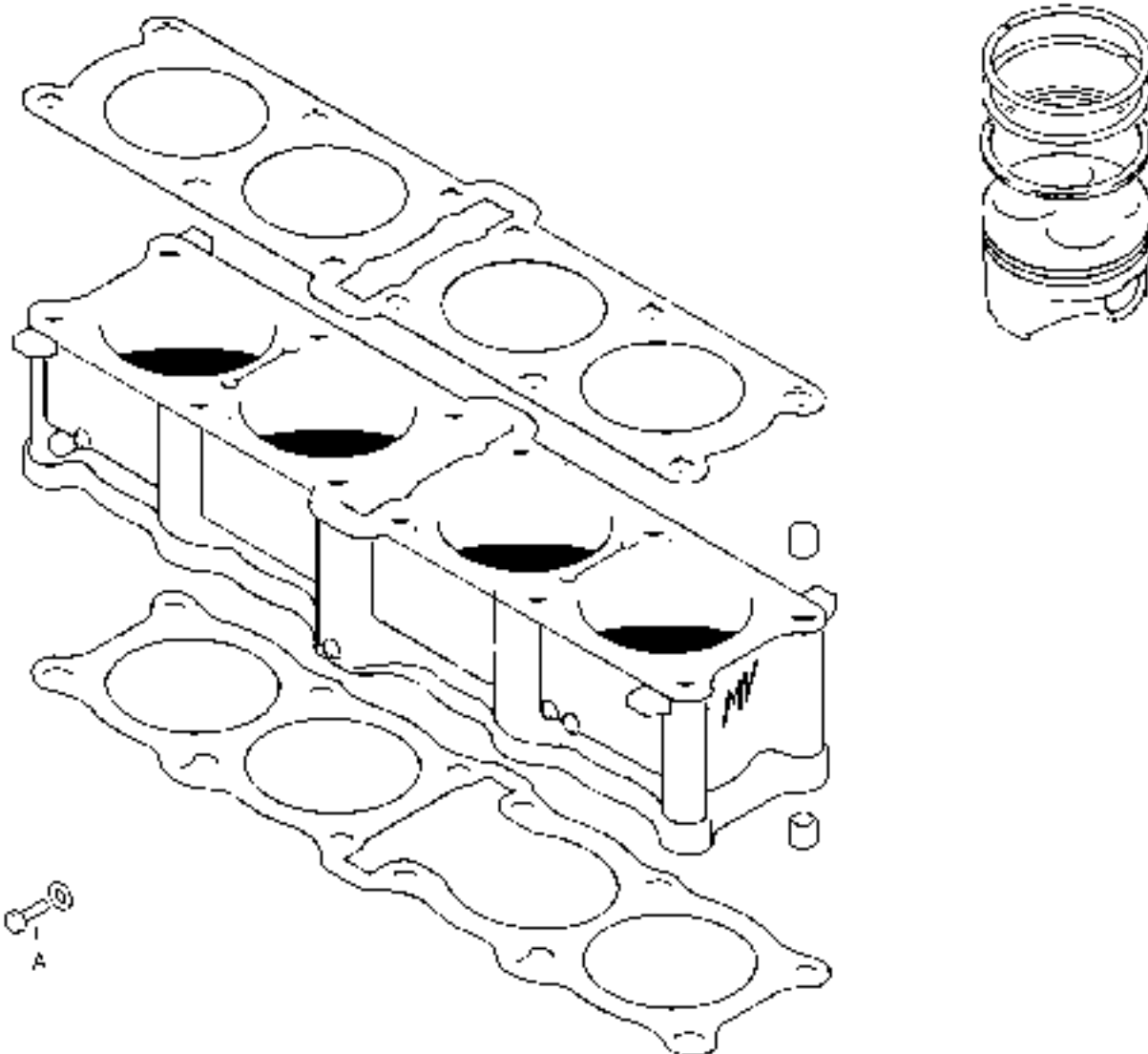
Install in this order: the pin in the spring, the spacer and the screw cap.

Lock the screw cap by hand till you feel the tensioner extend, then lock it with a 8 Nm torque

Acting this way the chain tensioner is adjusted.



CYLINDER AND PISTON GROUP



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8									
	Kg·m										
	ft·lb										
Thread blockers		Medium									

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Removing cylinder and pistons

Remove the cylinder head and rubber connecting rod between the cylinder and water pump as described in the relative paragraphs.

Carefully slide out the cylinder group being careful not to damage the elastic strips.

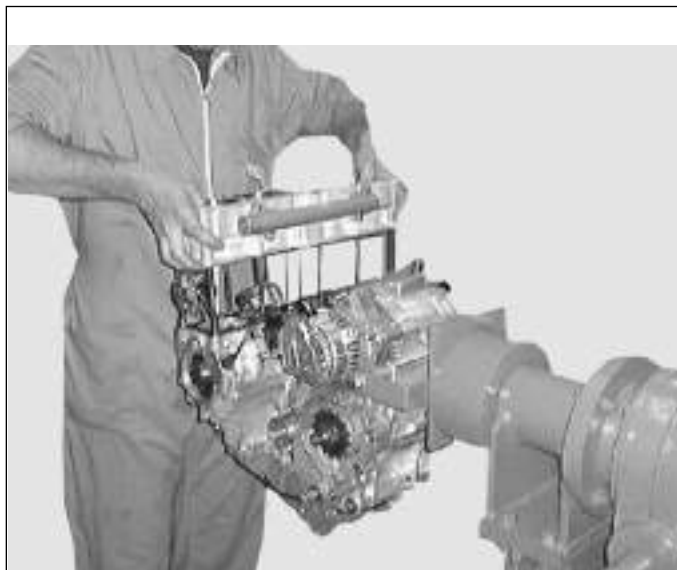
Work on one piston at a time to continue the removal. First remove the 2 pistons which are at the MSP and rotate the drive shaft at 180° and disassemble the 2 remaining pistons.

Remove the elastic ring which blocks the plug to the piston.

Slide the plug off.

Slide the piston off only after having marked the ceiling with a marker to reassemble it properly.

Slide the gasket off between the cylinder and bedplate.



Cylinder revision

Check to be sure that enclosures show no sign of seizures with the pistons.

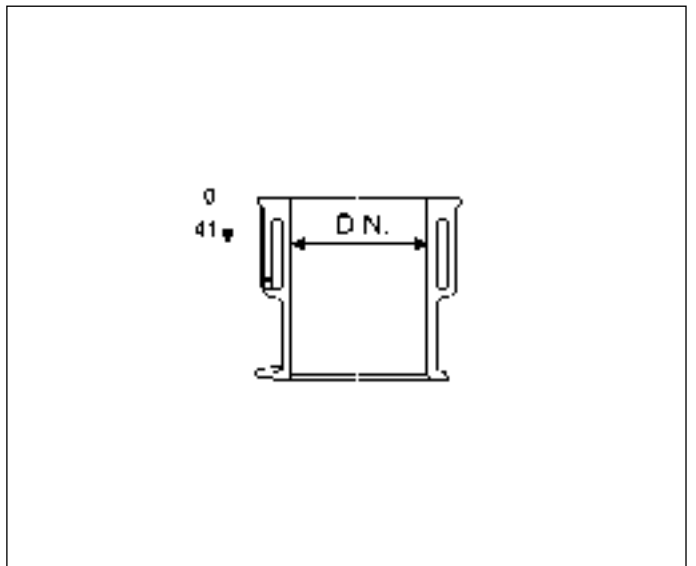
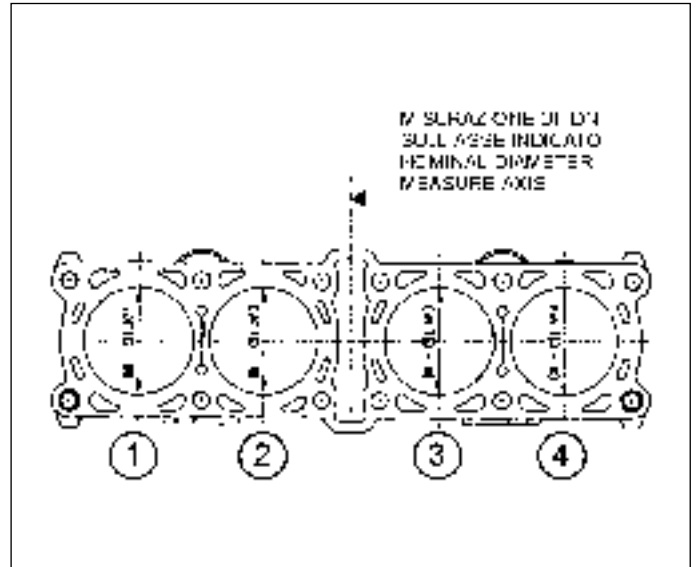
Check piston ovalization in the following way:

A) Measure the **nominal diameter of each cylinder at a distance of 41 mm from the superior edge** as indicated in the figure.

B) Perpendicularly repeat the measurements to the preceding ones.

C) Verify that the **ovalization is inferior to 0.015 mm** (wear limits).

In the case that not even one cylinder should pass this verification, substitute the entire block. If the block should be substituted and if necessary also substitute the pistons and elastic strips.



Piston revision

Carefully clean the piston ceiling from carbon residues. Continue with a careful visual check of the piston; no signs of lines or other damage must appear.

Measure the diameter of the piston at the portion indicated in the direction perpendicular to the piston pin axle.

In the case of excessive wear of one of the pistons, substitute it.

Piston-cylinder coupling

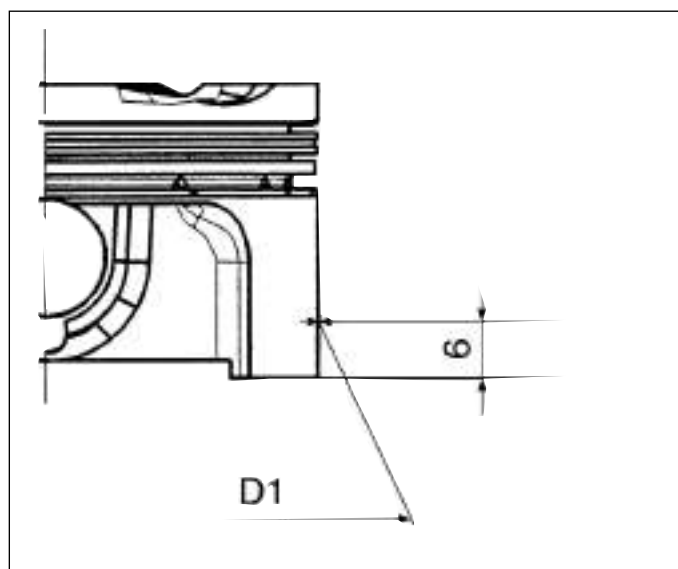
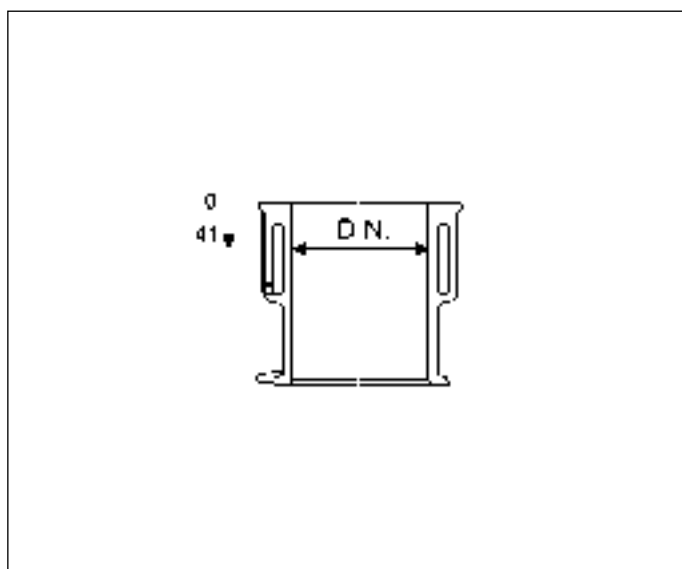
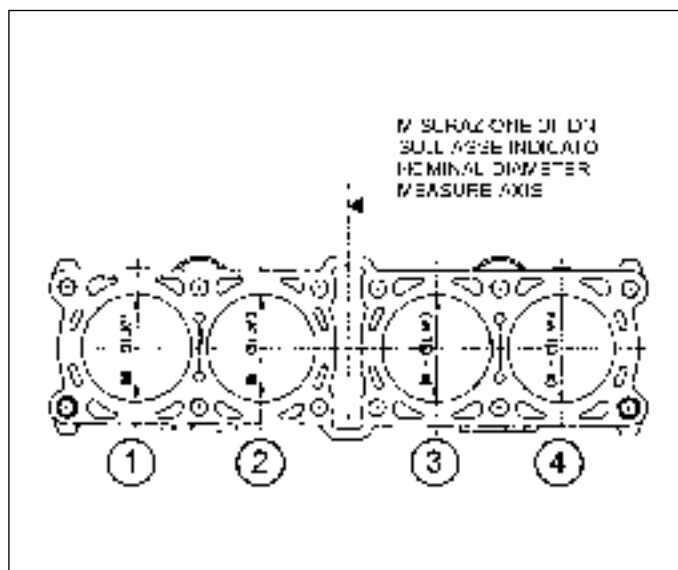
Measure the diameter of the (ND) pipe at 41 mm from the superior plane, as indicated on the sketch.

The piston diameter must be measured at 6 mm from the shell base, in a perpendicular position to the piston pin axle.

These measurements must be carried out at a stabilized temperature of 20°.

The play between piston and cylinder must fall between 0.014 and 0.046 mm.

Maximum wear limit permitted 0.10 mm.



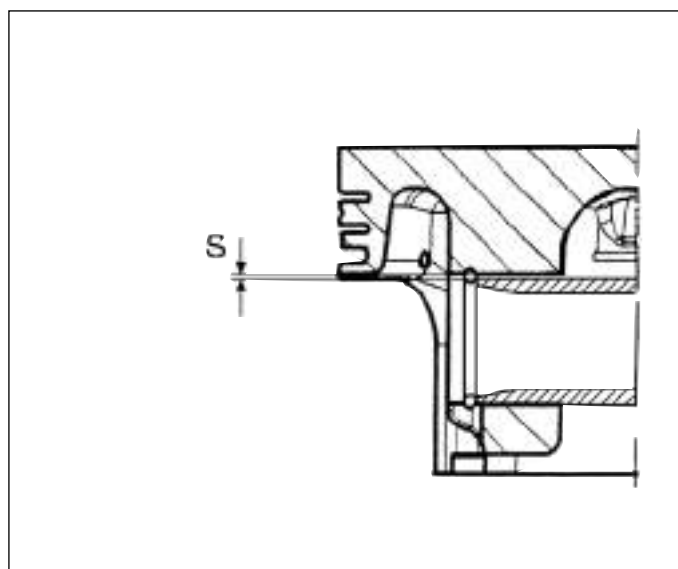
Piston pin revision

Verify that the piston pins show no lines or bluish colours which indicate overheating.

Piston-pin coupling

The (S) play between piston pins and piston must be of 0.002 ÷ 0.010 mm in case the limit is exceeded it is necessary to substitute the piston pin and piston.

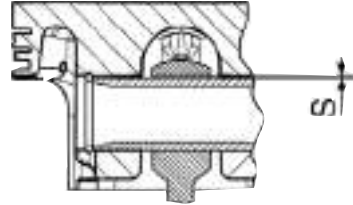
The limited wear permitted is 0.03 mm.



Piston-pin connecting rod foot coupling

Play between piston pin and connecting rod foot must be of $0.015 \div 0.032$ mm.

Maximum wear limit allowed **0.04** mm.



Segments

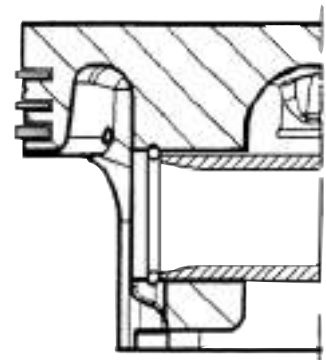
Verify the absence of lines and traces of shrinkage on each segment.

Verify that the edge of the segment is well defined and free in the segments.

The spare pistons are furnished complete with segments and piston pins.

Whenever segment wear is noticeable it is recommended to change the pistons as well.

SEGMENT	Standard	Wear limit
1°	SP 1 -0.01 -0.030	0.96
2°	SP 1 -0.01 -0.030	0.96
Oil scraper	SP 2 -0.01 -0.025	1.95



Segment-cylinder coupling

Introduce the 5 mm segment under the head plane being careful to position it well in "square" and to measure the distance between the two ends of the segment.

The maximum play allowed between the ends of the ring is the following for each segment:

SEGMENT N°1: **$0.2 \div 0.4$ mm;**

Maximum wear limit allowed **0.6** mm.

INTERMEDIATE SEGMENT: **$0.2 \div 0.4$ mm;**

Maximum wear limit allowed **0.6** mm.

OIL SCRAPER: **$0.2 \div 0.7$ mm;**

Maximum wear limit allowed **1.0** mm.

Cylinder and piston assembly

The segments must be assembled on the piston with the writing Ne Top turned upwards and by following the outline in the figure.

Oil the connecting rod foot and piston pin.

Assemble the internal ring on the piston

Insert the pistons complete with segments on the connecting rods with the arrow facing the exhaust

Insert the piston pins into the piston until beat.

Assemble the external rings.



Before securing the piston pins with the blocking rings, cover the bedplate opening with a clean rag to avoid any pieces from falling into the oil cup. Always use new blocking rings.

Assemble a new gasket between the cylinder and bedplate.

Position the clamps onto the pistons in the direction shown in the sketch.

Oil cylinders and clamps.

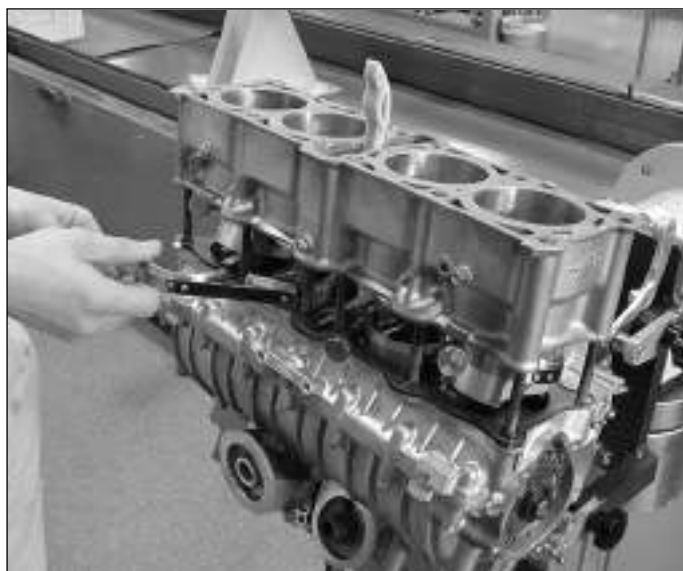
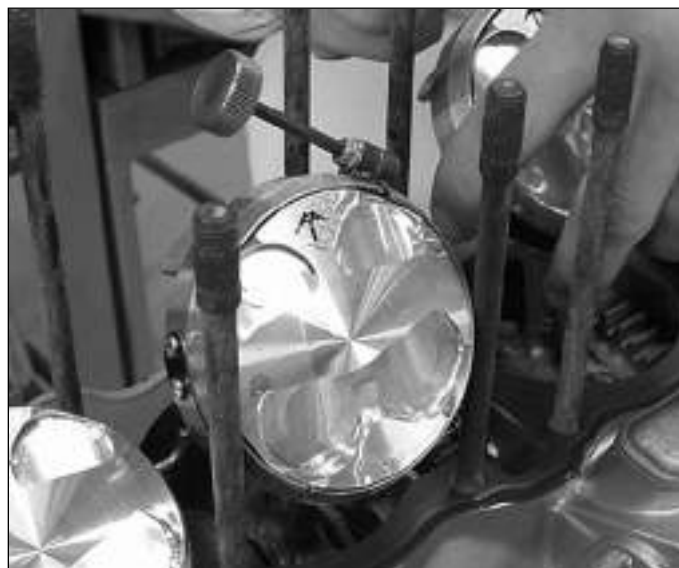
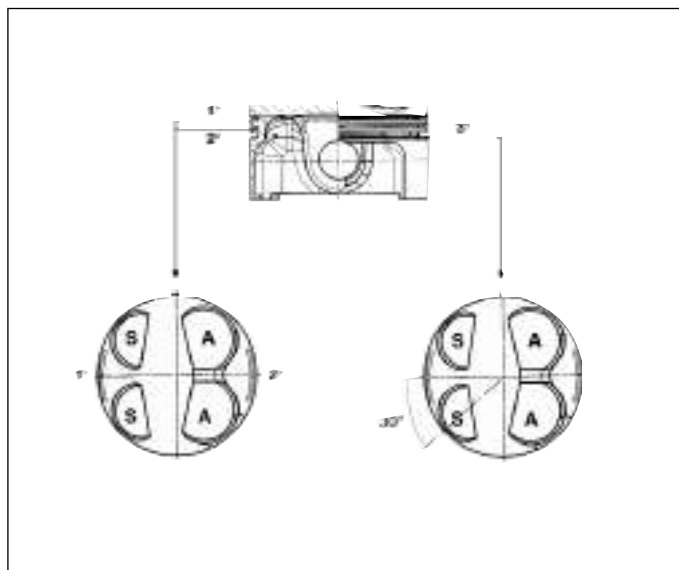
Position the two pistons 1 and 4 at the MSP turning the drive shaft.

Assemble the 8000A1432 band tightening tools on the 4 pistons in the positions shown in the picture.

Lower the cylinder inserting into its inside the two pistons at the TDC, thus rotate the drive shaft at 180° to invert the piston positions and to insert the two remaining ones.

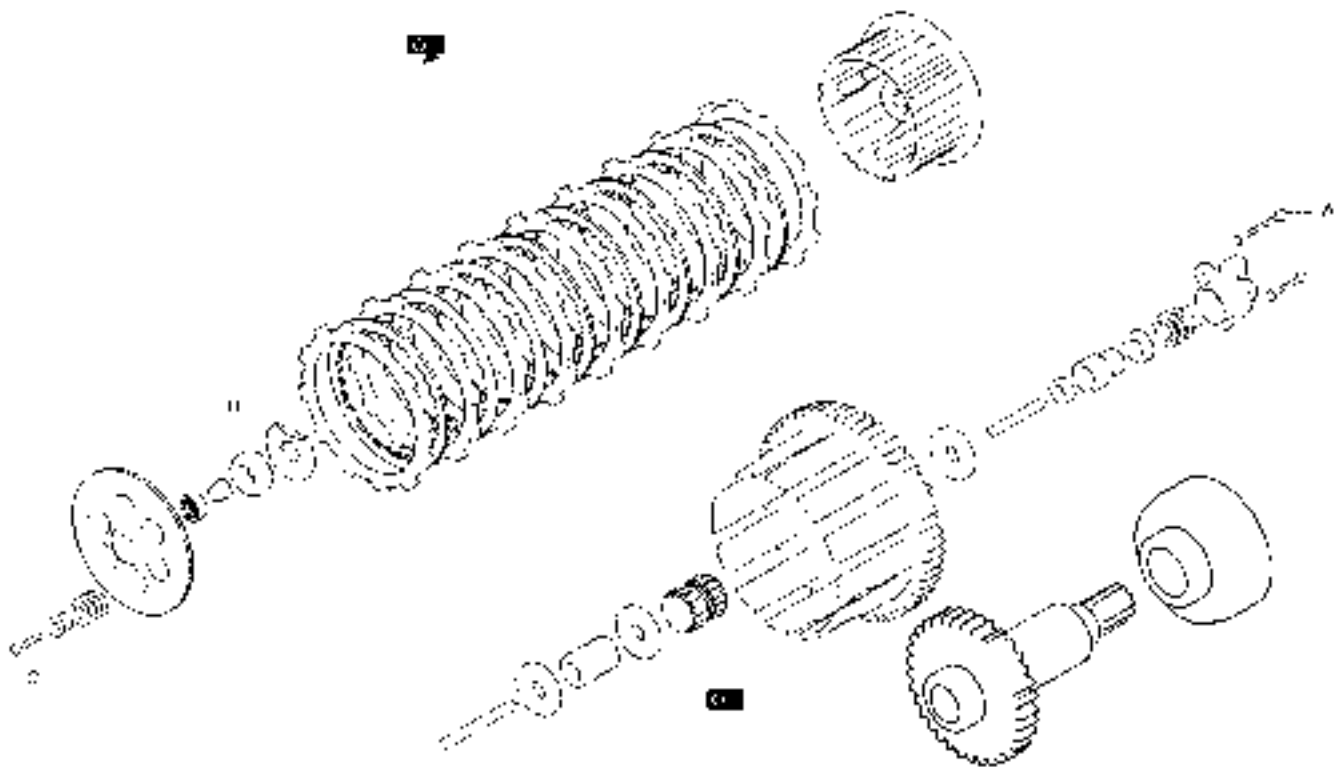
Once you have completely inserted the pistons into the cylinder, remove the specific tools.

Make some turns with the unloaded drive shaft and check to be sure that the pistons move freely without force.





CLUTCH



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	150	10							
	Kg·m										
	ft·lb										
Thread blockers			weak								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

The clutch release occurs using a postponing return group composed of a small thrust piston placed on the left side of the motor and operated by a hydraulic system.

This small piston pushes a command rod which makes the disk pusher plate function.

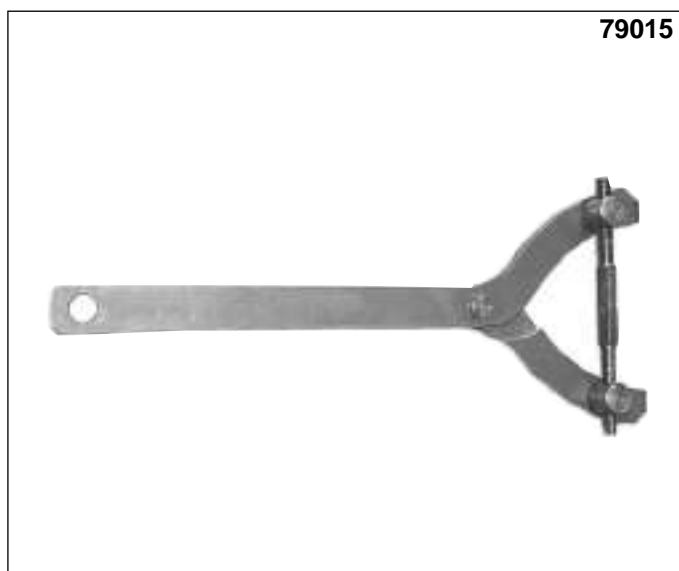
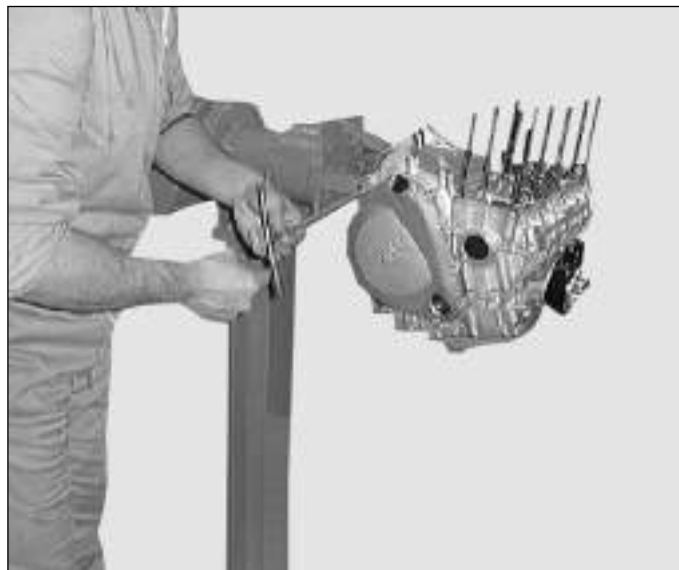
Clutch disassembly

In order to carry out this function the following special tool is necessary:

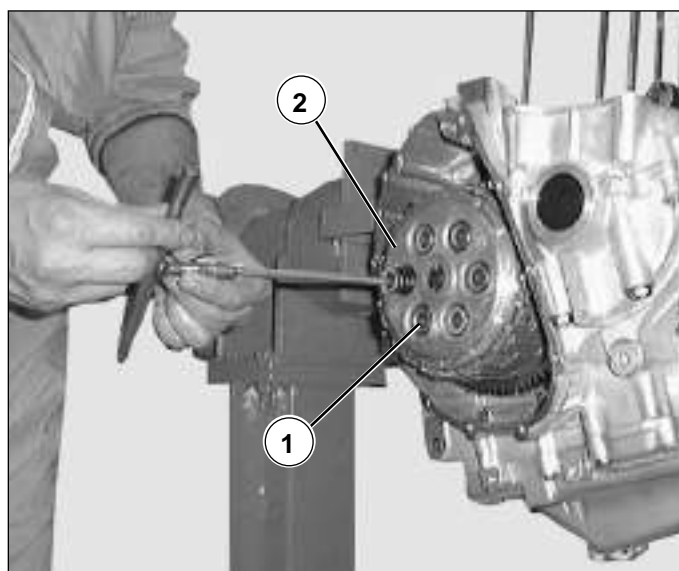
Utensil n° 79015

Remove the 11 screws which fasten the clutch cap to the bedplate.

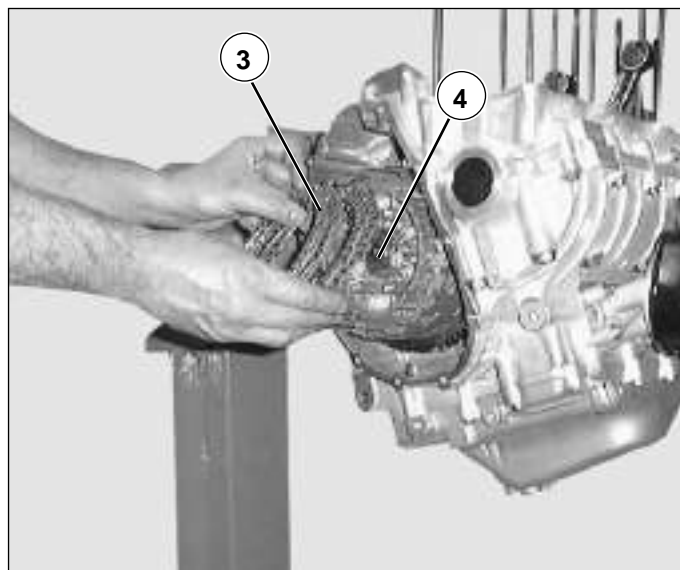
Remove the clutch cap together with the gasket which will be substituted during reassembly.



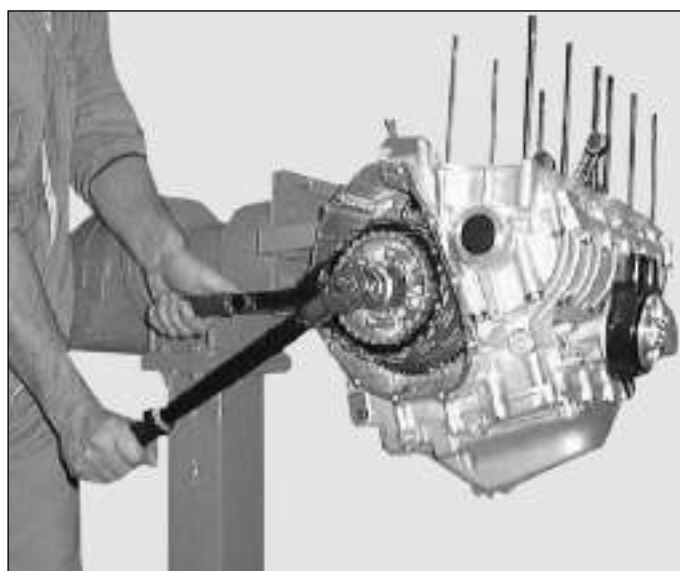
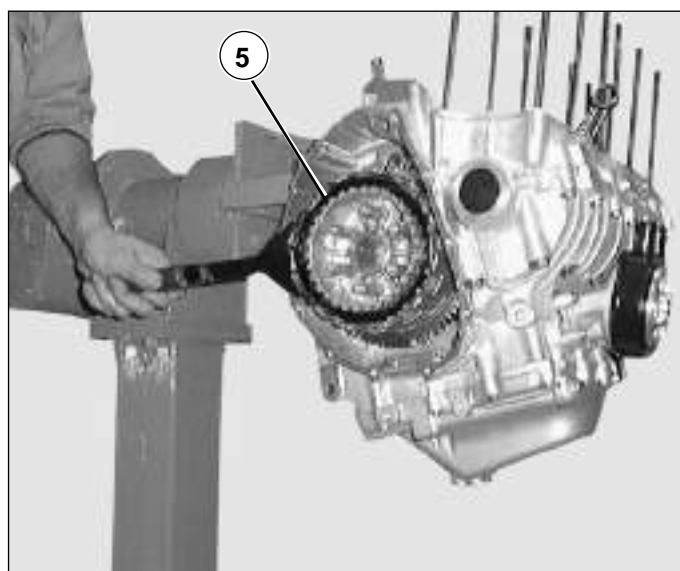
Remove the 6 disk pusher plate tightening screws (1) together with the relative springs (2).



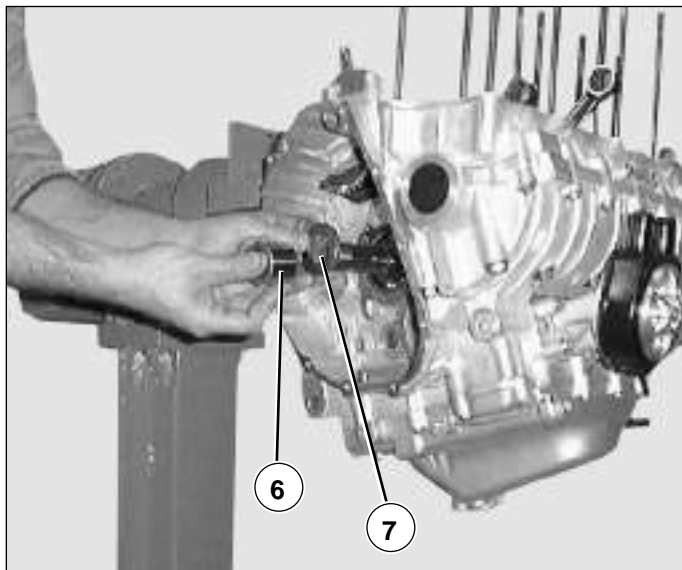
Remove the disk pusher plate.
Manually remove all of the attrition disks (3) that you can.
Straighten the nut washer (4).



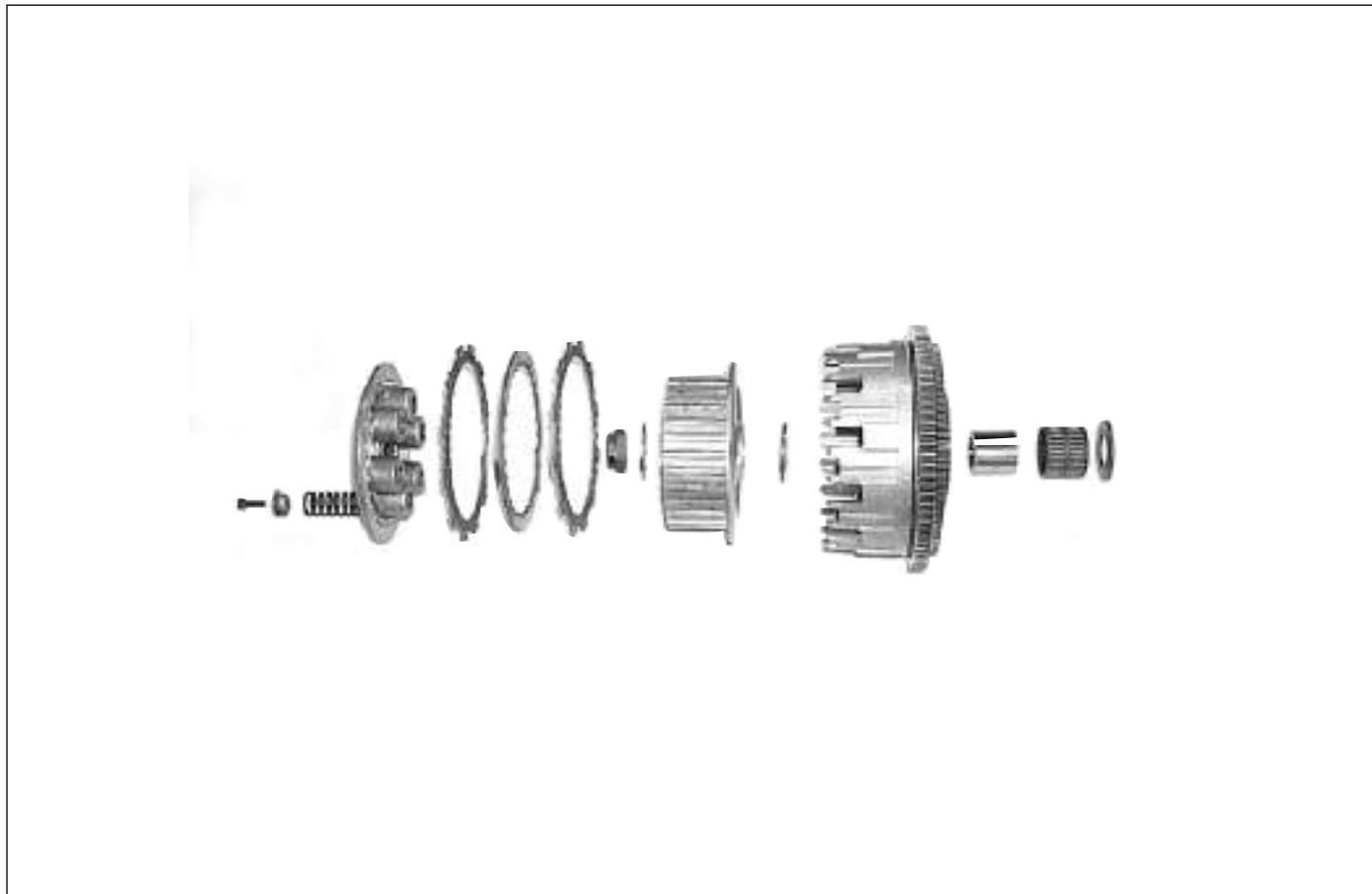
Unscrew the nut using tool n°79015 to hold the clutch hup still and remove it (5).



Remove the clutch block and then the separator (6) and the grazer washer (7).



Disassemble the clutch block following the sequence in the figure.



Clutch overhauling

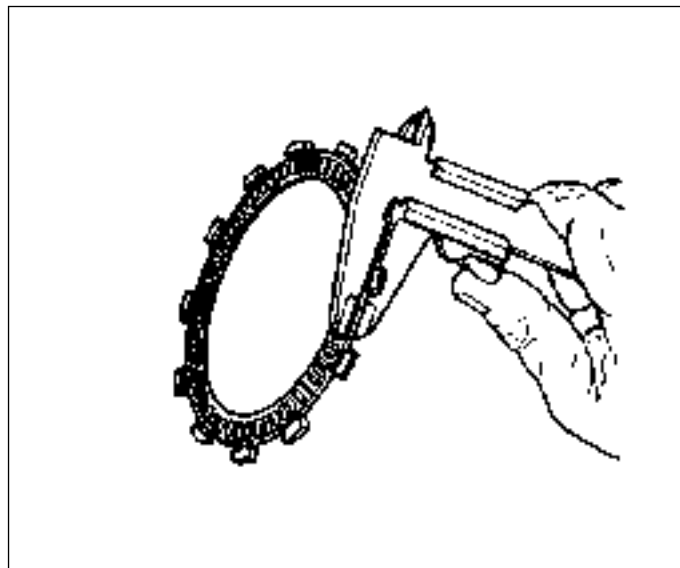
Check the rod for straightness and wear.

Check the friction plates for wear. **The standard thickness is 3 mm**

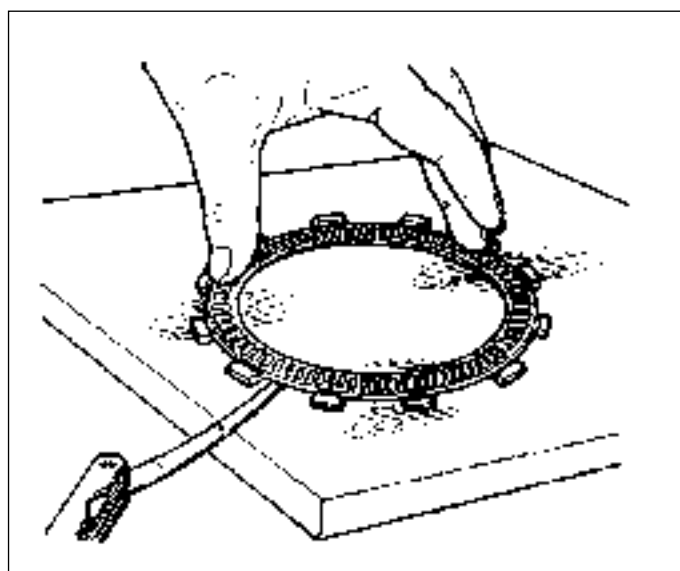
Wear limit : **2.8 mm**.

No signs of burning, grooves or other damages are allowed.

Replace the whole plates group even if only one is damaged.



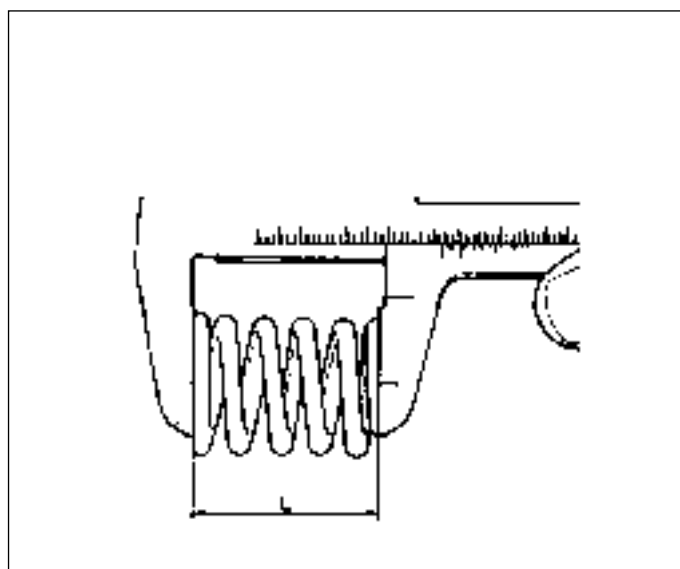
Put the plate on a table and check the deformation.



Measure the length "L" of the springs with a gauge.

Service limit: **38.8 mm**

Replace the springs exceeding the service limit.



Clutch reassembly

Assembling clutch block.

Assemble the disks alternating the 9 garnished ones with the 8 smooth ones beginning with a garnished disk.

Assemble the block respecting the 3 grippings particularly verifying the one with the drive shaft.

Insert the grazing washer and the separator.

Insert the clutch hub.

Insert the safety washer and nut.

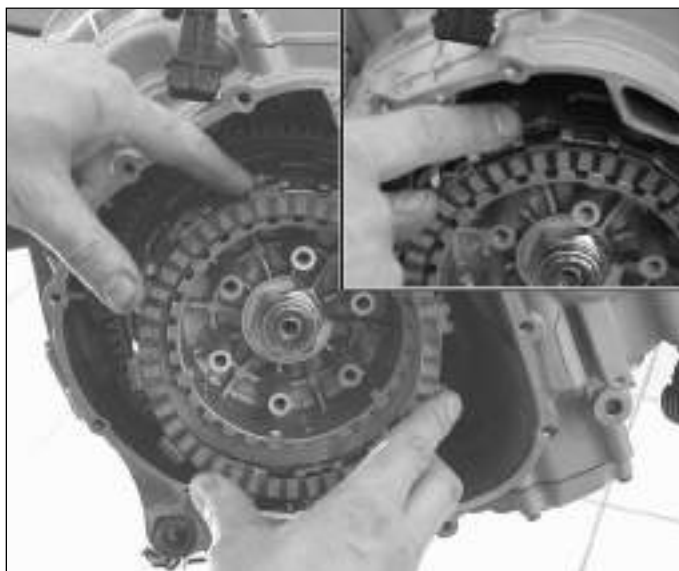
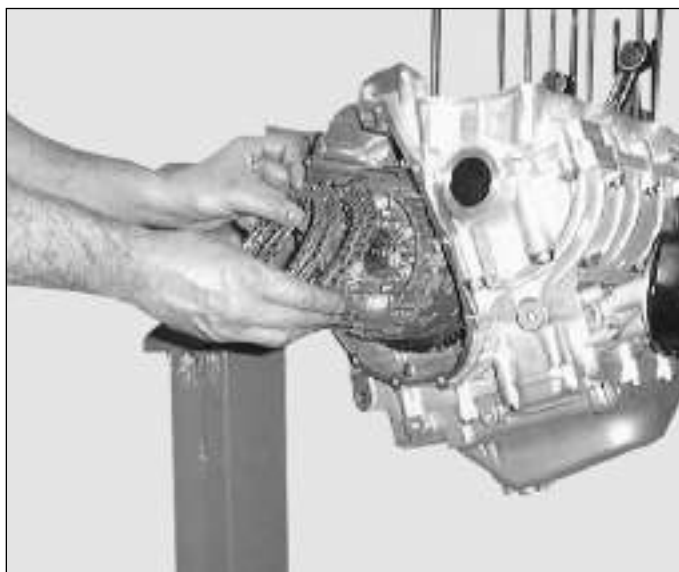


It is recommended that a new safety washer and nut be used during reassembly.

Tighten the nut at 150 Nm using a weak thread blocker and bend the safety washer.



The first 8 garnished disks must be assembled in the same clutch dome groove. The last disk must be rotated a pace further than the proceeding ones.



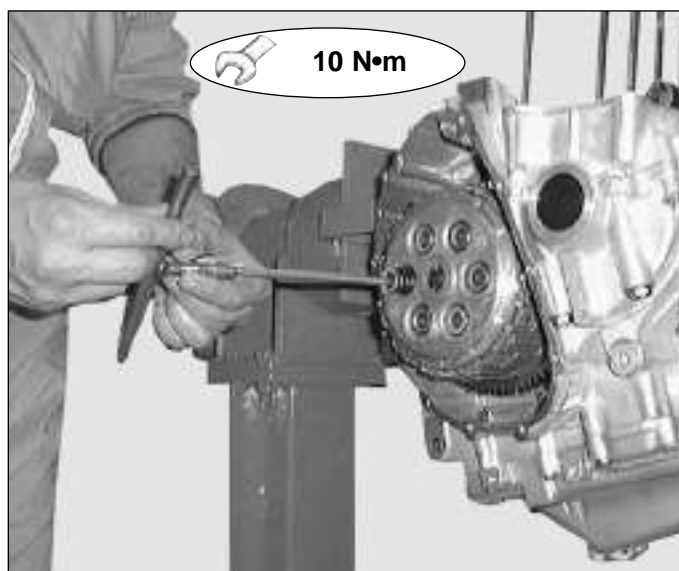
Assemble the disk pusher plate tightening the screws with springs as 10 Nm.

Substitute the cap gasket.

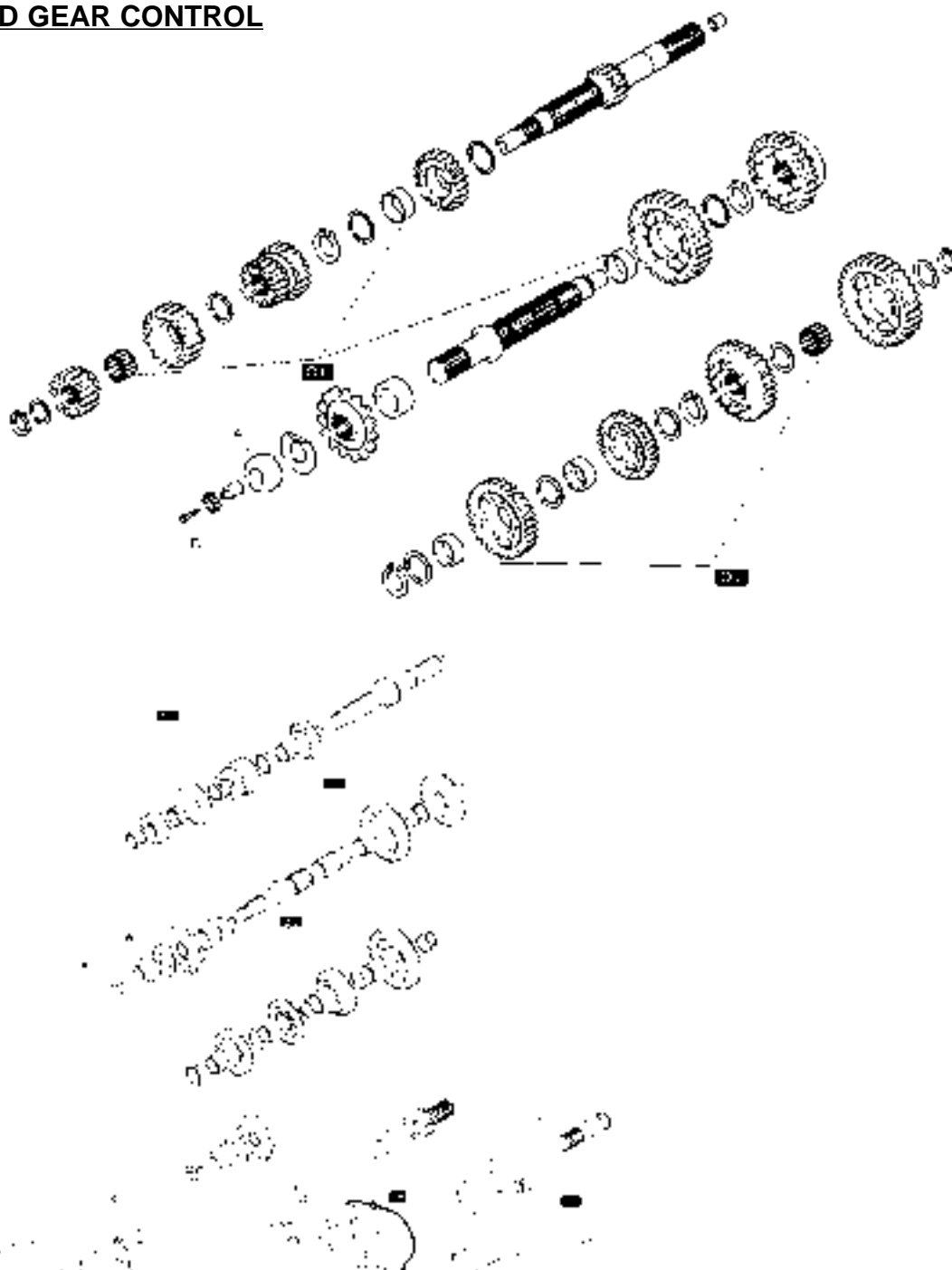
Aline the centering pins.

Position the cap and manually bring screws close.

Tighten the screws at 8 Nm.



GEAR AND GEAR CONTROL



		A	B	C	D	E	E	F	G	H	I
Tightening torque	N·m	150	8	8	6	12 (M6)	25 (M8)	25			
	Kg·m										
	ft·lb										
Thread blockers		Weak	Medium			Medium	Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Disassembling gear group

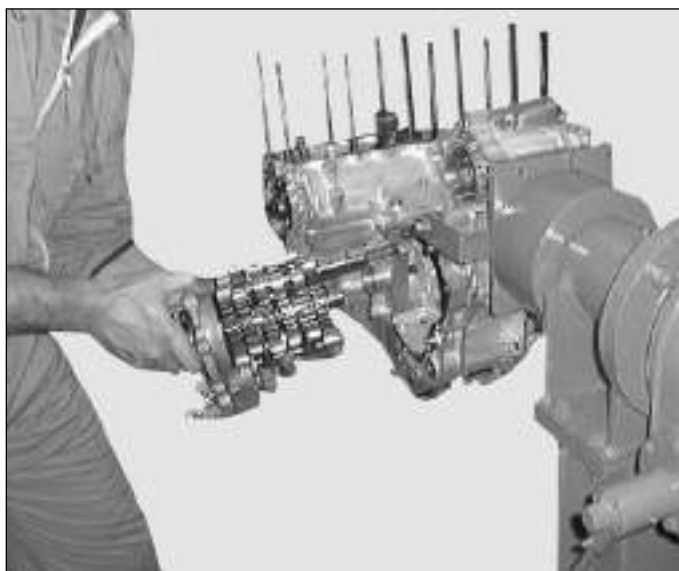
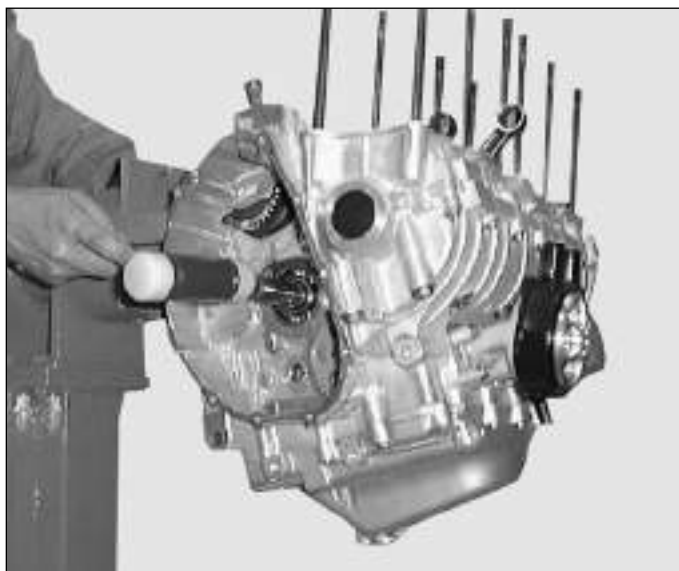
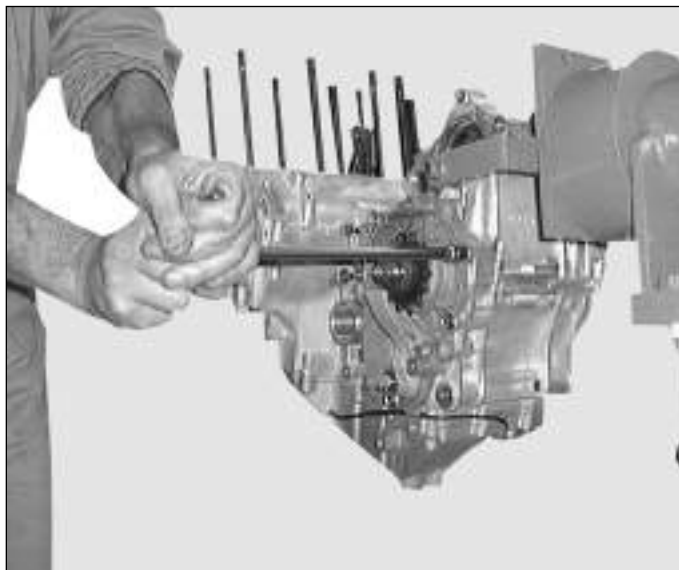
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.

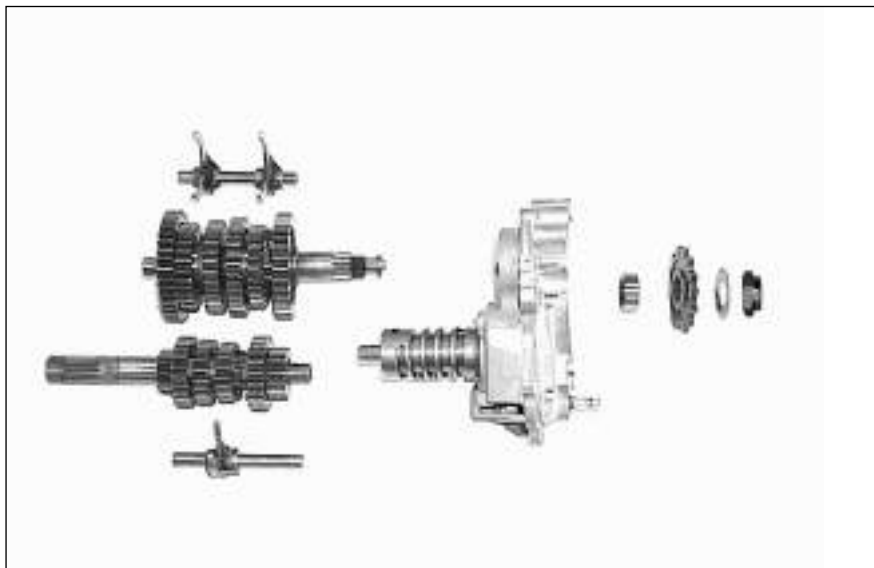


Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear of irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

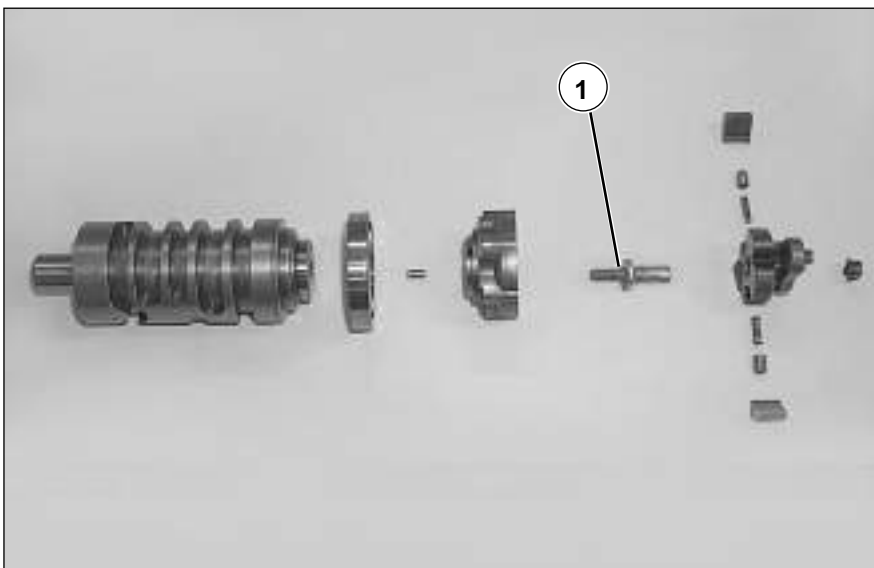
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.

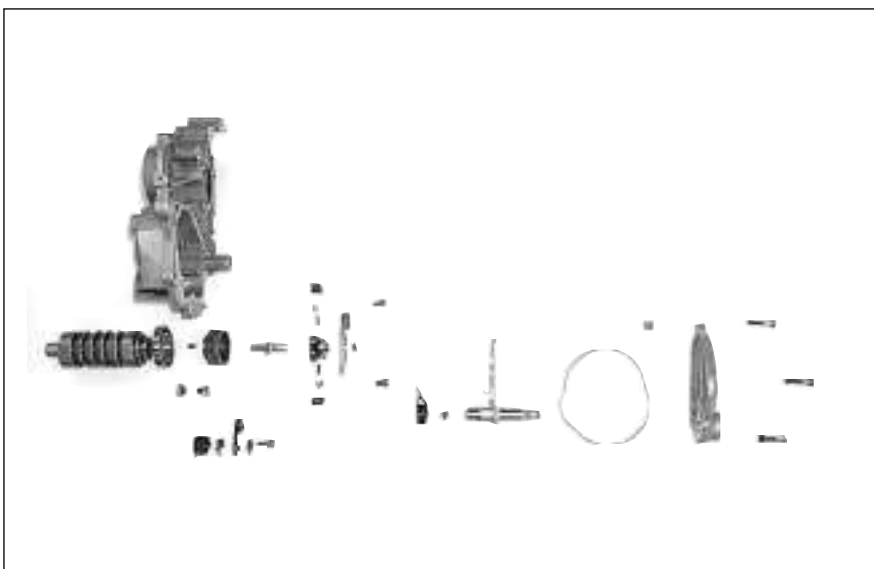


Verify the gear locker pawl free movement.

Reassemble the various parts by acting in the opposite way.



Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly. Tighten all of the screws at 8 Nm except for screw 1, which is to be tightened at 12 Nm if it is of the type having an M6 thread, and at 25 Nm if it is of the type having an M8 thread.



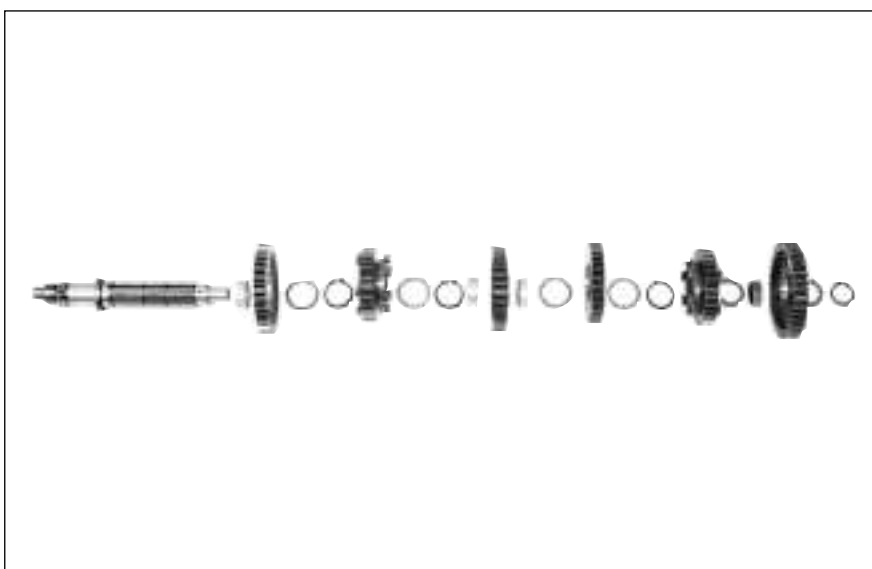
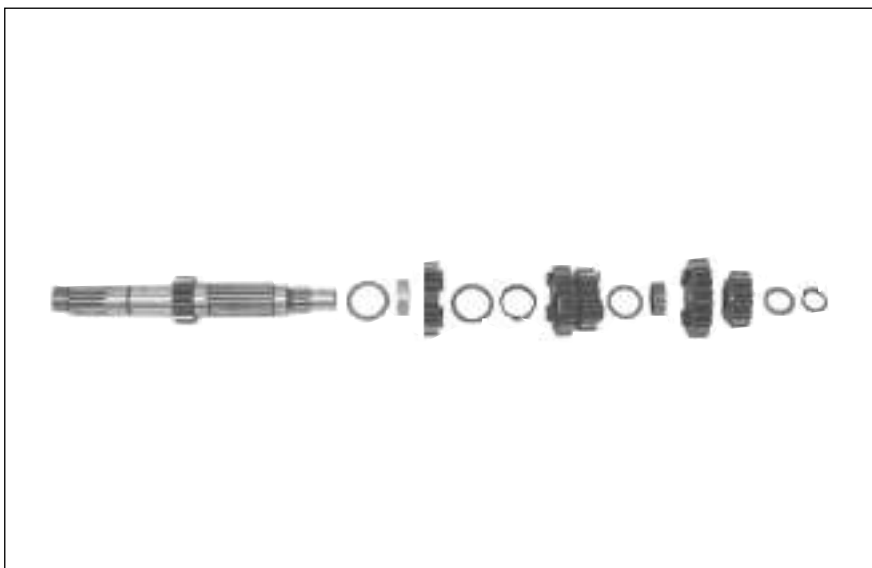


Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.



Gear group revision

In order to carry out the following procedure the following special tool is necessary:

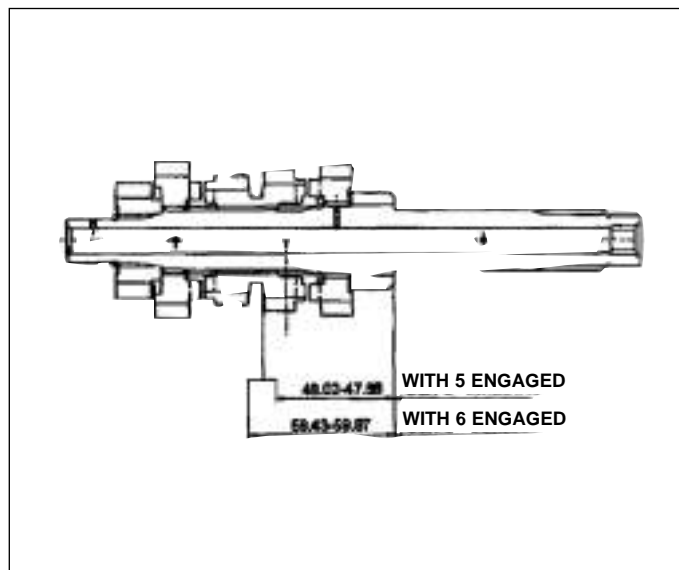
Motor simulation utensil n° 94792

Disassemble the gear group from the motor and reassemble it on the special utensil n° 94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.



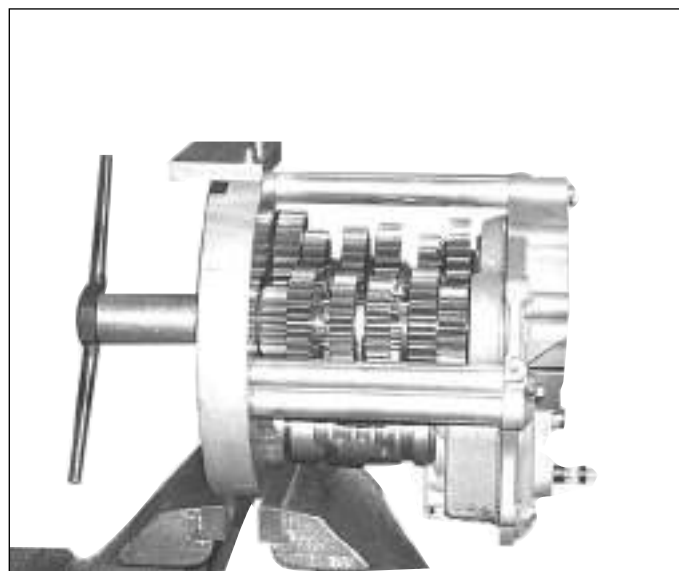
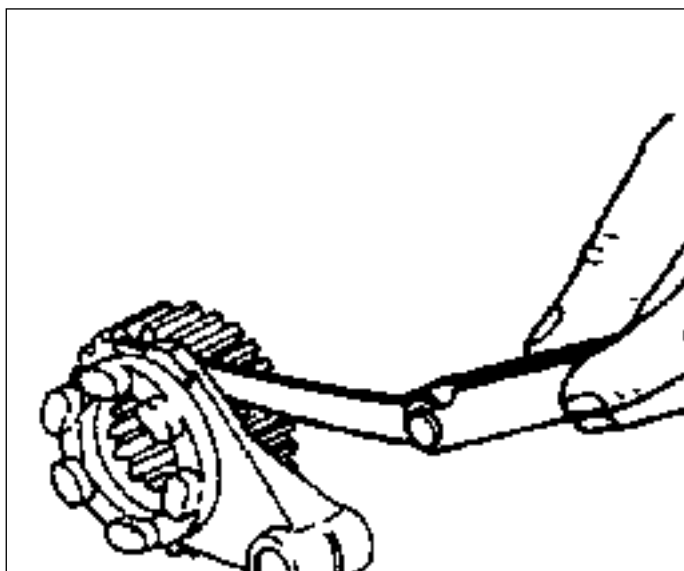
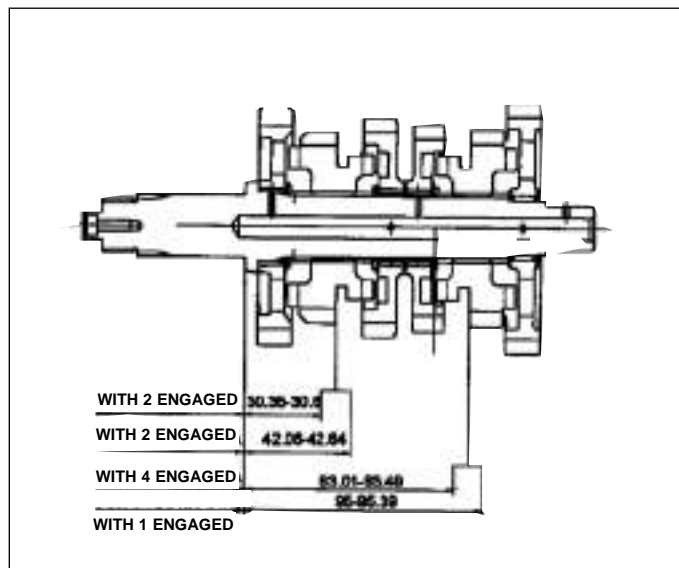
Gear selection forks

Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm Primary
	4.6 mm Secondary
Fork limits	4.65 mm Primary 5-6 gear
	3.65 mm Secondary 1-2, 3-4 gear

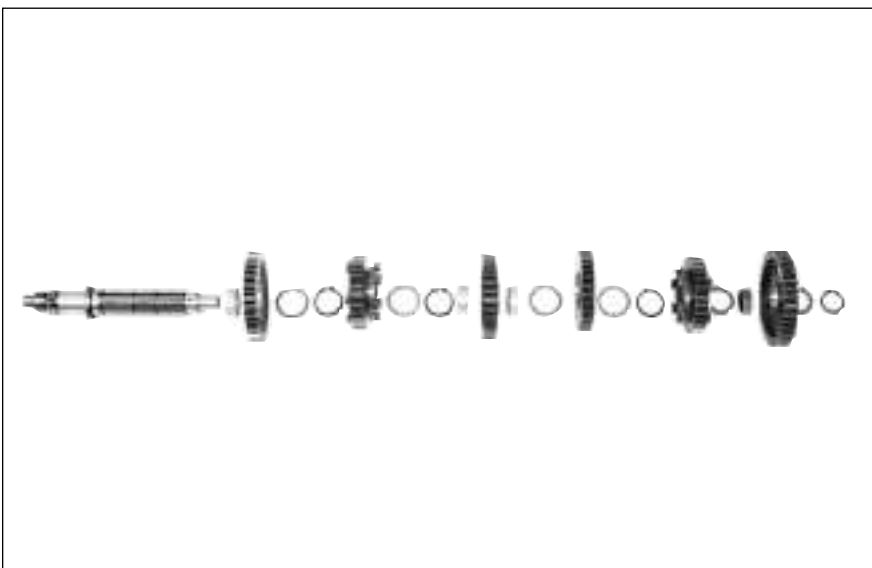
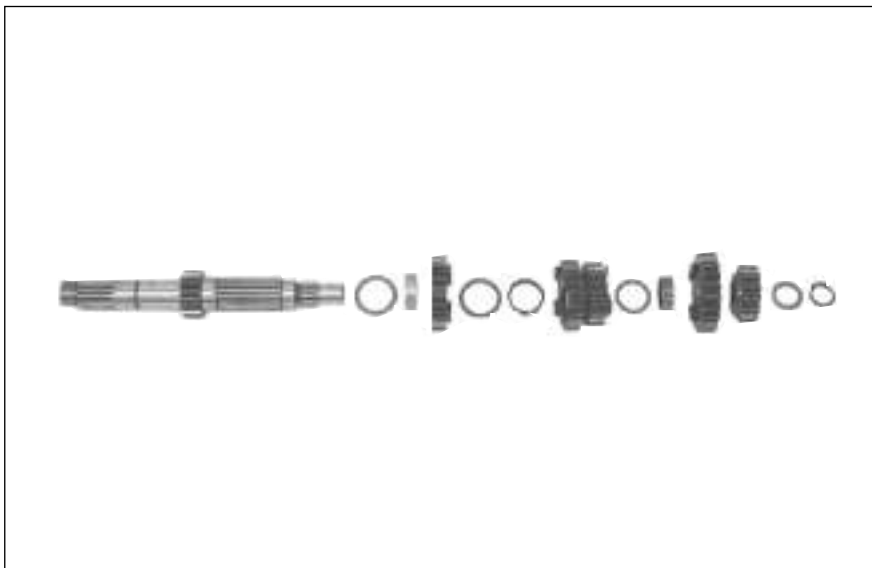
The fork must be able to move without force. Grippage of the gears must flow without impediments and without excessive attritions.



Installation

To execute this operation you need the following special tools:

n° 94792 gearbox tool



Reassembly the various parts by acting in the opposite way.
Install the 2 shafts on the n° 94792 engine simulation tool.
Install a shift pedal and check the gear box is correctly working.



Always insert a new washer and new nut every time you reassemble.

Carefully degrease the threads before reassembly.

Tighten the pinion nut at 150 Nm using a weak thread blocker. Turn the security washer again so as to avoid the accidental unscrewing of the pinion nut.



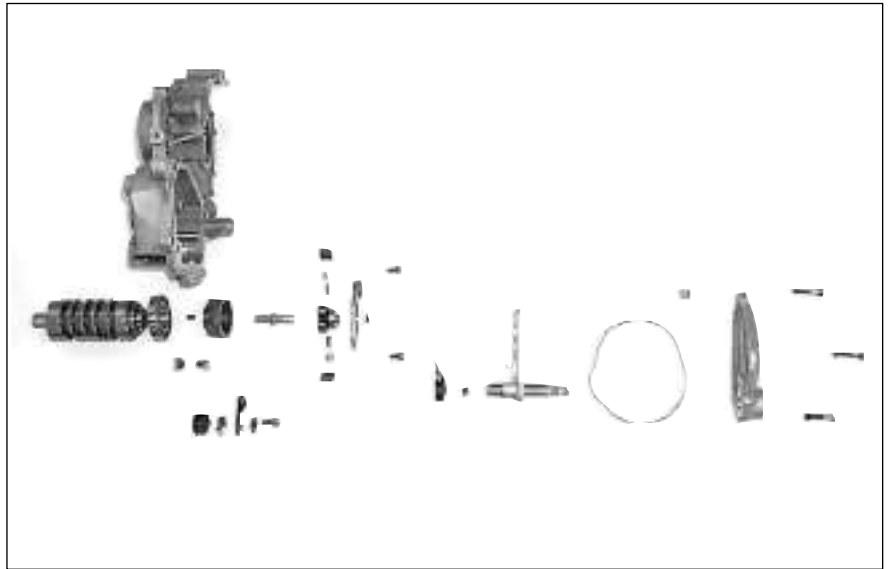
All the gears must be inserted and uninserted without stumbling.

In case of stumbling, verify that the axial play has been correctly restored.

With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to **0.2 ÷ 0.3 mm** placing it on both ends of the coupling.

The fork must be free.

Assemble the gasket on the internal end.

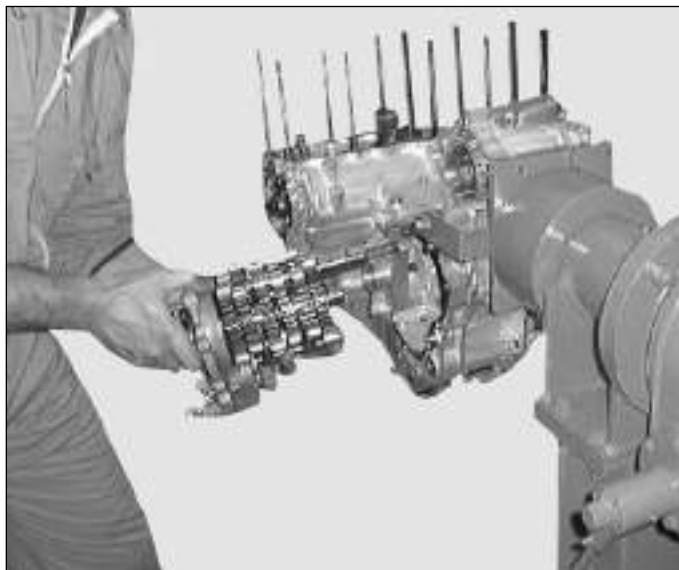




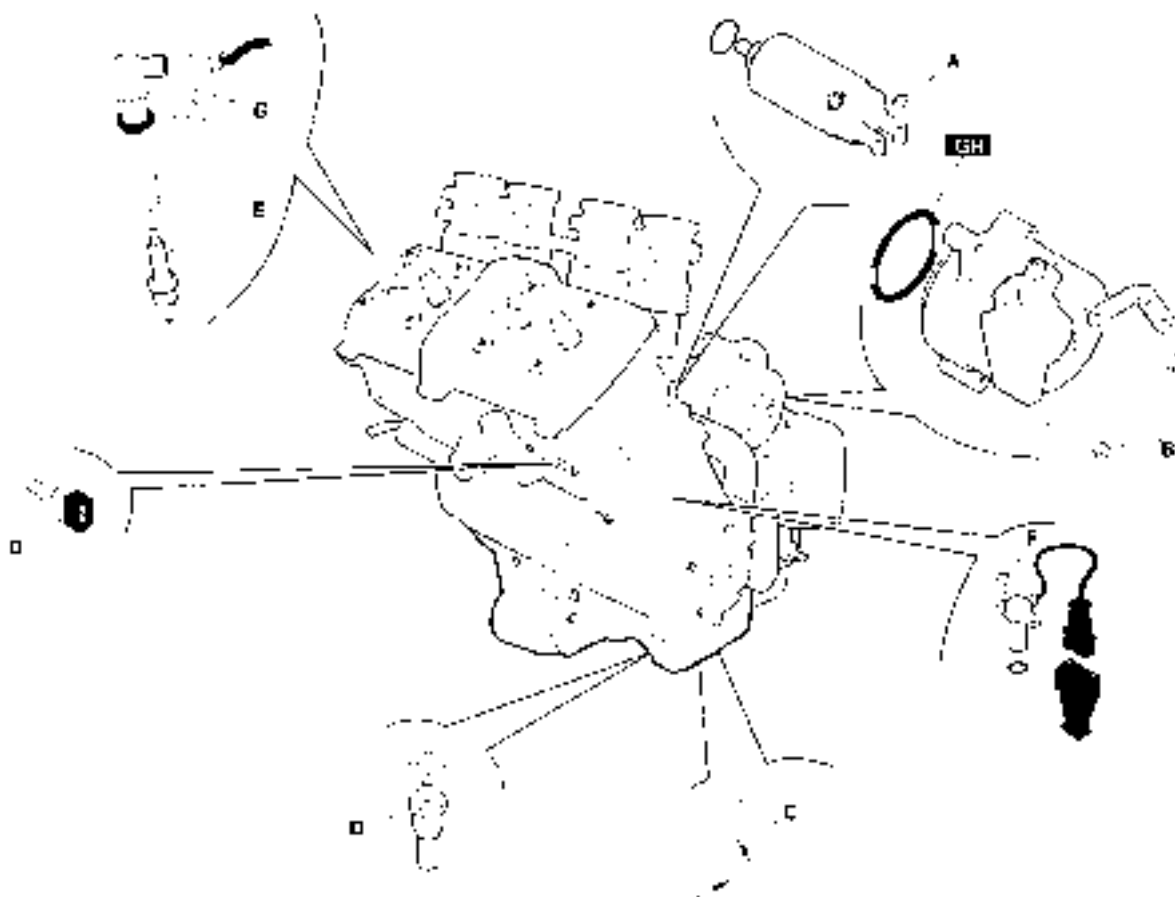
Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.



**Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.**



ELECTRICAL COMPONENTS



		A	B	C	D	E	F	G	H	I	L
Coppia di serraggio	N·m	8	25	10	22	12	6				
	Kg·m										
	ft·lb										
Tipo Frenafilletti					medio		medio				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Remove the pick-up from the phonic wheel.

Alternator

- Removal:

Working on the left side of the motor, remove the three alternators and the stiffening stirrup tightening nuts.

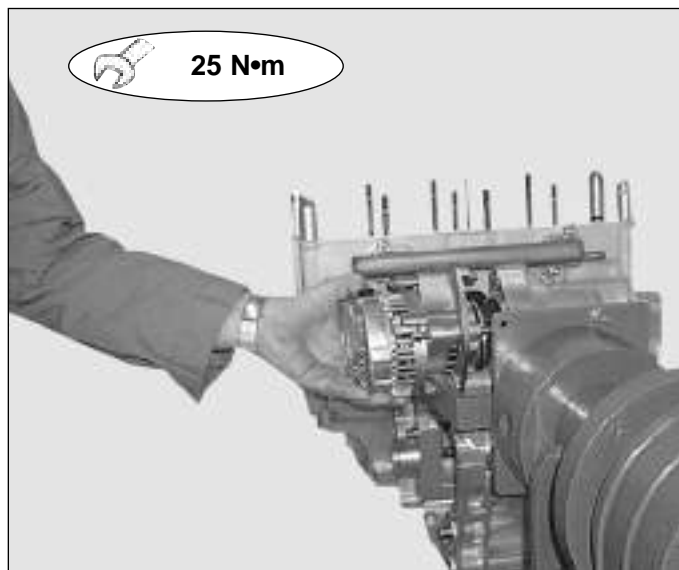
Slide the alternator out being careful not to let the rubber torsions fall .

Assembly:

Grease the torsions and O-Rings.

Insert the pallets together with the torsions.

Manually bring the screws together, thus tighten them at 25 Nm.



Starter motor



- Removal:

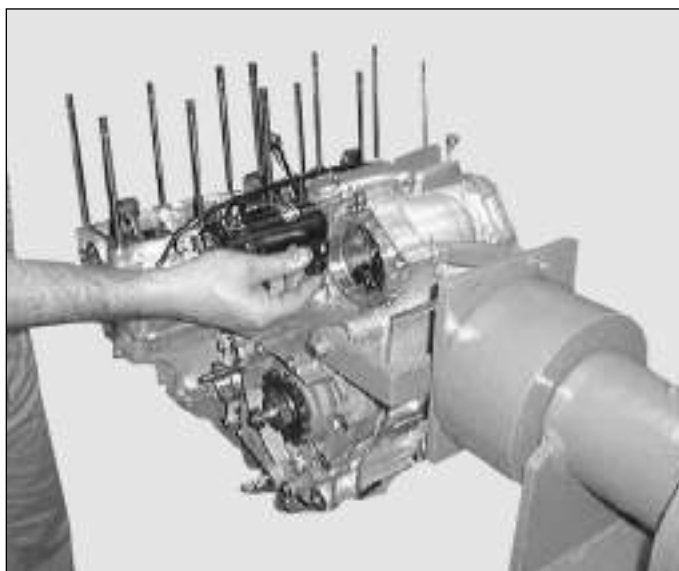
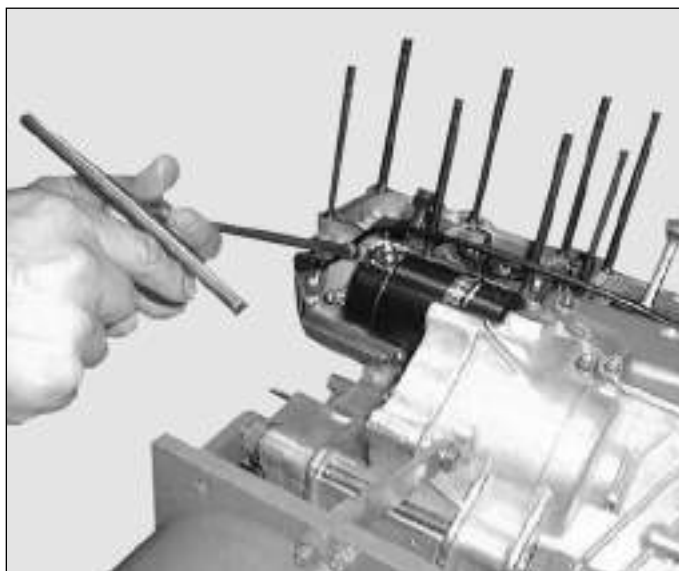
Remove the two tightening screws.

Slide the starter motor out, being careful not to damage the O-Rings on the shaft.

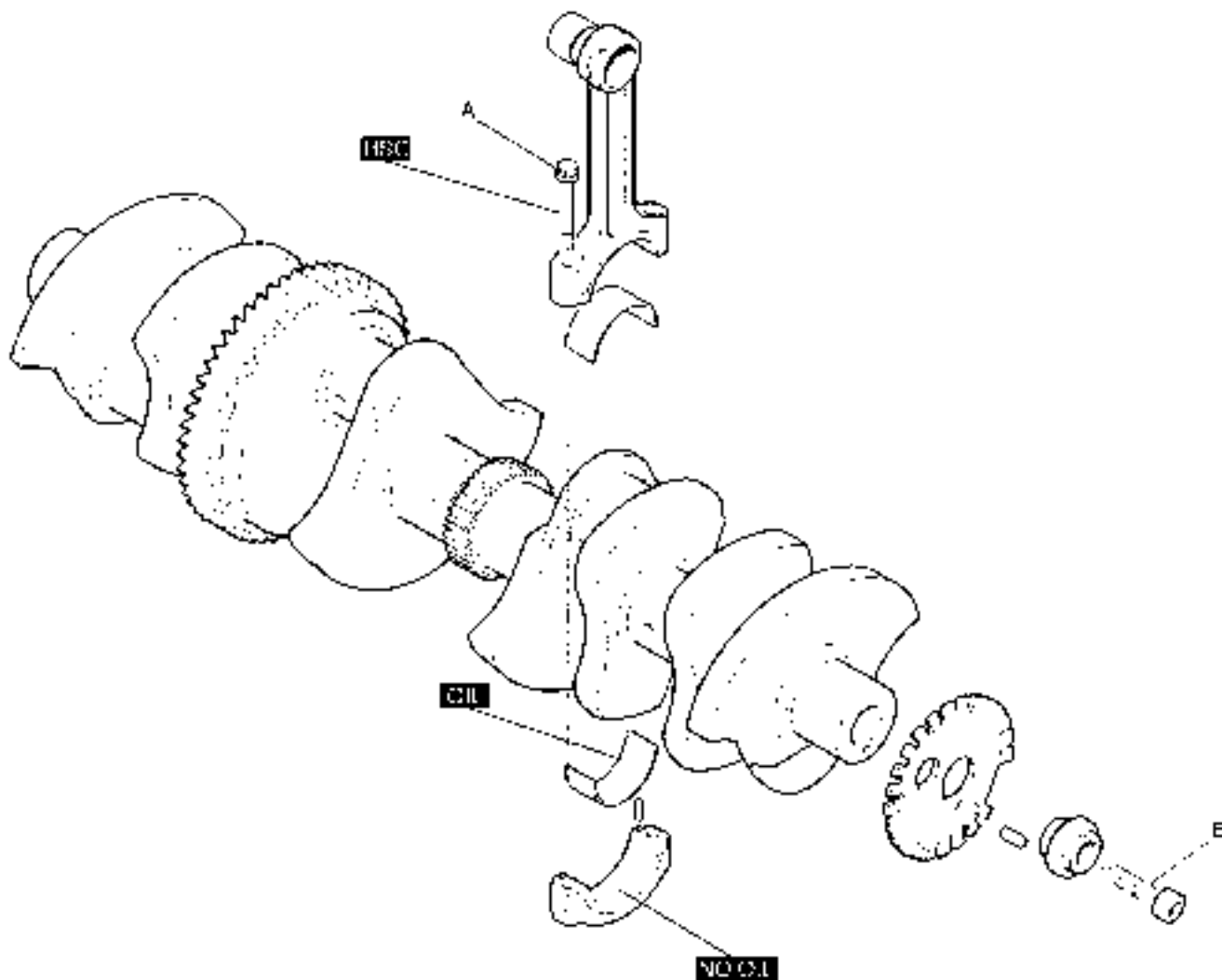
Assembly:

Reassemble the motor on the bedplate.

Manually bring the two screws together, thus tighten them at the prescribed coupling.



MOTOR SHAFT

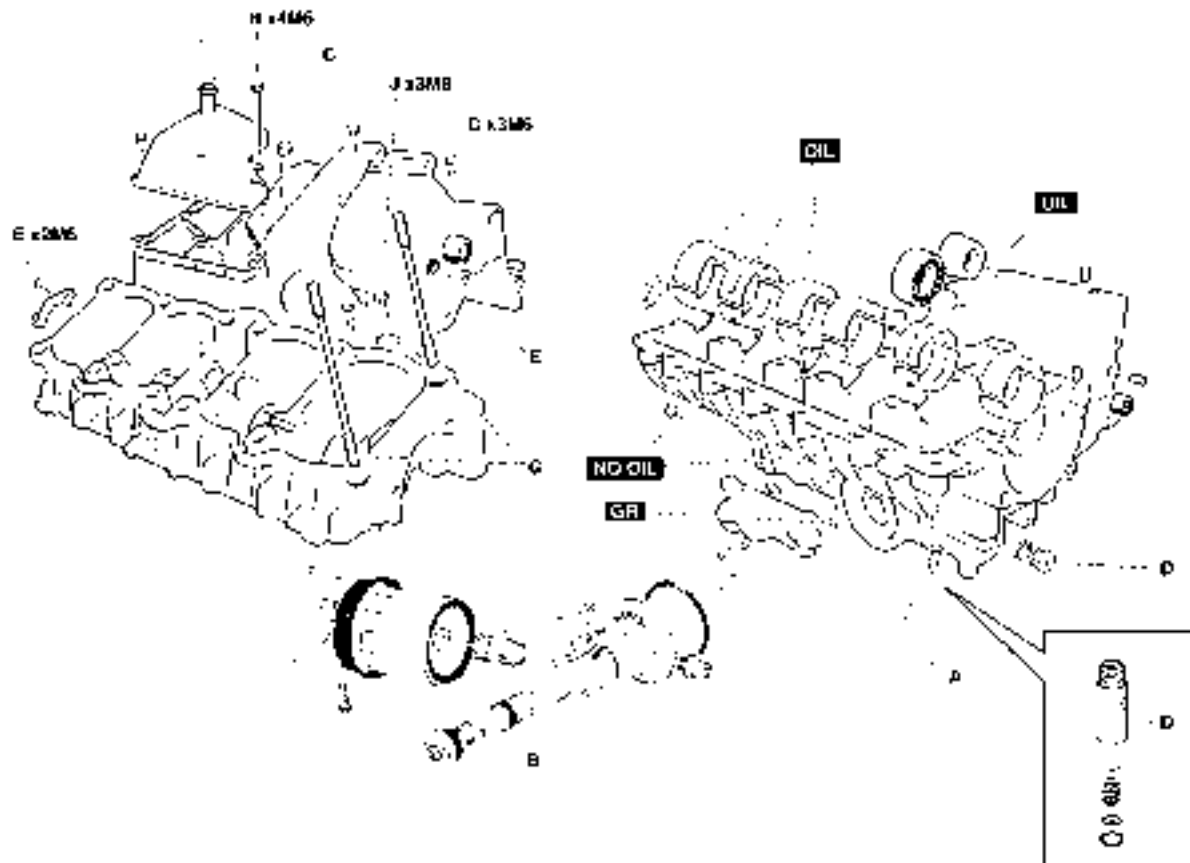


		A*	B	C	D	E	F	G	H	I	J	K
Tightening torque	N·m	25 + 55°	25									
	Kg·m											
	ft·lb											
Thread blockers			medio									

* (see text).

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

BEDPLATE



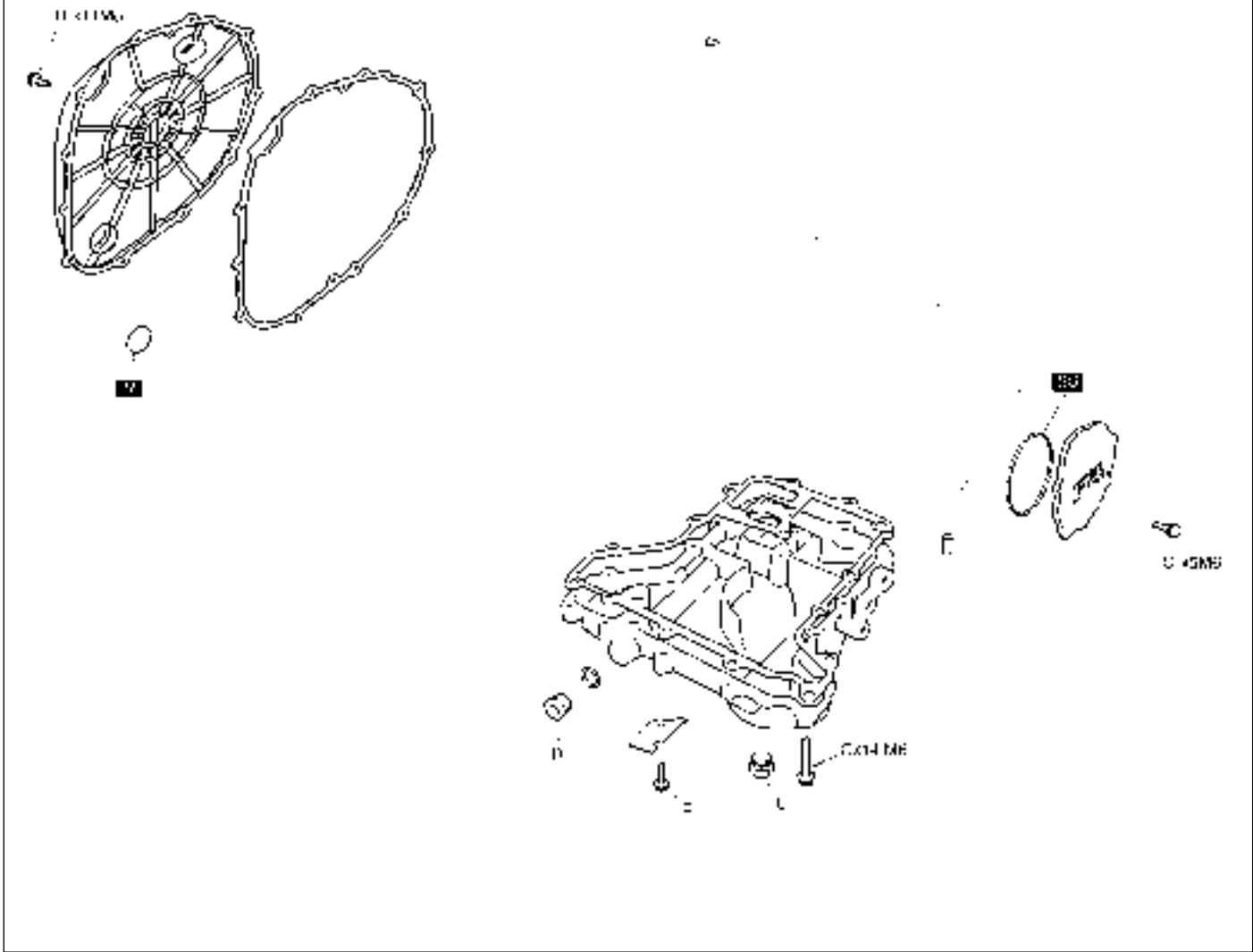
		A	B	C	D	E	F*	G	H	I	J	K
Tightening torque	N-m			10	25	10	10+60°	22	8	14	25	30
	Kg-m											
	ft-lb											
Thread blockers					Medium	Medium		Medium				Medium

* (see text).

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



CAPS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m			10	25	10			8		35
	Kg·m										
	ft·lb										
Thread blockers					Medium	Medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Oil cup

Remove the oil cup by means of the 6 mm tightening screws.

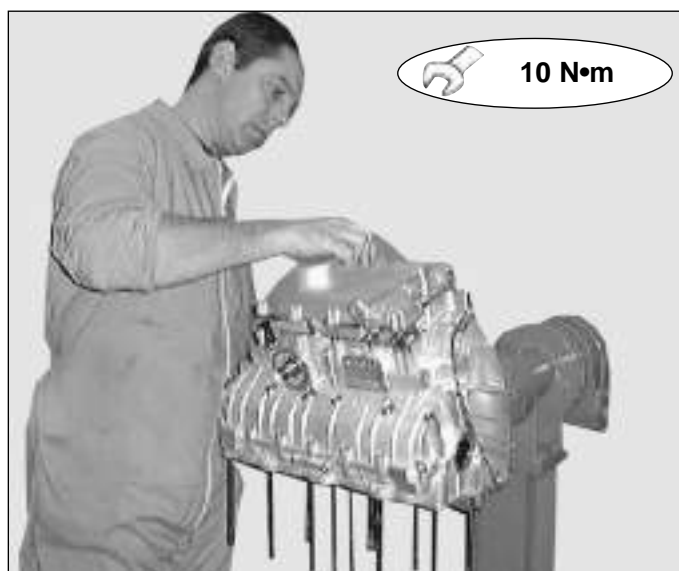
Always substitute the gasket during reassembly.

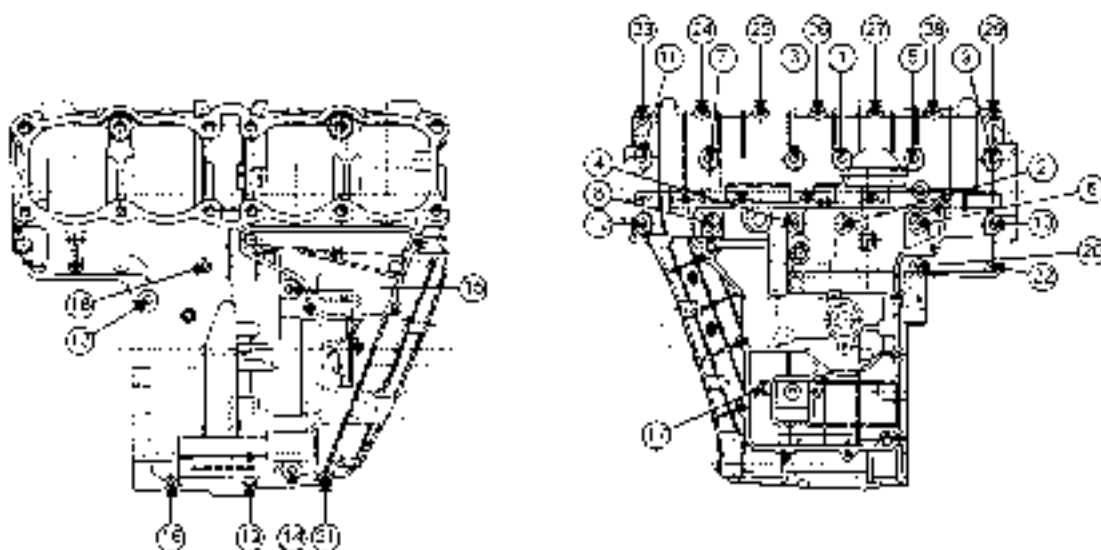
Check to be sure that the oil inlet filter is integral with no cracks or slits; clean it with compressed air at a low pressure blown from the inside towards the outside.

To remove the oil inlet filter unscrew the tightening screws. At reassembling tighten the 2 screws at 8 Nm and block them with 242 LOCTITE after having carefully degreased them.

Position the gasket and manually bring the screws closer.

Tighten the cup screws at 10 Nm.





Disassembly

Remove the oil filter exchanger with heat relative bearing.

Remove as follows as indicated in the relative paragraphs:

- A) The head
- B) The cylinder group
- C) The pistons
- D) The clutch
- E) The gear

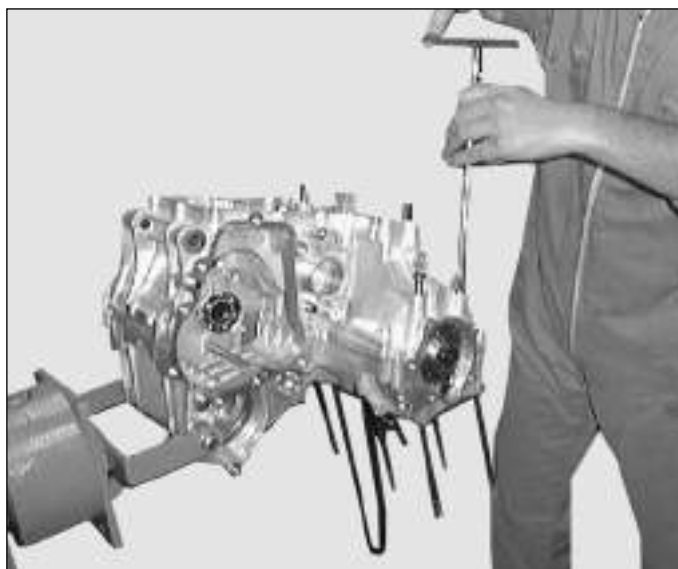
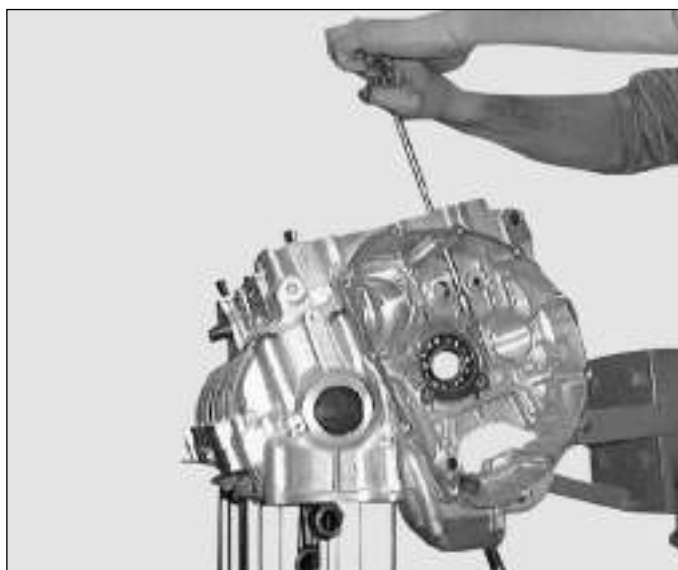
Remove:

F) The screws including the one for the blow-by cap.

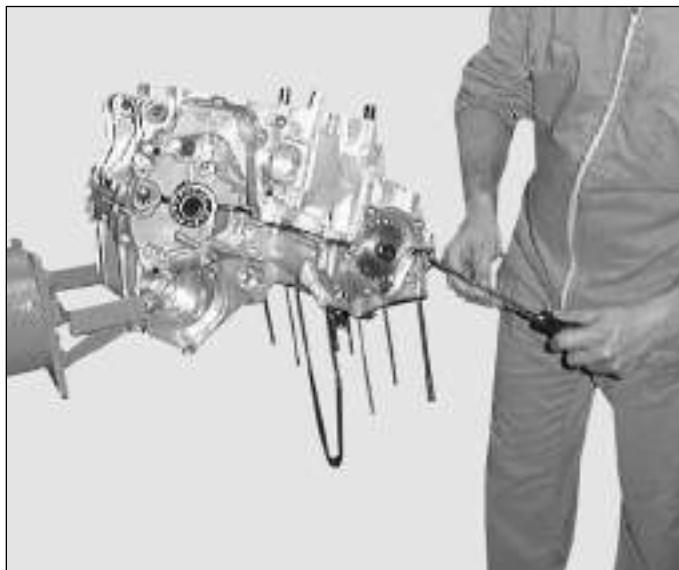
NOTE Remember to unscrew the screw inside the carter indicated in the picture at the right.

G) The size 8 screws.

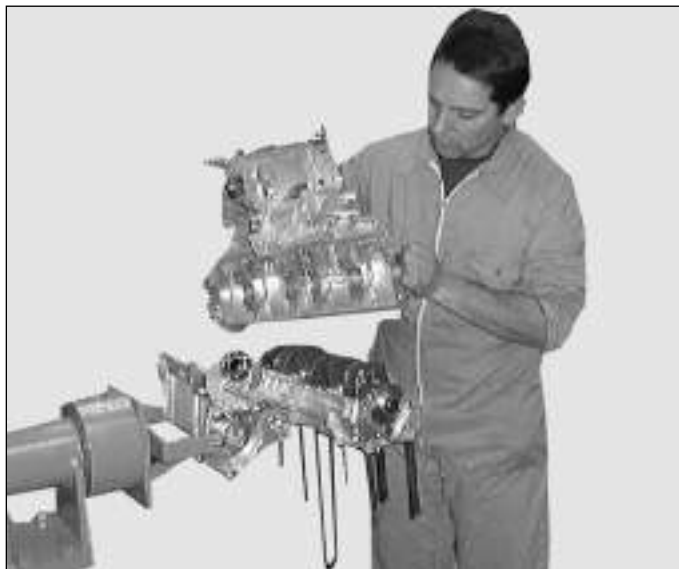
NOTE All the screws are of the same length or visually different; it is therefore impossible to confuse them during reassembly.



H) Separate the two carters (1 and 2) by manipulating the protrusions.



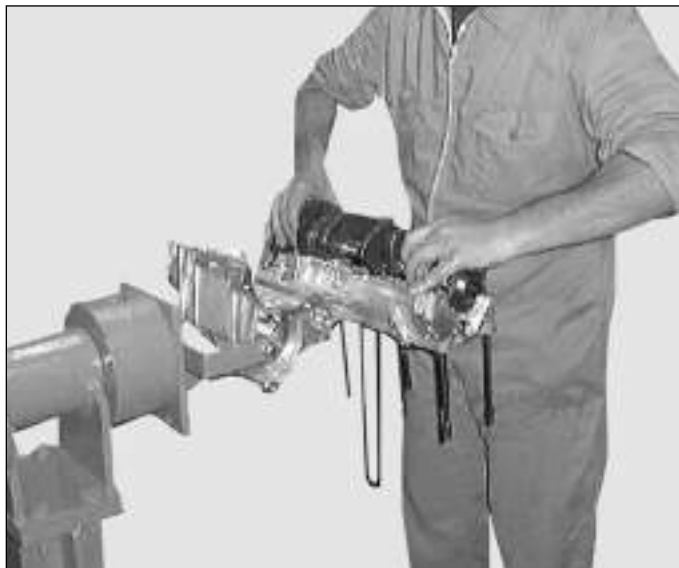
I) If necessary remove the bearings (3).



L) Slide the motor shaft out.

In the event that the bushings should be temporarily removed (4) it is a good idea to identify the bearing number and its carter with a number using a marker. For example the bushing removed from the n°1 bearing of the superior carter (starting from the left) will be identified by the mark S1.

For the couplings refer to the groups they belong to shown on the chart.



SELECTION TABLE FOR F4 BEARINGS					
			BEDPLATE SLOT DIAMETER		
			A		B
BENCH PIN DIAMETER	A	34.981 34.988	1.546/1551 BLUE	1.550/1.555 YELLOW	
	B	34.989 34.997	1.542/1.547 RED	1.546/1.551 BLUE	
	FUNCTIONING PLAY 0.012/0.038				

Revision

Once you have disassembled the motor shaft and in case there should be any doubt substitute the bench bushings as well as the connecting rod.

Verify the motor shaft wear tolerance.

The function **play** of the **bench bearings** must be between **0.012 ÷ 0.038 mm**.

Service limit is **0.06 mm**.

The function play of the **connecting rod bearing** must be between **0.036 ÷ 0.061 mm**.

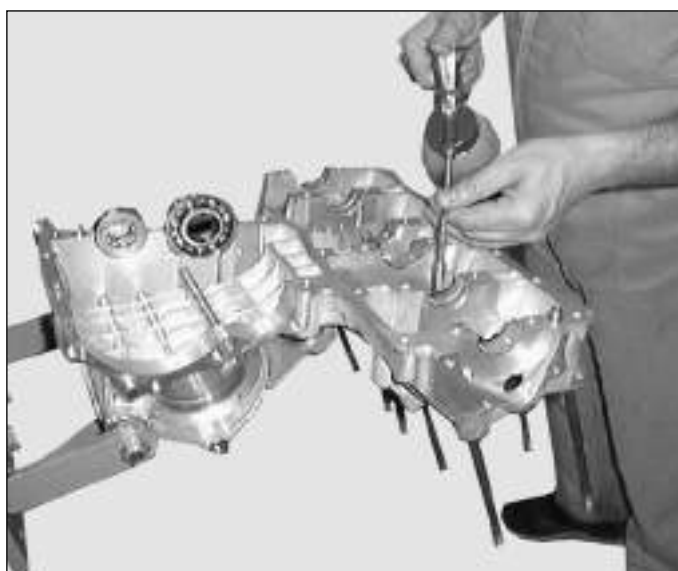
With a service limit of **0.08 mm**.

Reassembly

Carefully degrease and clean from any paste residues
Position the bushings into the carter without lubricating.



After having positioned them put oil on each bush.



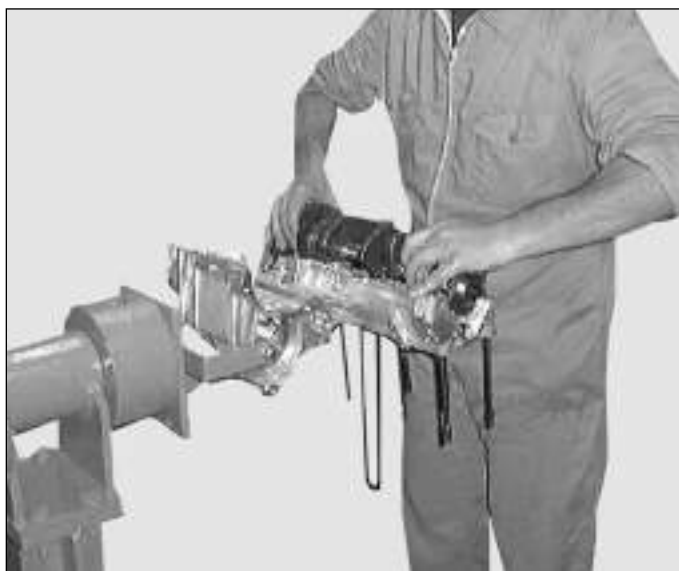
Laterally lubricate the n° 5 support as it carries out the function of the motor shaft centering.



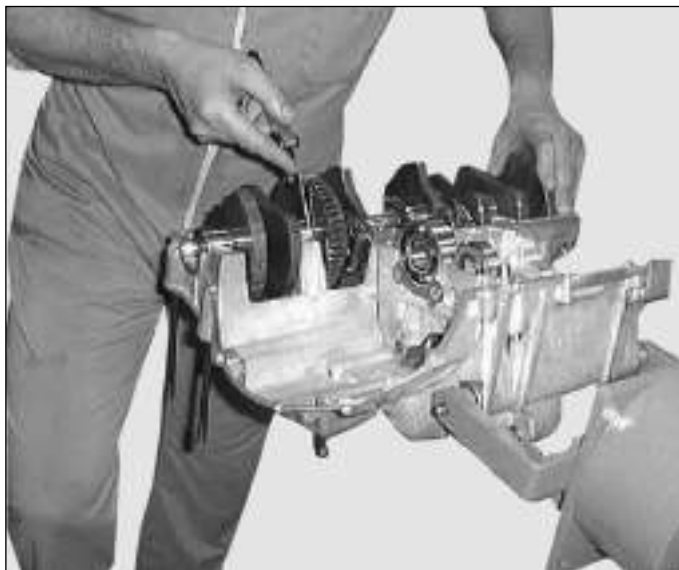
Put the new cap on the right side after having put the silicone type paste on the cap's surface, between cap and carter bearing.



Assembly the motor shaft.



Verify with a thick meter that the motor shaft has an **axial play of 0.2 mm** as regards the bench bearings. In case there should be different values contact the manufacturer.

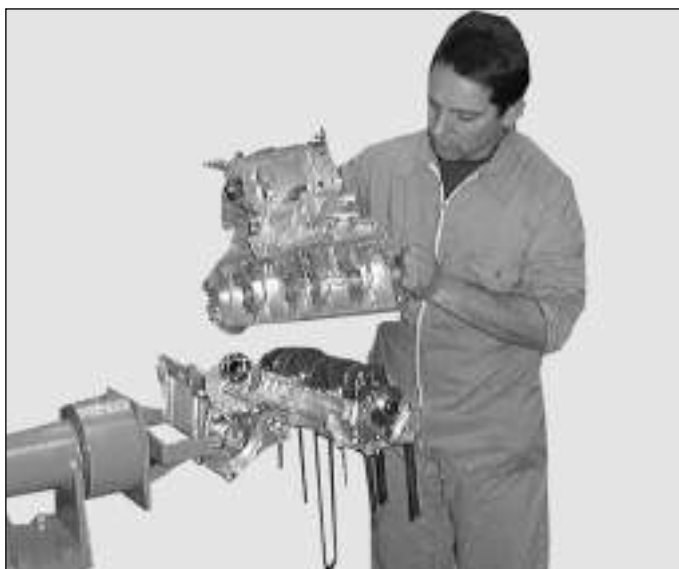


Reassemble the bearing on the inferior semi carter with the locks facing each other and turned inward the bedplate.

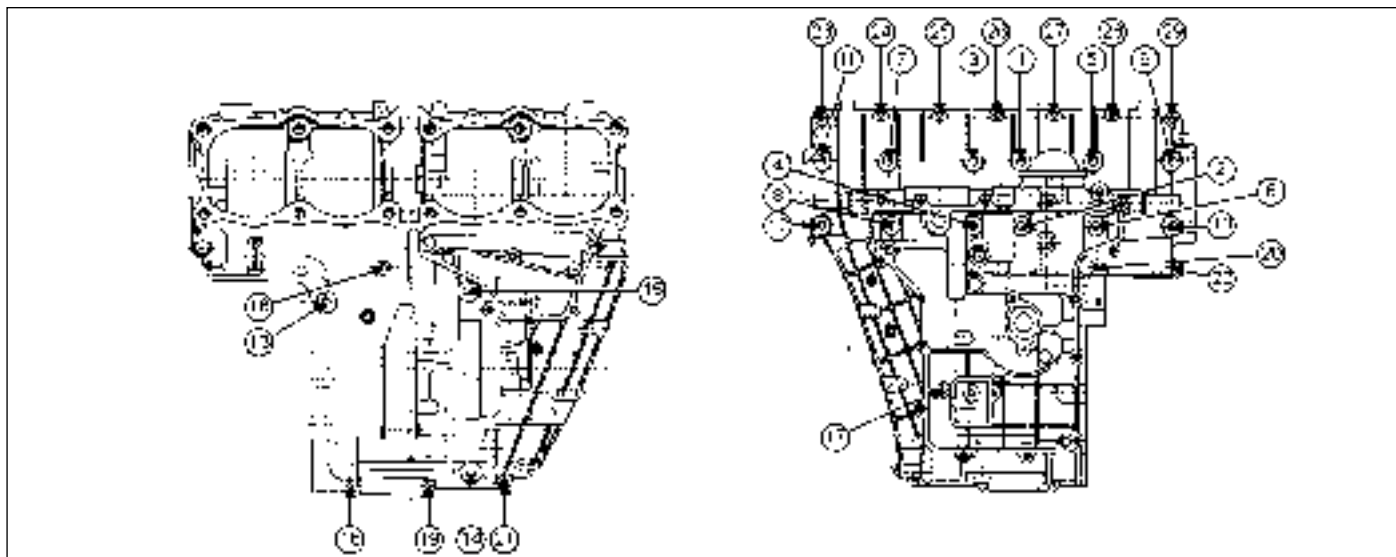


Be sure that the centering bushes are installed on the inferior semi carter. Spread a layer of the 1215 THREEBOND type garnish on the stroke points of the two semi carters.

Couple the two semi carters carefully beating them with a plastic hammer until completely closed.



Tighten bedplate screw.



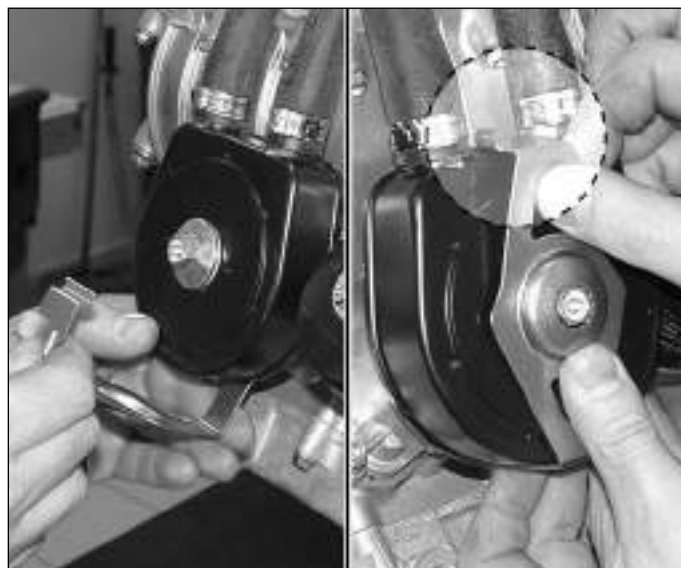
Insert the 12 n°8 screws manually bringing them together, thus tighten them at the established tightening coupling.



Tighten all the screws inversely to the order they were disassembled.

Lubricating Components

Position the heat exchange with the relative O-Ring. Substitute the aluminium washer with a new one. Tighten the central exchanger fixing screw at a coupling of 14 Nm. Position the heat exchanger safety plaque under it. Push the plaque towards the exchanger helping it automatically insert itself in the area pointed out in the figure.



In case the plaque should not correctly match up with the screw hexagon, gradually rotate the screw itself, until the two elements match up.

Substitute oil filter

Take an oil filter out of (black version) the new motor oil filter kit (Part. code n° 8000A1428) of new furnishing. Exclusively us MV Agusta components.

Before assembling the filter lubricate the gasket holding.

Using the appropriate tool, code 99010 and a dynamometric key proceed by tightening the filter. Tightening couple: 15 Nm.

Take the new motor oil filter clamp and the relative screw out of the oil filter kit (Part. Code n° 8000A1428) of new furnishing. Insert the clamp bringing it in beat on the posterior edge of the oil filter.

Position the clamp blocker in contact with the screw on the bedplate. Place clamp screw without tightening it.

Mark the screwing point on the screw as well as on the clamp with a marker.

Carry out the final tightening of the screws by making 2 turns and 1/4 beyond the already obtained position (see phase 13).

Mark the final tightening position on the filter as well as on the clamp with a marker. Be sure that the final distance between the screw and clamp blocker falls between 0,5 and 1 mm.



Disassembling connecting rod

Remove the driveshaft following the suggested procedure.

Position the shaft with the connecting rod downwards. Work on each connecting rod separately.

Loosen the two screws that tighten the foot of the connecting rod and the head of the rod.

Remove the two screws that sustain the connecting rod stem.

Move the two motor drive shaft parts away.

NOTE Reassemble each connecting rod before working on the next one.

Removing semi bearings

Disassemble the connecting rod following the suggested procedure.

Unscrew the screws and remove the semi bearings from the foot and head of the connecting rod.

Coupling semi bearings-connecting rod pin

If no substitutions have been made it is sufficient to verify the connecting rod measurement and its pins and refer to the chart included, choose the semi bearings according to the colour.

The measurement has to be carried out on the principal axle of the stem, after having tightened at 35 Nm.

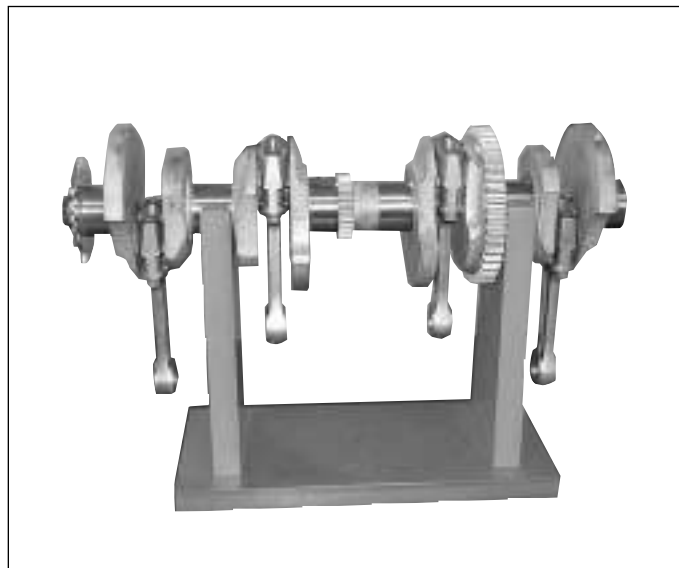
If substitution of one or more parts is necessary, it is sufficient to follow the indications of the letter indicating the class that the connecting rod and bushing belong to, indicated on them.

Assembling semi bearings

Screw the semi bearing to the foot of the connecting rod and to the head.

Tighten at a couple equal to 25 Nm + 55°.

Always use new screws, even with the used connecting rod.



D

SELECTION TABLE FOR F4 CONNECTIN ROD

		CONNECTING ROD HEAD DIAMETER			
		A	38.114 38.122	B	38.123 38.130
CONNECTING ROD PIN DIAMETER	A	34.981 34.988	1.450/1.545 BLUE	1.544/1.549 YELLOW	
	B	34.989 34.997	1.536/1.541 RED	1.540/1.545 BLUE	
FUNCTIONING PLAY 0.036/0.061					

Check and placement of distribution chain

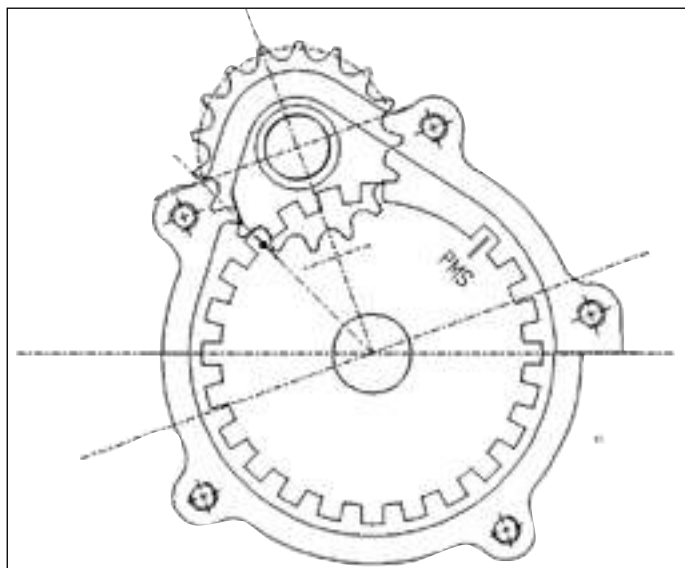
At each motor revision verify the wear state of each transmission distribution component. If the gear teeth appear to be very worn substitute each piece. Substitute the chain at the foreseen mileage (see section 5).



In case wear should result beyond the permitted allowance even of just one of the distribution components, check them all and if necessary substitute them.

D Rotate the drive shaft until the pellet on the phonic wheel tooth coincides with the notch on the bedplate, as shown in the following picture.

Attention: the drive shaft in this position is NOT in the MSP position.



Fit the distribution chain on the intermediate gear. Position the intermediate gear being careful that the pellet on the gear corresponds with the pellet on the bedplate, being careful that the drive shaft has not moved from the position priorly described.

Insert the intermediate gear rotation pin and tighten it with the relative seeger.

Without rotating the drive shaft check again to be sure that the pellet on the phonic wheel corresponds to the notch on the bedplate.

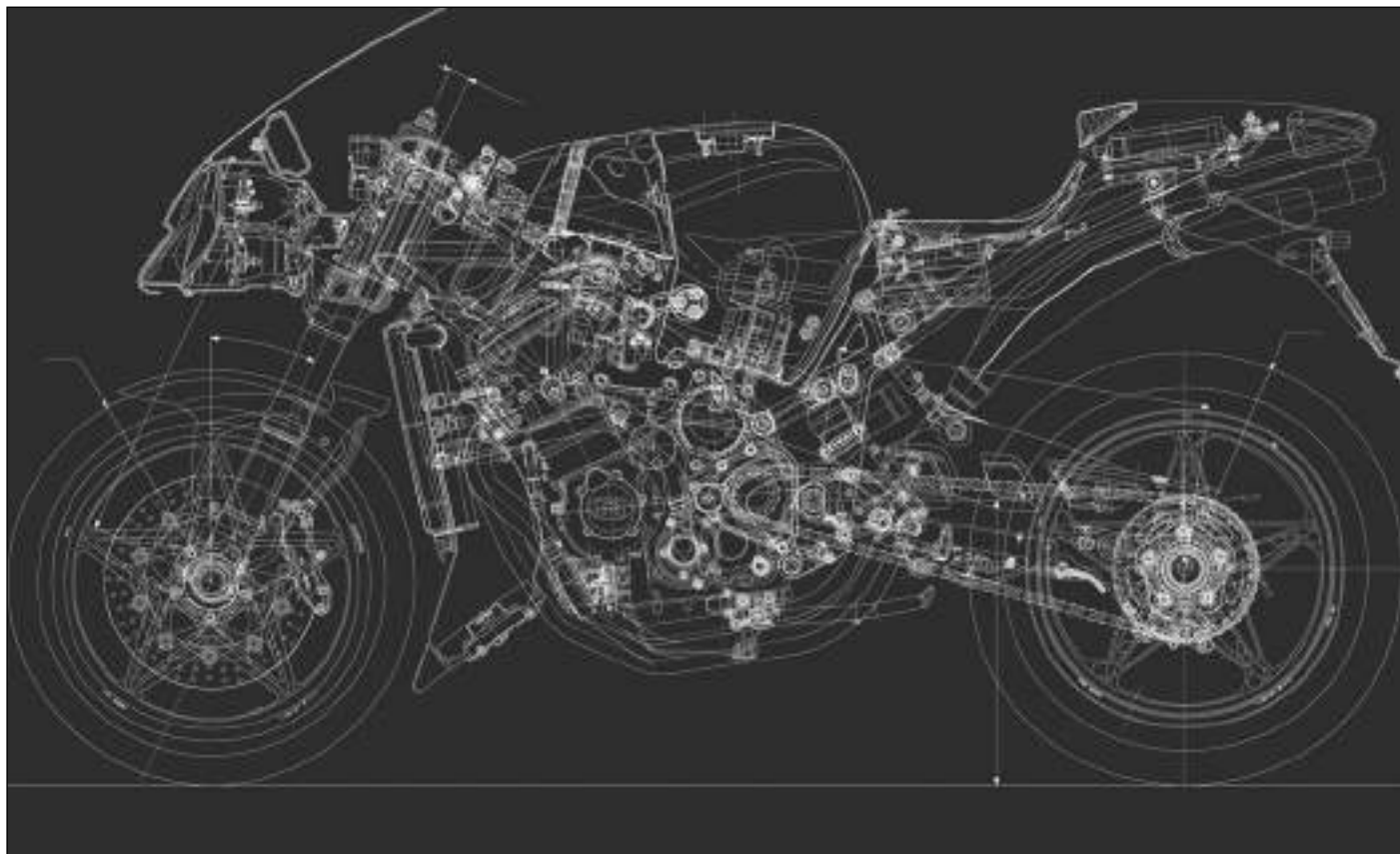
At this point, rotate the drive shaft and verify the correct teeth gripping.

Attention: The relative pellet position will repeat itself only after a few rotations of the drive shaft.





Engine F4 SENNA



E

SECTION E

Revision 1



Engine F4 SENNA

SUMMARY

CLAMPING TORQUES TABLE	PAGE 3
MAINTENANCE TABLE	PAGE 5
CO REGULATION	PAGE 10
GEAR AND GEAR CONTROL	PAGE 13

NOTE For the sub-groups not listed, refer to “F4 S MY 2002” model.



Engine F4 SENNA

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	150	14.25	Weak
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	150	14.25	Weak
Gear selection drum tightening screws	12 If M6 thread 25 If M8 thread	1.2 2.5	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	

E



Engine F4 SENNA

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws	10+60°	1.0+60°	
Bearing exchange screws	10	1	
Exchanger steel screws	15	1.5	
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate thread with Molikote HSC Plus



Engine F4 SENNA

MAINTENANCE TABLE

Slip		Pre-delivery	A		B		C	
Frequency	km	0	1000	6000	12000	18000	24000	30000
Procedure								
Cooling liquid level	C	•	•	•	•	•	•	•
Cooling liquid substitution	S		Substitute every 2 years				•	
Motor oil level	C	•	Check every 1000 km					
Motor oil	S	6000 km or 12 months	•	•	•	•	•	•
Motor oil filter	S		•	•	•	•	•	•
Valve play	C		•	Check every 12000 km				
Distribution chain	S							•
Mobile distribution block	C/S				•		•	
Chain tightening block	C/S				•		•	
Spark plugs			Substitute every 12000 km					
	S				•			
Minimum synchronizing regime	C		•	•		•		•
Fluttering body: synchronization, minimum, CO control	C/P		•	•		•		•

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions

E



Engine F4 SENNA

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter		
Exhaust.....	$24.6 \begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$ mm	
Inlet.....	$28.6 \begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$ mm	
Sealing face thickness		
Exhaust.....	$0.9 \begin{smallmatrix} +0 \\ +0.3 \end{smallmatrix}$ mm	limit 1.5 mm
Inlet.....	$0.7 \begin{smallmatrix} +0 \\ +0.3 \end{smallmatrix}$ mm	limit 1.3 mm
Stem-guide clearance		
Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	$4.5 \begin{smallmatrix} +0 \\ +0.012 \end{smallmatrix}$ mm.....	4.55 mm
Valve stem		
Exhaust.....	$4.5 \begin{smallmatrix} -0.02 \\ -0.035 \end{smallmatrix}$ mm.....	4.460 mm
Inlet.....	$4.5 \begin{smallmatrix} -0.01 \\ -0.025 \end{smallmatrix}$ mm.....	4.470 mm
Valve spring		
Internal.....	33.8 mm.....	33.5 mm
External.....	37.9 mm.....	37.5 mm
Valve-cam clearance		
Exhaust.....	0.20 ÷ 0.29	
Inlet.....	0.15 ÷ 0.24	



Engine F4 SENNA

ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.014 ÷ 0.046 mm	0.10 mm
Piston-pin play.....	0.002 ÷ 0.010 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	1 $\begin{matrix} -0.01 \\ -0.03 \end{matrix}$ mm.....	0.96 mm
2 nd	1 $\begin{matrix} -0.01 \\ -0.030 \end{matrix}$ mm.....	0.96 mm
Oil scraper.....	2 $\begin{matrix} -0.010 \\ -0.025 \end{matrix}$ mm.....	1.95 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	38.8 mm



Engine F4 SENNA

ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

- Heat the motor to the usual functioning temperature (of regime);
- Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;
- Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

<i>Cylinder compression control (280 rpm-min)</i>		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- carbon deposits on the walls of the combustion chamber and on the piston ceiling;
- the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- The seat of one or more valves is damaged and the valves do not maintain the compression pressure;
- One or more valves have null functioning play;
- The piston, cylinder play is excessive;
- The cylinder head is twisted and/or the head gasket is damaged;
- Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.

CO REGULATION

Attention: CO regulation is of vital importance for the correct functioning of the motor.

Prior to carrying out the CO regulation accurately check:

- That there are no cracks or damage of the rubber tubes of the vacuum meter line
- That gas does not seep out of the exhaust pipe joints
- That the gas tube links are correctly inserted in the tank lodgings and that the tubes are neither bent nor crashed

A) Verify and if necessary regulate the butterfly valve opening to minimum using Magneti Marelli MDST software. The butterfly valve angle must be of 1.7 degrees. Fluctuation between 1.7 and 1.9 are allowed; fluctuation between 1.5 and 1.7 are not allowed.

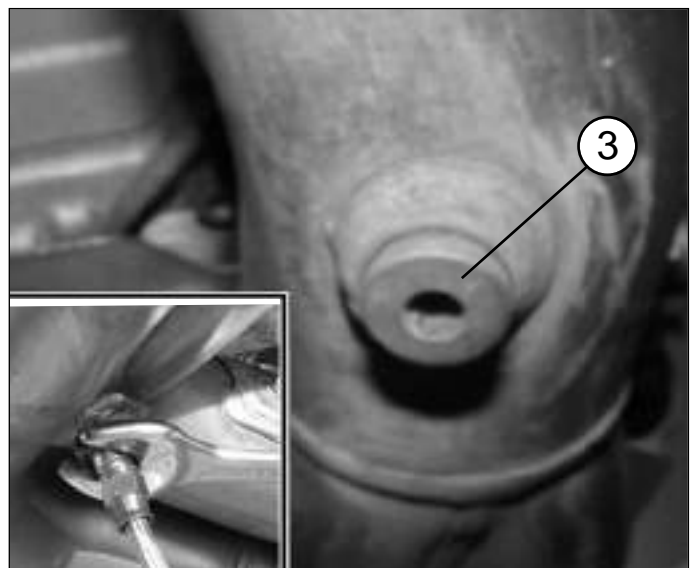
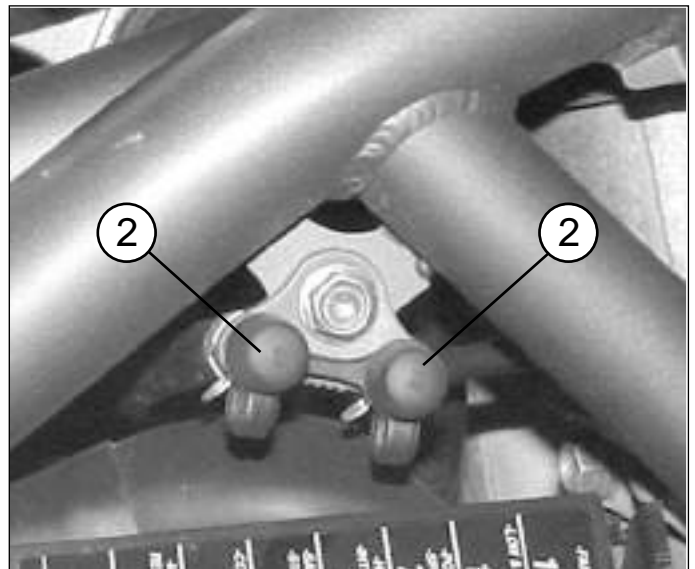
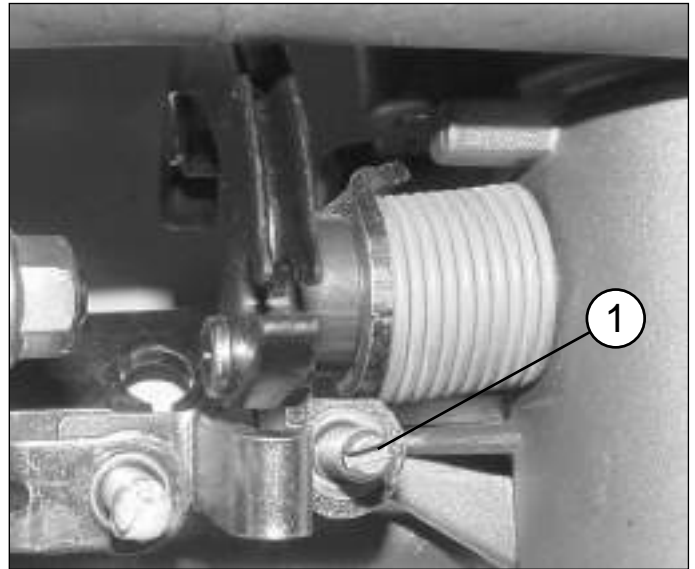
If required, You can intervene exclusively operating on the specific screw (1) placed on the opening gudgeon of the fluttering body.

NOTE Operate only on the right screw (the smaller one).

B) Verify the correct functioning of the water temperature sensors and environmental air and pressure and the battery tension using Magneti Marelli MDST software.

C) Wait with the motor at minimum speed for the culling vents to start up.

D) Connect the vacuometer to the sockets (2) and the CO tester to the socket (3) after having unscrewed the cap with a number 5 hexagonal closure.



E) Balance the cylinder depression by means of the bypass screws (1) Of the fluttering body trying to get close to the inserted vent at following CO levels and minimum functioning:

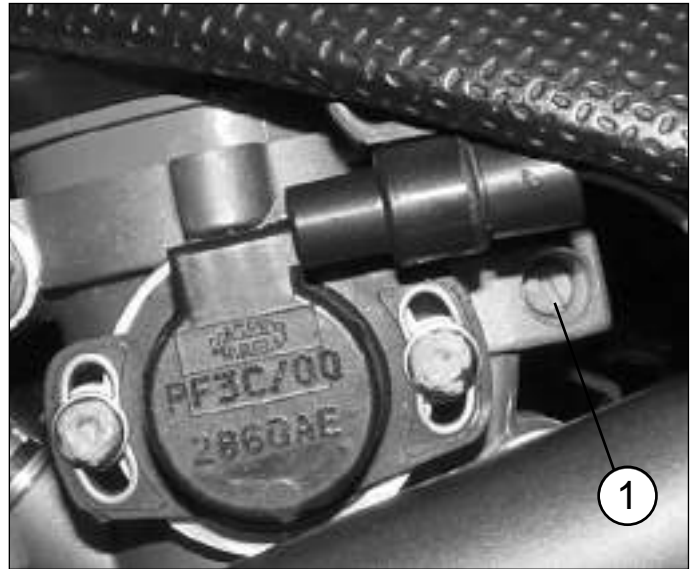
Bypass opening 1 1/4 - 1 1/2 turns

CO 3.5 +- 0.5%

Minimum RPM 1150 +- 50

F) Disconnect the vacuumeter, speed up the engine and verify the throttle goes back to the value previously defined, wait for the CO value stabilisation and verify CO and rpm values are in the given clearance.

G) If the values are out of range check the vacuumeter line for air infiltration, reconnect the vacuumeter and repeat the operation starting from the E) point.



E

Substitute oil filter

Take an oil filter out of (black version) the new motor oil filter kit (Part. code n° 8000A1428) of new furnishing. Exclusively us MV Agusta components.

Before assembling the filter lubricate the gasket holding.

Using the appropriate tool, code 99010 and a dynamometric key proceed by tightening the filter. Tightening couple: 15 Nm.

Take the new motor oil filter clamp and the relative screw out of the oil filter kit (Part. Code n° 8000A1428) of new furnishing.

Insert the clamp bringing it in beat on the posterior edge of the oil filter.

Position the clamp blocker in contact with the screw on the bedplate. Place clamp screw without tightening it.

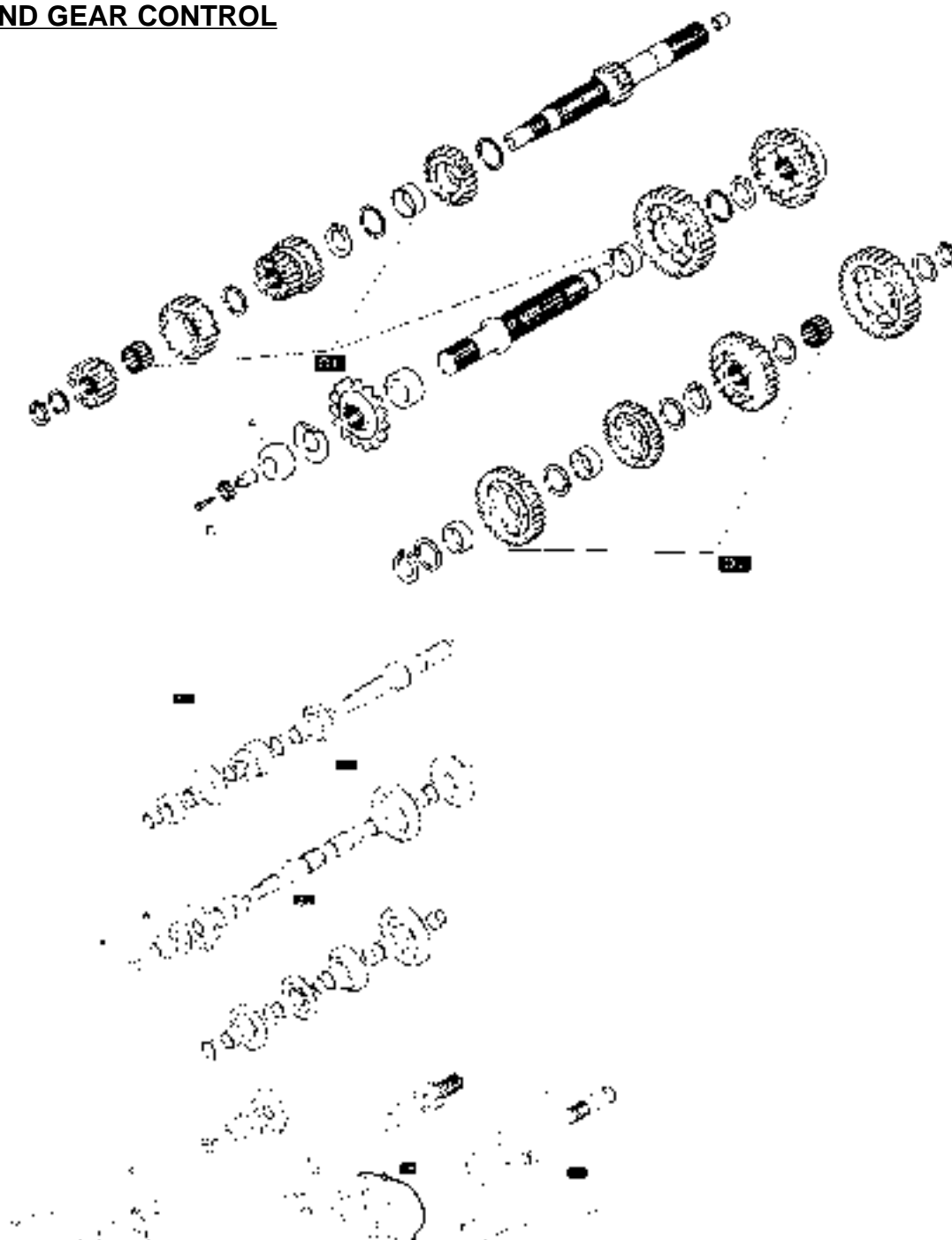
Mark the screwing point on the screw as well as on the clamp with a marker.

Carry out the final tightening of the screws by making 2 turns and 1/4 beyond the already obtained position (see phase 13).

Mark the final tightening position on the filter as well as on the clamp with a marker. Be sure that the final distance between the screw and clamp blocker falls between 0,5 and 1 mm.



GEAR AND GEAR CONTROL



		A	B	C	D	E	E	F	G	H	I
Tightening torque	N-m	150	8	8	6	12 (M6)	25 (M8)	25			
	Kg-m										
	ft-lb										
Thread blockers		Weak	Medium			Medium	Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Disassembling gear group

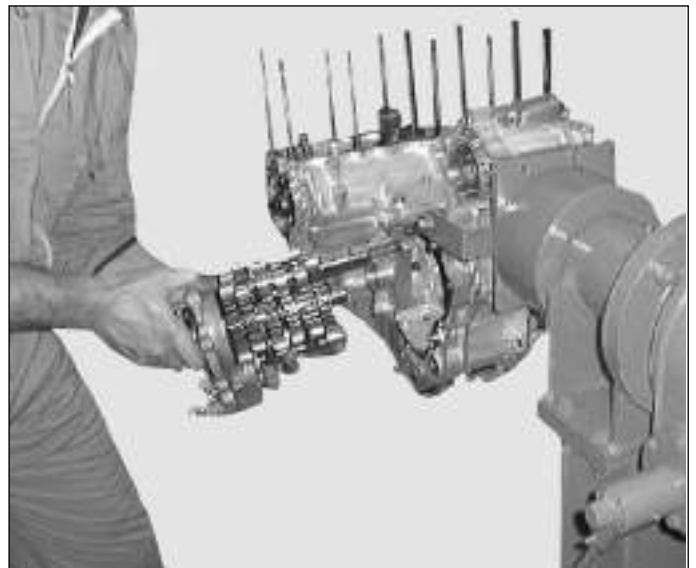
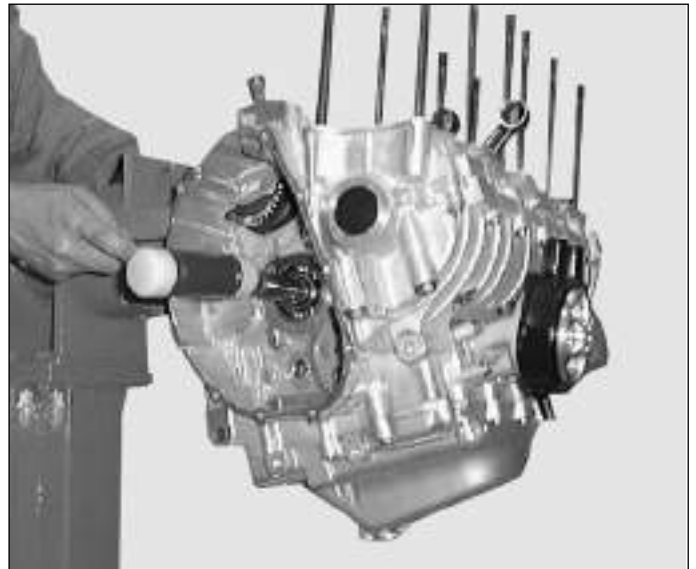
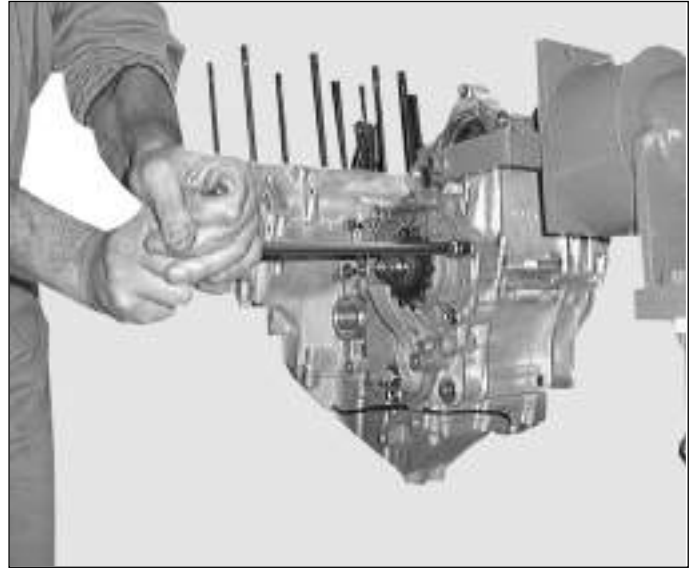
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.

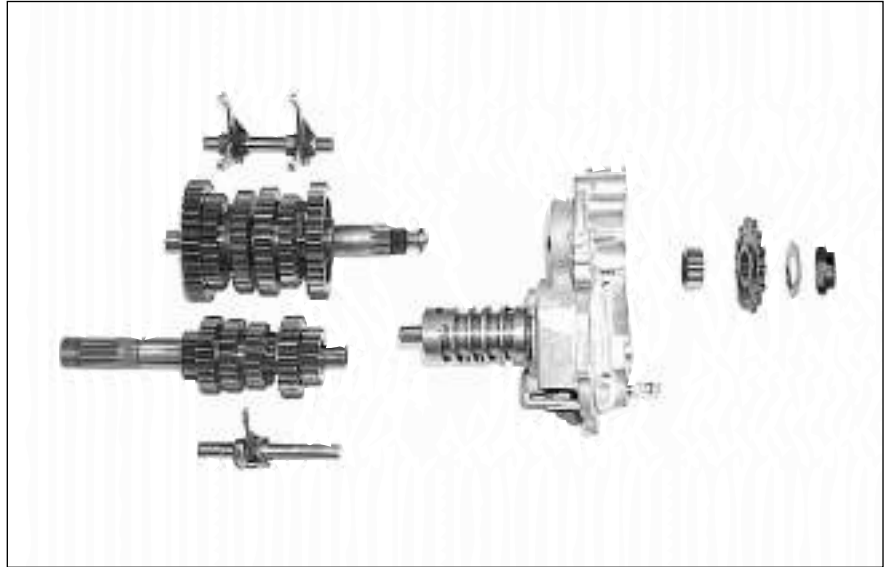


Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear of irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

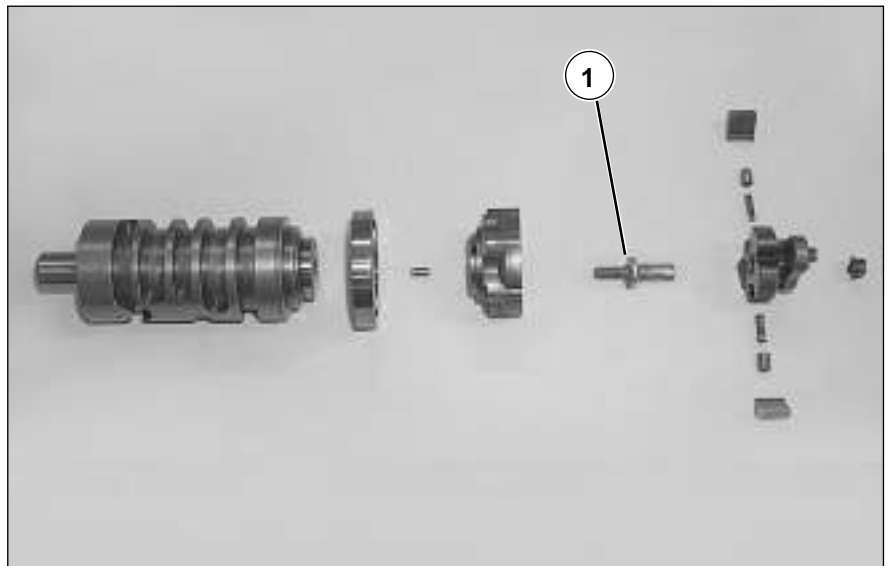
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.

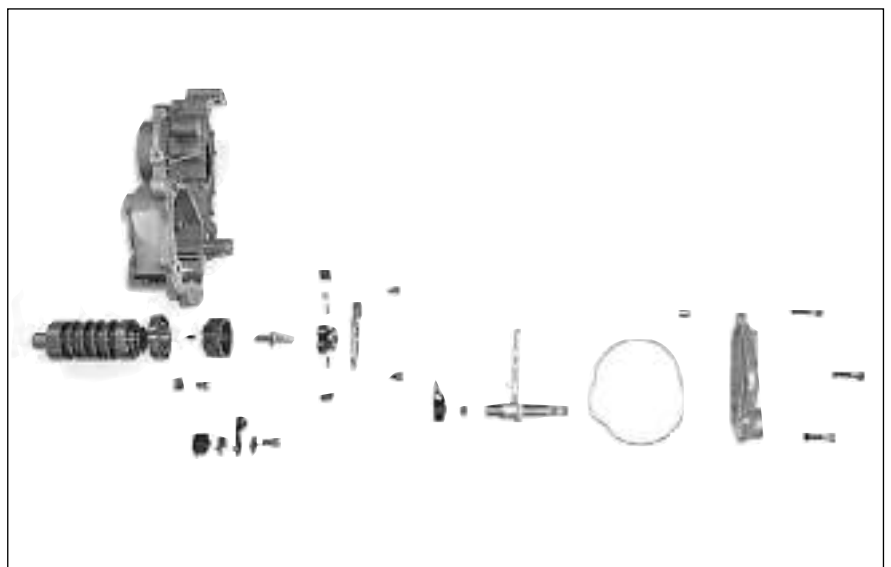


Verify the gear locker pawl free movement.

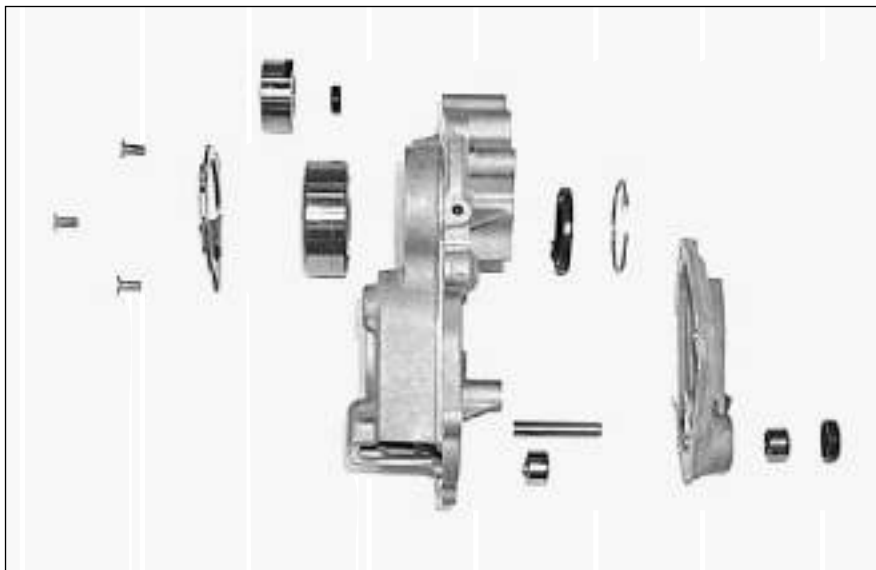
Reassemble the various parts by acting in the opposite way.



Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly. Tighten all of the screws at 8 Nm except for screw 1, which is to be tightened at 12 Nm if it is of the type having an M6 thread, and at 25 Nm if it is of the type having an M8 thread.



E

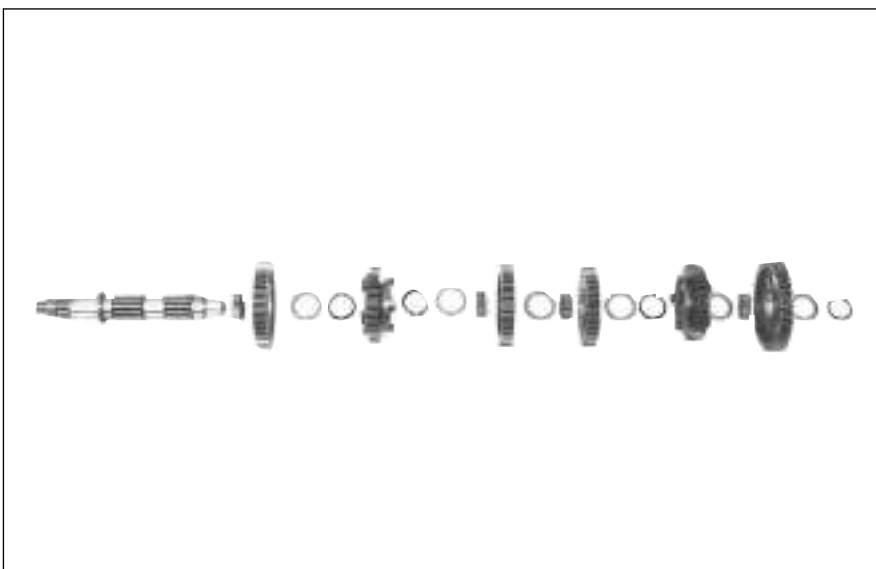


Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.



Gear group revision

In order to carry out the following procedure the following special tool is necessary:

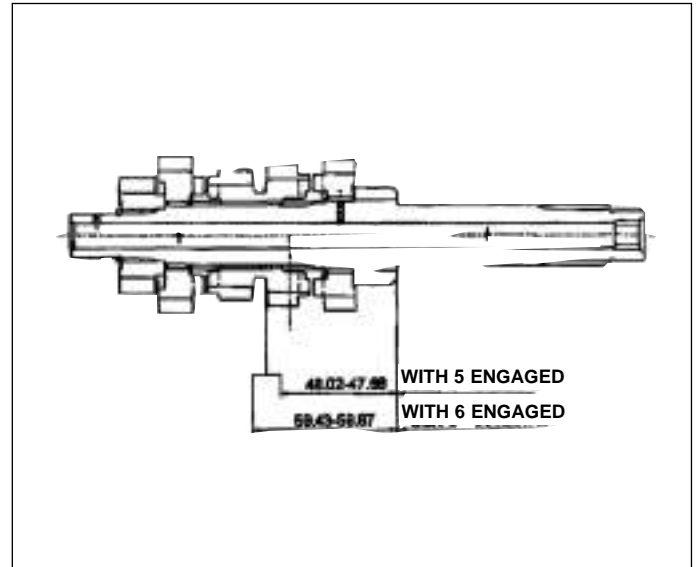
Motor simulation utensil n° 94792

Disassemble the gear group from the motor and reassemble it on the special utensil n° 94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.



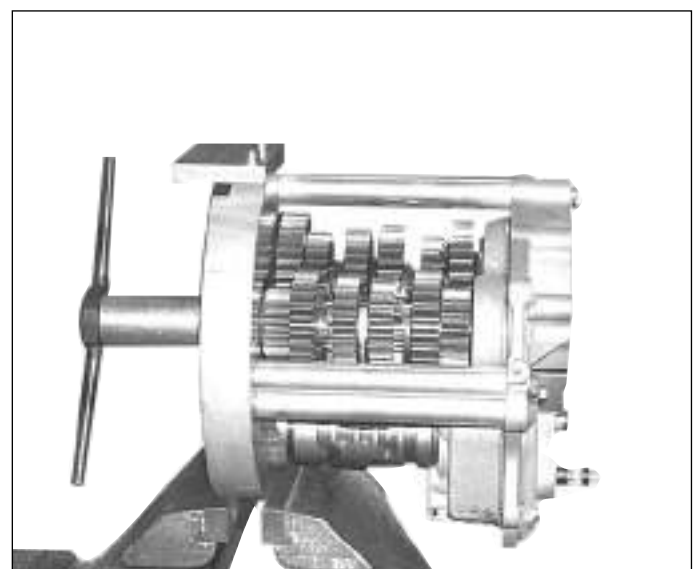
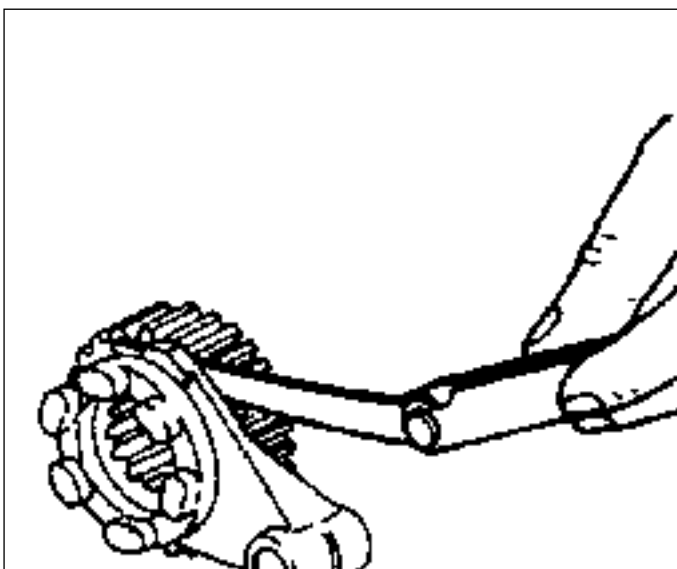
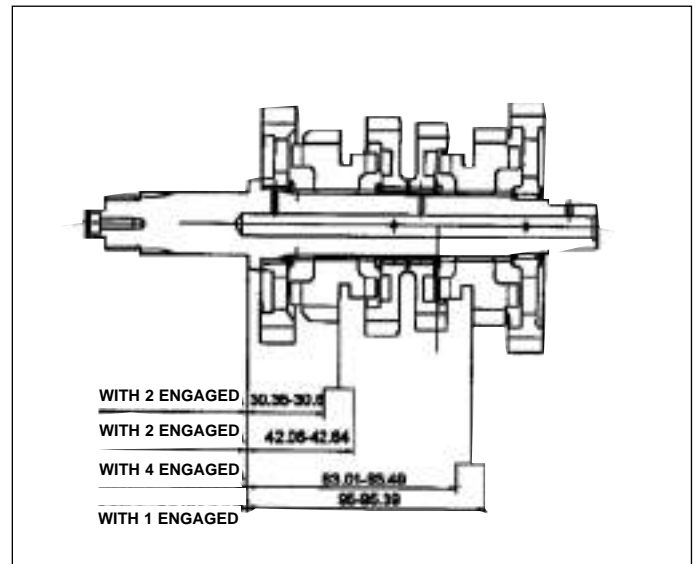
Gear selection forks

Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm Primary
	4.6 mm Secondary
Fork limits	4.65 mm Primary 5-6 gear
	3.65 mm Secondary 1-2, 3-4 gear

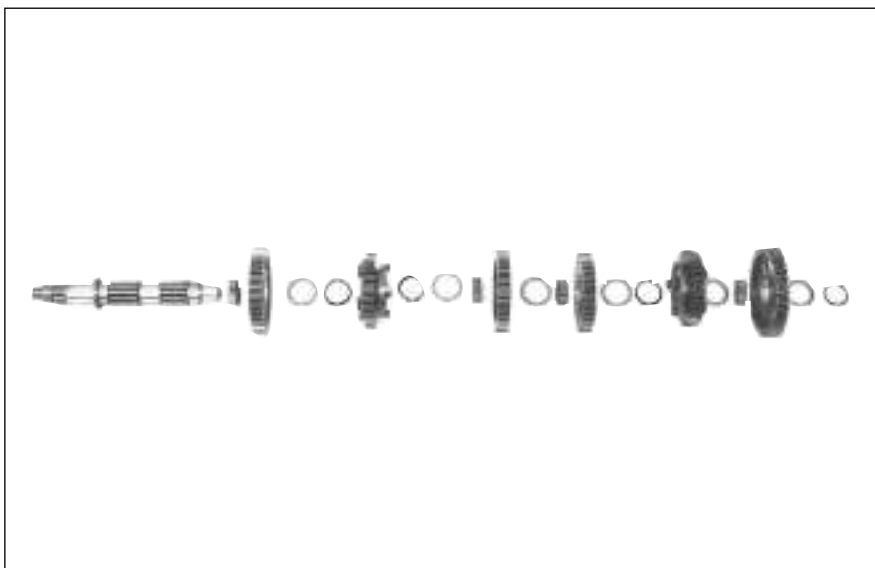
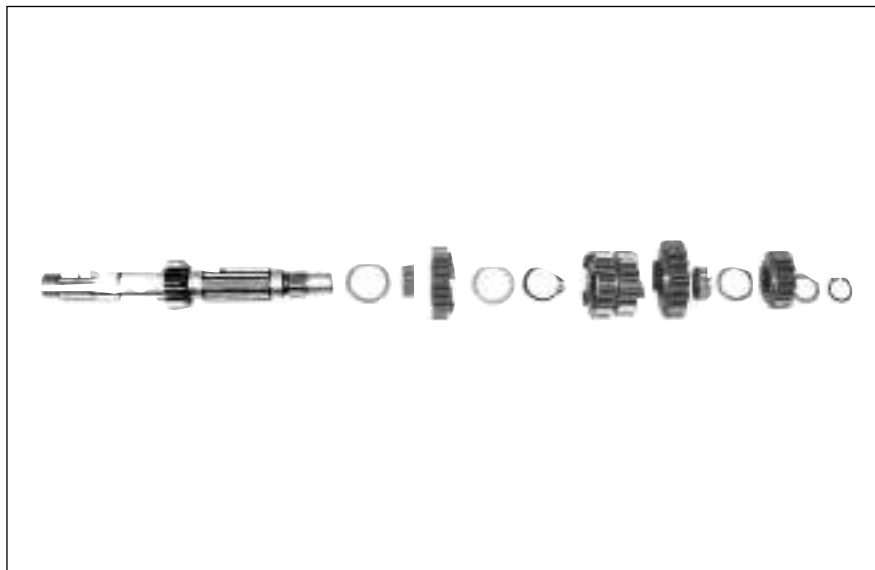
The fork must be able to move without force. Grippage of the gears must flow without impediments and without excessive attritions.



Installation

To execute this operation you need the following special tools:

n° 94792 gearbox tool



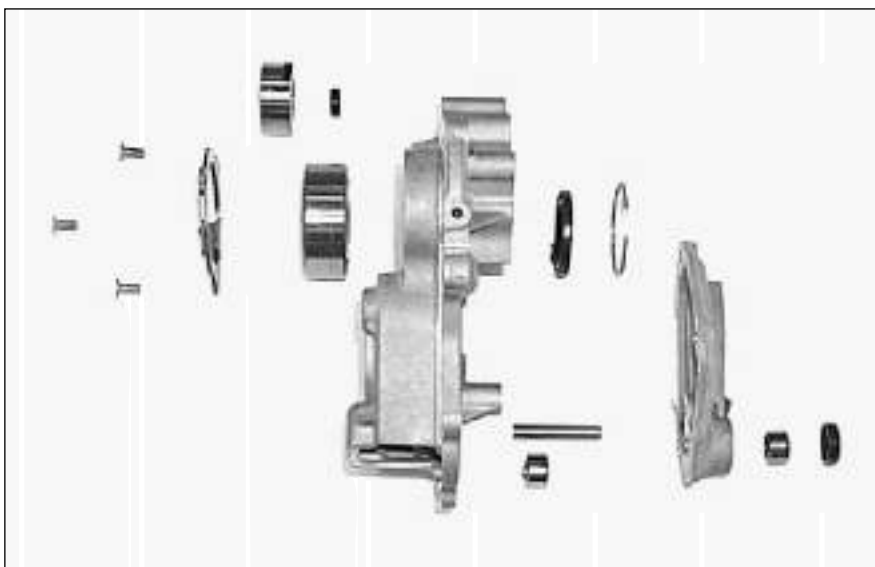
Reassembly the various parts by acting in the opposite way.
Install the 2 shafts on the n° 94792 engine simulation tool.
Install a shift pedal and check the gear box is correctly working.



Always insert a new washer and new nut every time you reassemble.

Carefully degrease the threads before reassembly.

Tighten the pinion nut at 150 Nm using a weak thread blocker. Turn the security washer again so as to avoid the accidental unscrewing of the pinion nut.



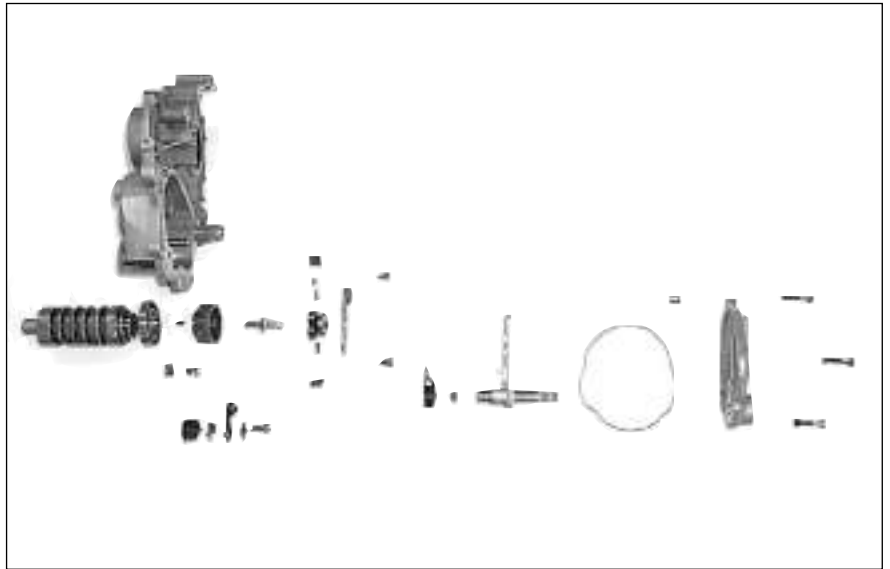
All the gears must be inserted and uninserted without stumbling.

In case of stumbling, verify that the axial play has been correctly restored.

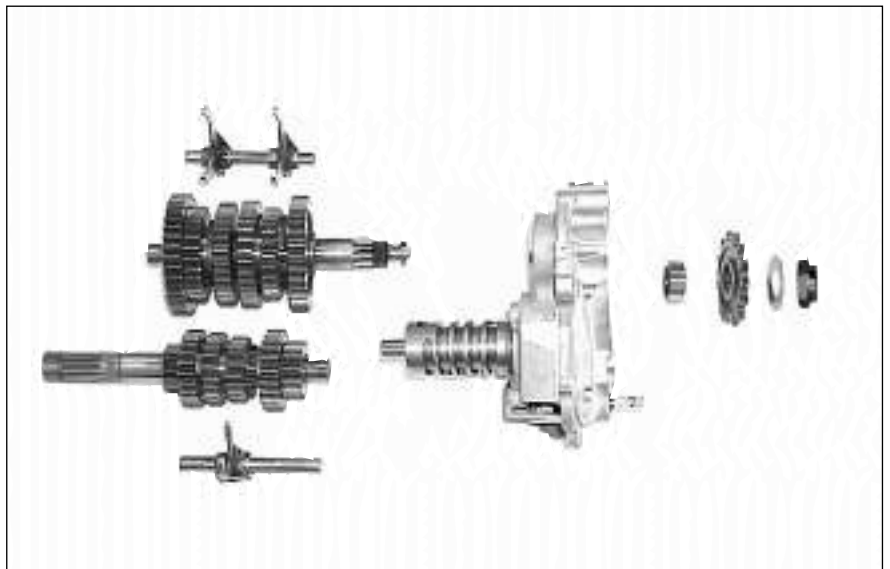
With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to $0.2 \div 0.3 \text{ mm}$ placing it on both ends of the coupling.

The fork must be free.

Assemble the gasket on the internal end.



E



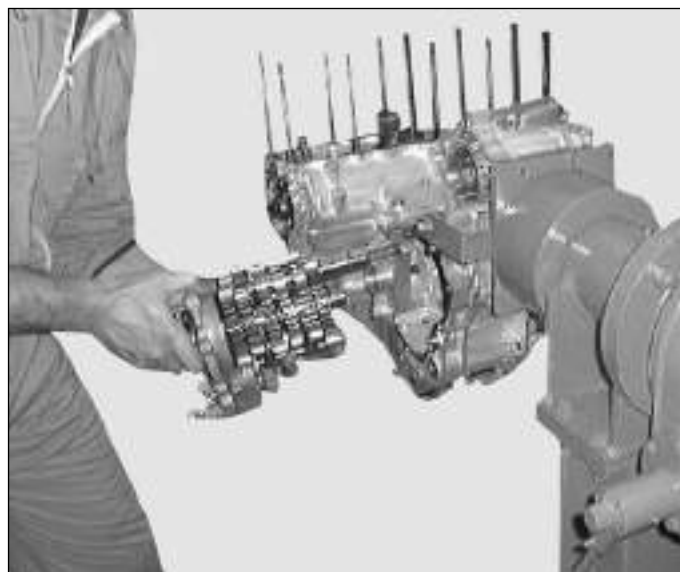


Engine F4 SENNA

Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.

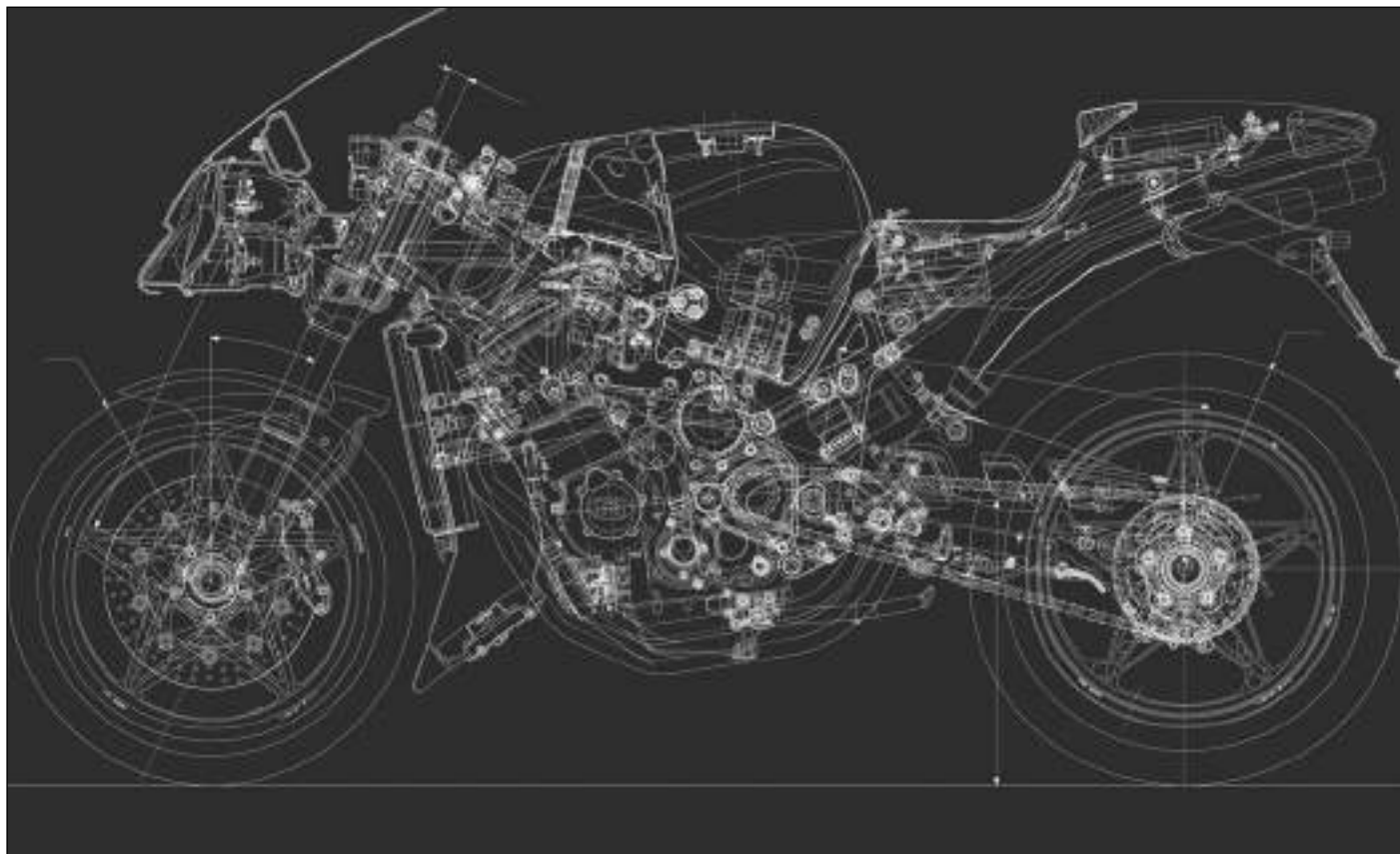


**Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.**





Engine F4 SPR/SR



F

SECTION F

Revisione 1



SUMMARY

CLAMPING TORQUES TABLEPAGE 3

MAINTENANCE TABLEPAGE 5

CO REGULATIONPAGE 10

GEAR AND GEAR CONTROLPAGE 13

DISTRIBUTIO CONTROL UNITSPAGE 21

NOTE For the sub-groups not listed, refer to “F4 S MY 2002” model.



Engine F4 SPR/SR

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	150	14.25	Weak
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	150	14.25	Weak
Gear selection drum tightening screws	12 If M6 thread 25 If M8 thread	1.2 2.5	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	



Engine F4 SPR/SR

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws	10+60°	1.0+60°	
Bearing exchange screws	10	1	
Exchanger steel screws	15	1.5	
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate thread with Molikote HSC Plus



Engine F4 SPR/SR

MAINTENANCE TABLE

Slip			Pre-consegna	A		B		C	
Frequenza		km	0	1000	6000	12000	18000	24000	30000
Procedure									
Cooling liquid level	C		●	●	●	●	●	●	●
Cooling liquid substitution	S			Substitute every 2 years				●	
Motor oil level	C		●	Check every 1000 km					
Motor oil	S	6000 km or 12 months		●	●	●	●	●	●
Motor oil filter	S			●	●	●	●	●	●
Valve play	C			●	Check every 12000 km				
Distribution chain	S			Substitute at 24000 Km					
Mobile distribution block	C/S					●		●	
Chain tightening block	C/S					●		●	
Spark plugs				Substitute every 12000 km					
	S					●			
Minimum synchronizing regime	C			●	●	●	●	●	●
Fluttering body: synchronization, minimum, CO control	C/P			●	●	●	●	●	●

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions

F



Engine F4 SPR/SR

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter		
Exhaust.....	$24.6^{+0.3}_0$ mm	
Inlet.....	$28.6^{+0.3}_0$ mm	
Sealing face thickness		
Exhaust.....	$0.9^{+0}_{+0.3}$ mm	limit 1.5 mm
Inlet.....	$0.7^{+0}_{+0.3}$ mm	limit 1.3 mm
Stem-guide clearance		
Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	$4.5^{+0}_{+0.012}$ mm.....	4.55 mm
Valve stem		
Exhaust.....	$4.5^{-0.02}_{-0.035}$ mm.....	4.460 mm
Inlet.....	$4.5^{-0.01}_{-0.025}$ mm.....	4.470 mm
Intake spring valves		
Internal.....	35.3 mm.....	35 mm
External.....	39 mm.....	38.6 mm
Exhaust spring valves		
Internal.....	33.8 mm.....	33.5 mm
External.....	37.9 mm.....	37.5 mm
Valve-cam clearance		
Exhaust.....	0.20 ÷ 0.29	
Inlet.....	0.15 ÷ 0.24	



Engine F4 SPR/SR

ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.014 ÷ 0.046 mm	0.10 mm
Piston-pin play.....	0.002 ÷ 0.010 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	1 $\begin{matrix} -0.01 \\ -0.03 \end{matrix}$ mm.....	0.96 mm
2 nd	1 $\begin{matrix} -0.01 \\ -0.030 \end{matrix}$ mm.....	0.96 mm
Oil scraper.....	2 $\begin{matrix} -0.010 \\ -0.025 \end{matrix}$ mm.....	1.95 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	38.8 mm



Engine F4 SPR/SR

ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

- Heat the motor to the usual functioning temperature (of regime);
- Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;
- Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

<i>Cylinder compression control (280 rpm-min)</i>		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- carbon deposits on the walls of the combustion chamber and on the piston ceiling;
- the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- The seat of one or more valves is damaged and the valves do not maintain the compression pressure;
- One or more valves have null functioning play;
- The piston, cylinder play is excessive;
- The cylinder head is twisted and/or the head gasket is damaged;
- Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.

CO REGULATION

Attention: CO regulation is of vital importance for the correct functioning of the motor.

Prior to carrying out the CO regulation accurately check:

- That there are no cracks or damage of the rubber tubes of the vacuum meter line
- That gas does not seep out of the exhaust pipe joints
- That the gas tube links are correctly inserted in the tank lodgings and that the tubes are neither bent nor crashed

A) Verify and if necessary regulate the butterfly valve opening to minimum using Magneti Marelli MDST software. The butterfly valve angle must be of 1.7 degrees. Fluctuation between 1.7 and 1.9 are allowed; fluctuation between 1.5 and 1.7 are not allowed.

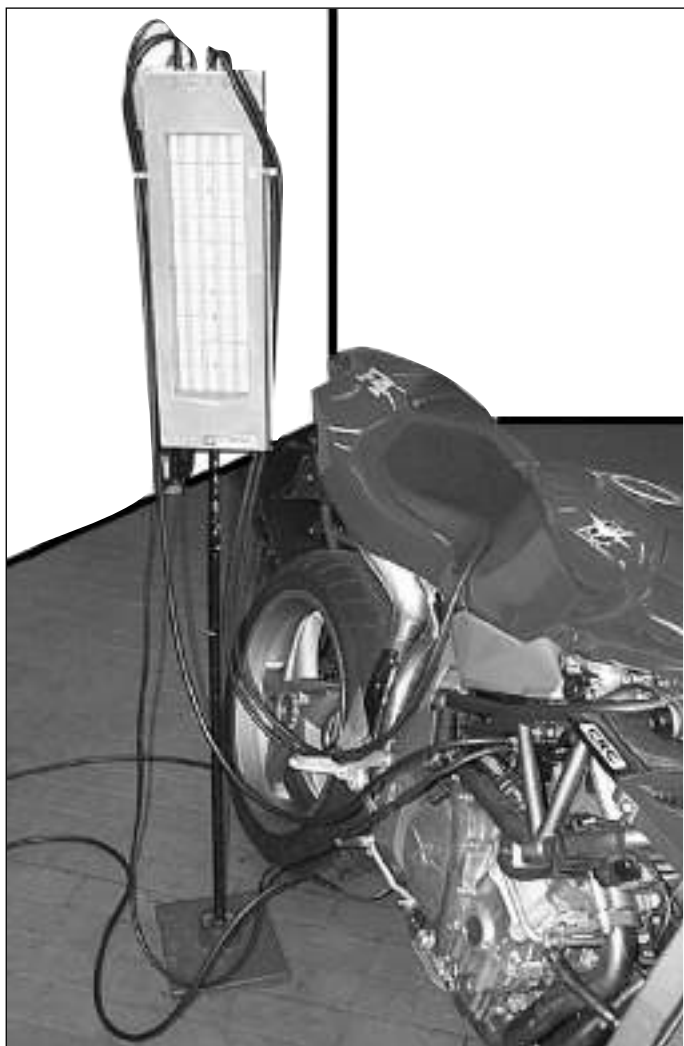
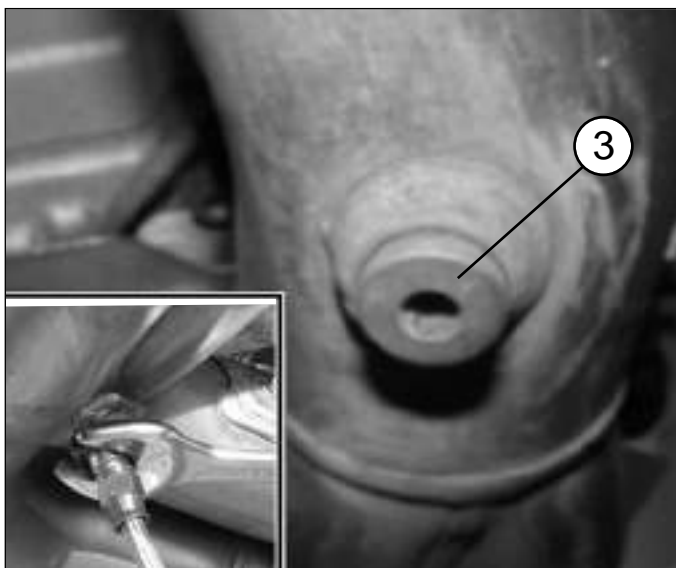
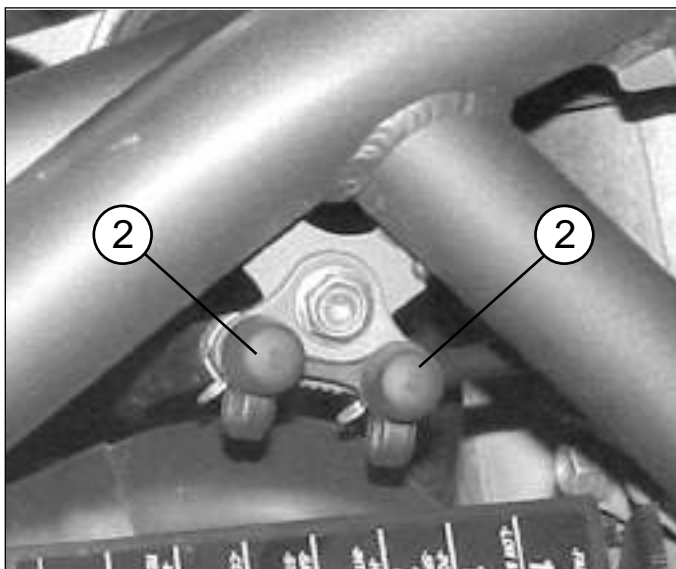
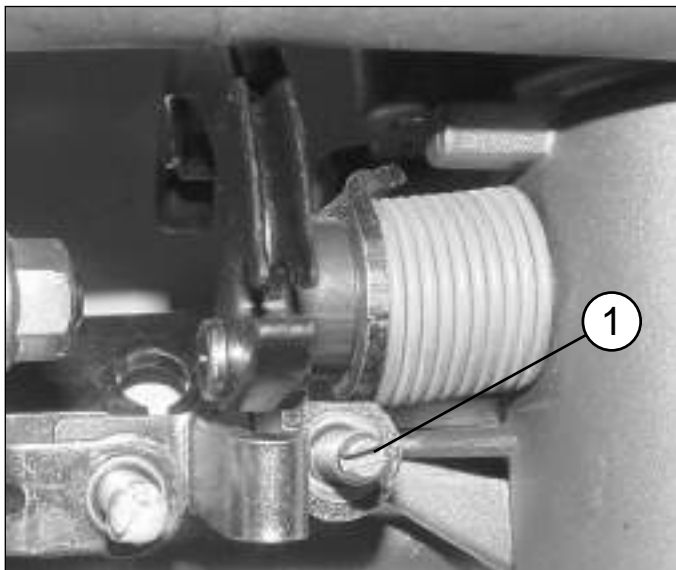
If required, You can intervene exclusively operating on the specific screw (1) placed on the opening gudgeon of the fluttering body.

NOTE Operate only on the right screw (the smaller one).

B) Verify the correct functioning of the water temperature sensors and environmental air and pressure and the battery tension using Magneti Marelli MDST software.

C) Wait with the motor at minimum speed for the culling vents to start up.

D) Connect the vacuometer to the sockets (2) and the CO tester to the socket (3) after having unscrewed the cap with a number 5 hexagonal closure.



E) Balance the cylinder depression by means of the bypass screws (1) Of the fluttering body trying to get close to the inserted vent at following CO levels and minimum functioning:

Bypass opening 1 1/4 - 1 1/2 turns

CO 3.5 +- 0.5%

Minimum RPM 1150 +- 50

F) Disconnect the vacuumeter, speed up the engine and verify the throttle goes back to the value previously defined, wait for the CO value stabilisation and verify CO and rpm values are in the given clearance.

G) If the values are out of range check the vacuumeter line for air infiltration, reconnect the vacuumeter and repeat the operation starting from the E) point.



F



Substitute oil filter

Take an oil filter out of (black version) the new motor oil filter kit (Part. code n° 8000A1428) of new furnishing. Exclusively us MV Agusta components.

Before assembling the filter lubricate the gasket holding.

Using the appropriate tool, code 99010 and a dynamometric key proceed by tightening the filter. Tightening couple: 15 Nm.

Take the new motor oil filter clamp and the relative screw out of the oil filter kit (Part. Code n° 8000A1428) of new furnishing. Insert the clamp bringing it in beat on the posterior edge of the oil filter.



F Position the clamp blocker in contact with the screw on the bedplate. Place clamp screw without tightening it.

Mark the screwing point on the screw as well as on the clamp with a marker.

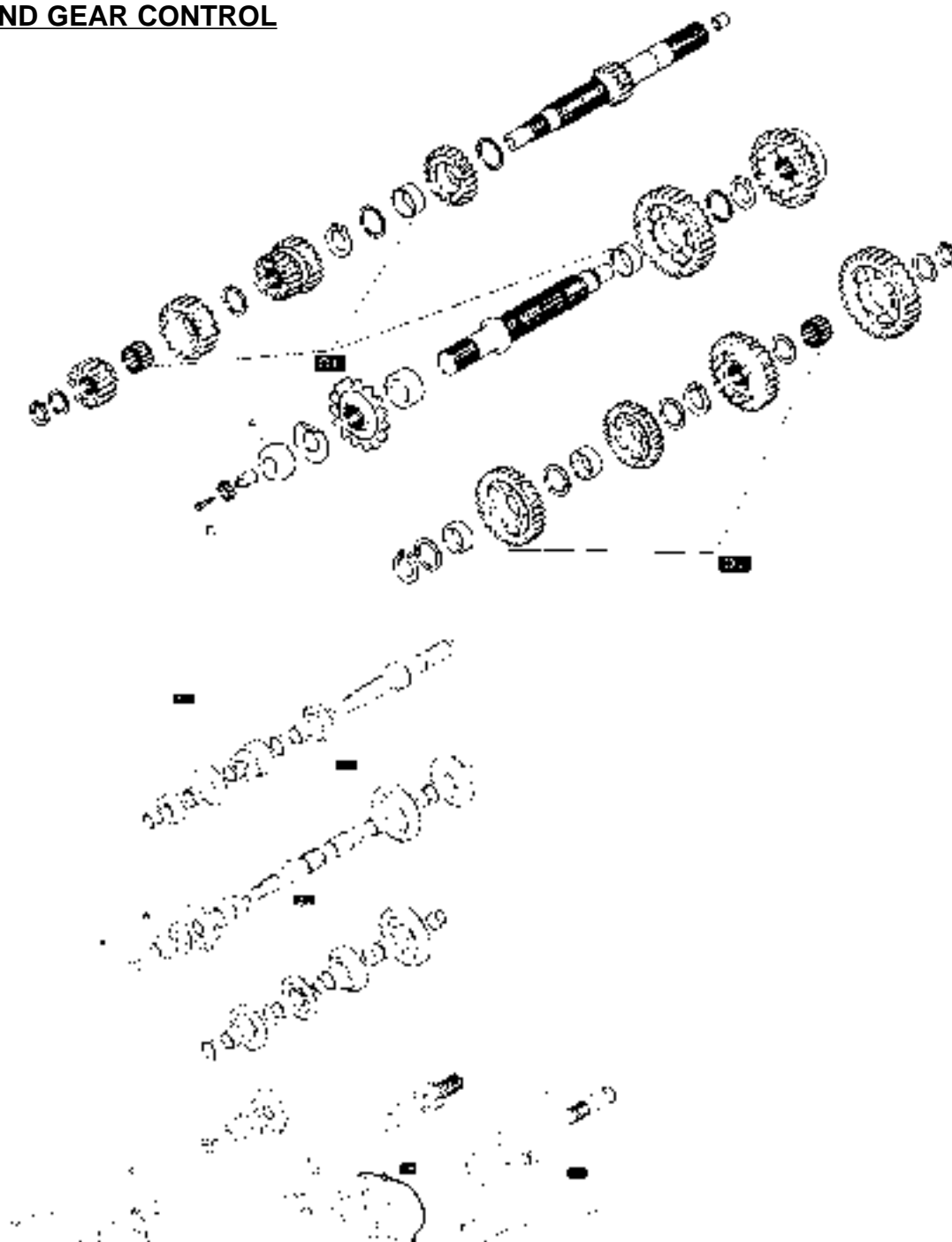
Carry out the final tightening of the screws by making 2 turns and 1/4 beyond the already obtained position (see phase 13).

Mark the final tightening position on the filter as well as on the clamp with a marker. Be sure that the final distance between the screw and clamp blocker falls between 0,5 and 1 mm.





GEAR AND GEAR CONTROL



		A	B	C	D	E	E	F	G	H	I
Tightening torque	N.m	150	8	8	6	12 (M6)	25 (M8)	25			
	Kg.m										
	ft-lb										
Thread blockers		Weak	Medium			Medium	Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Disassembling gear group

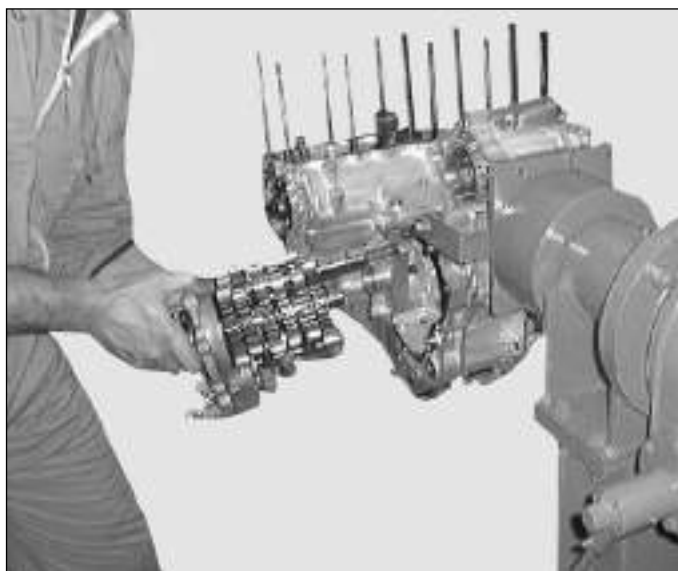
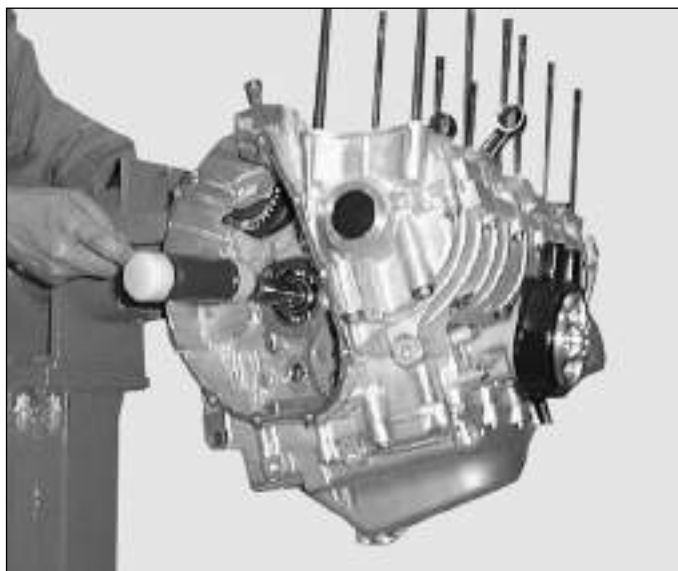
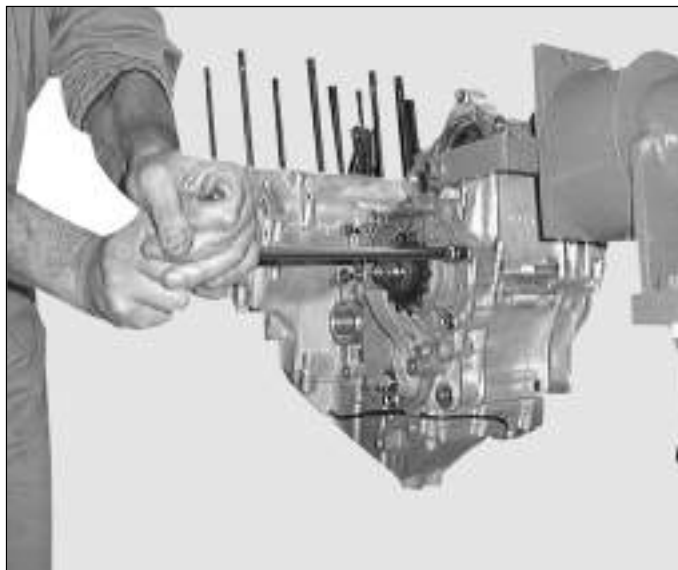
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.

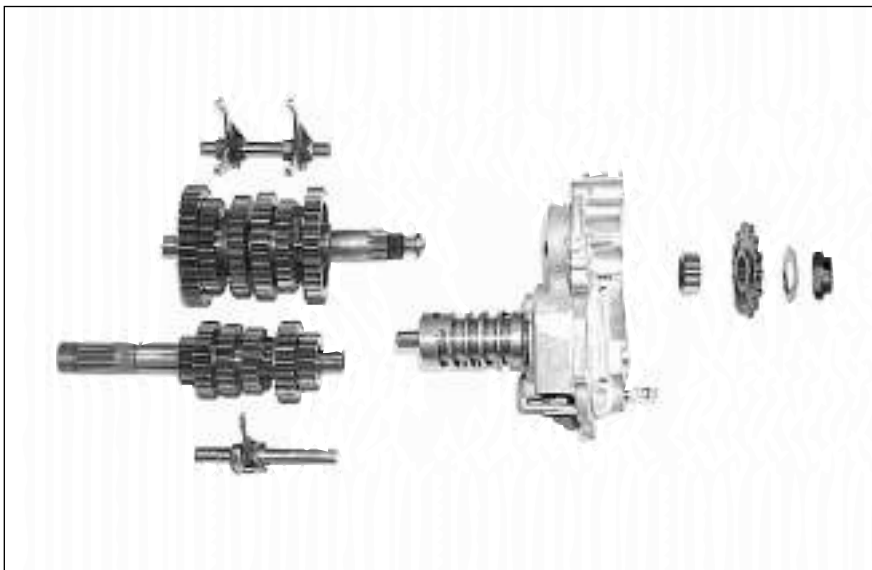


Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear of irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

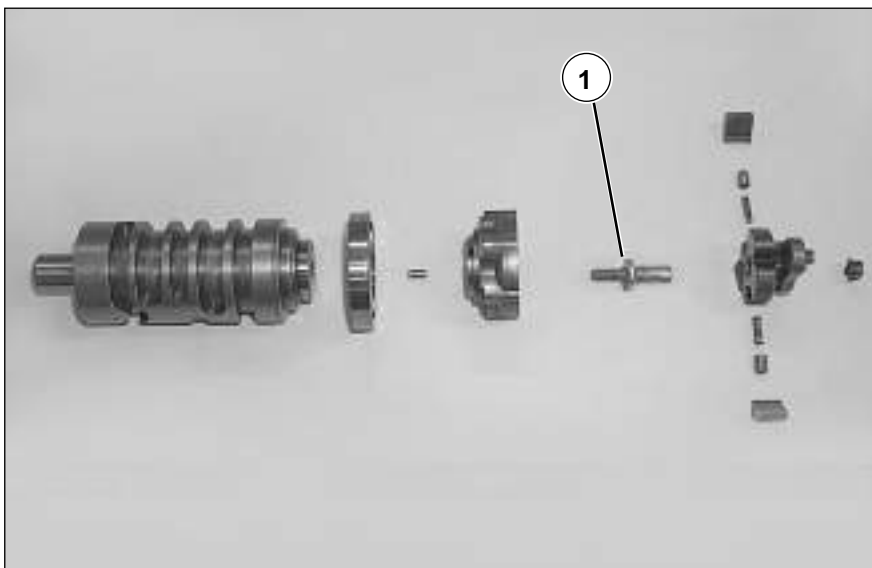
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.

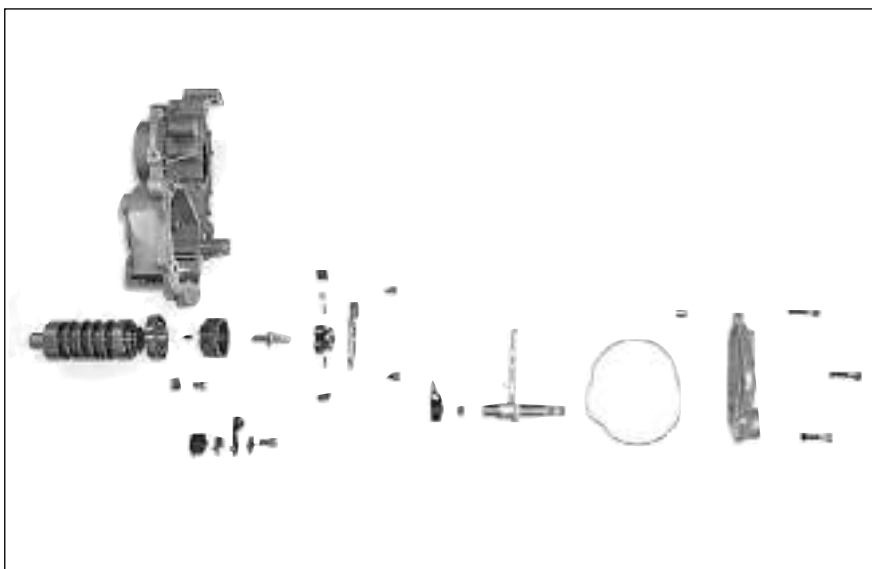


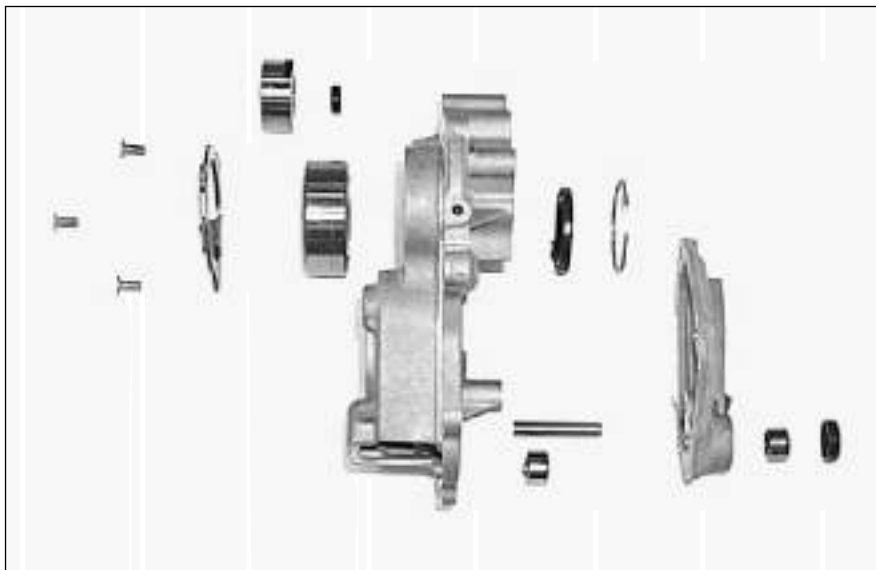
Verify the gear locker pawl free movement.

Reassemble the various parts by acting in the opposite way.



Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly. Tighten all of the screws at 8 Nm except for screw 1, which is to be tightened at 12 Nm if it is of the type having an M6 thread, and at 25 Nm if it is of the type having an M8 thread.



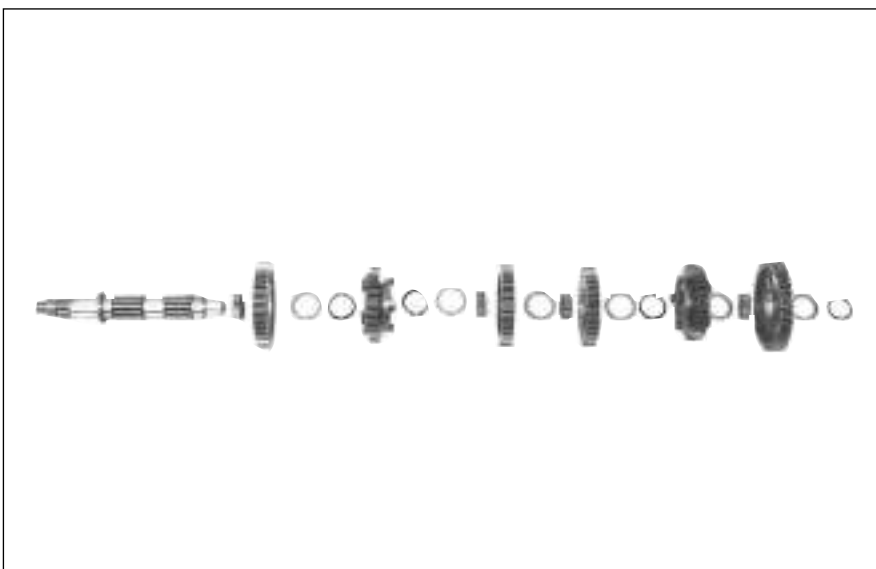


F Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.





Gear group revision

In order to carry out the following procedure the following special tool is necessary:

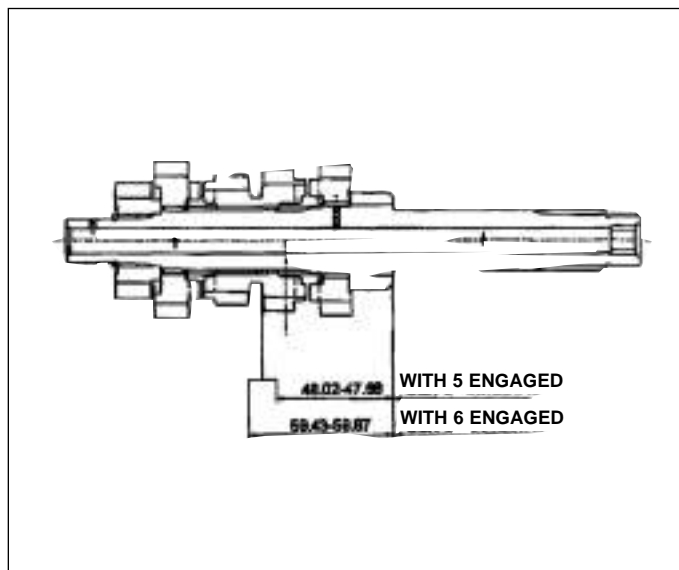
Motor simulation utensil n° 94792

Disassemble the gear group from the motor and reassemble it on the special utensil n° 94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.



Gear selection forks

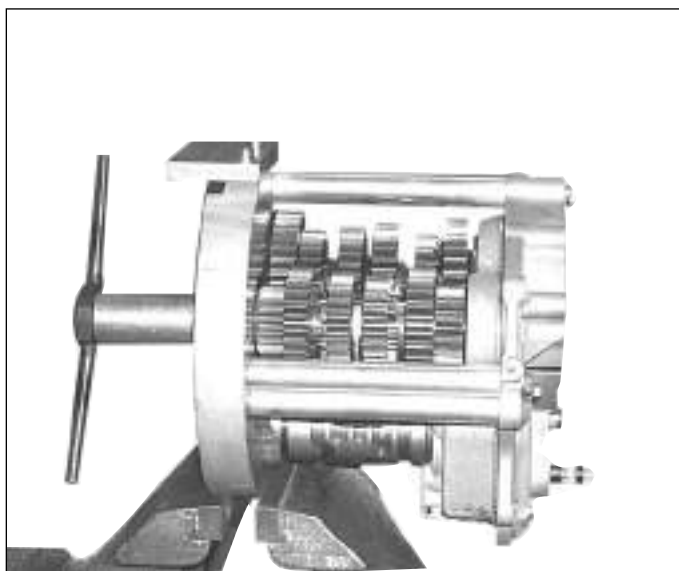
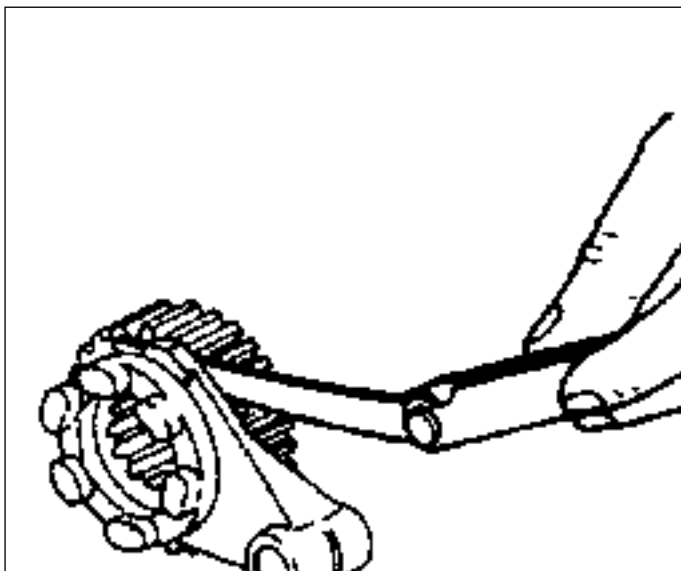
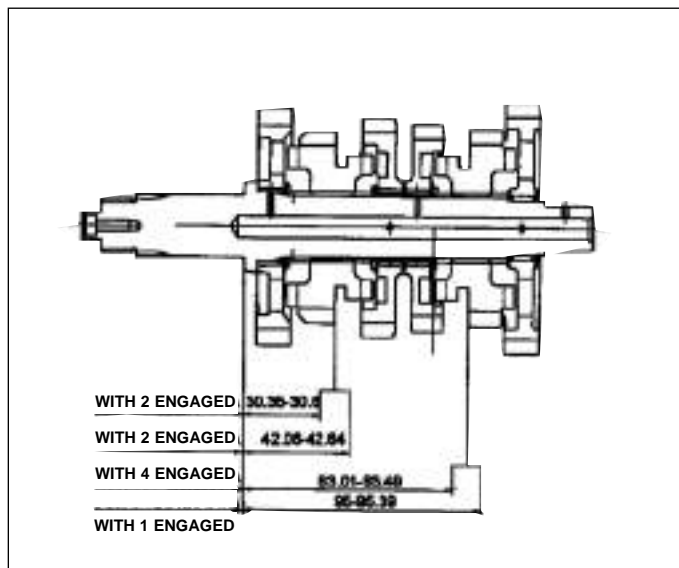
Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm Primary
	4.6 mm Secondary
Fork limits	4.65 mm Primary 5-6 gear
	3.65 mm Secondary 1-2, 3-4 gear

The fork must be able to move without force.

Grippage of the gears must flow without impediments and without excessive attritions.



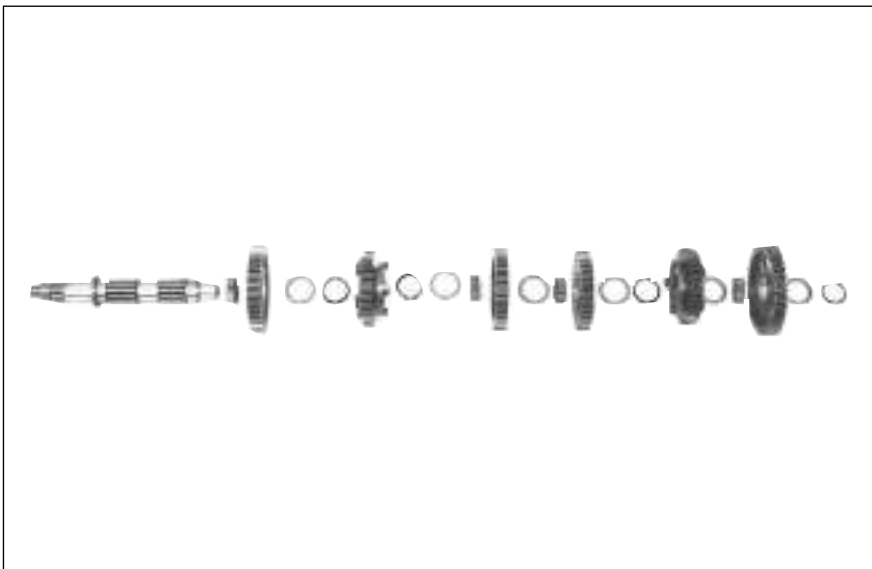
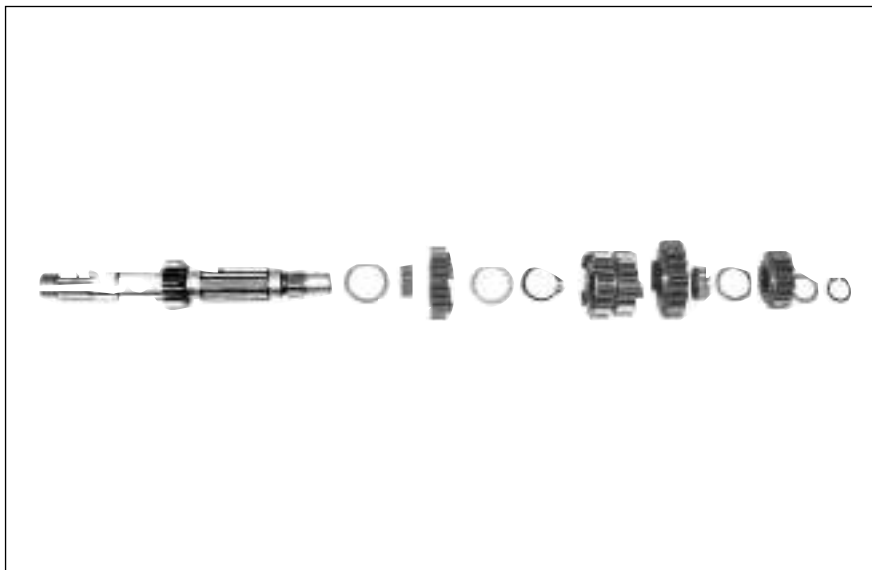


Engine F4 SPR/SR

Installation

To execute this operation you need the following special tools:

n° 94792 gearbox tool



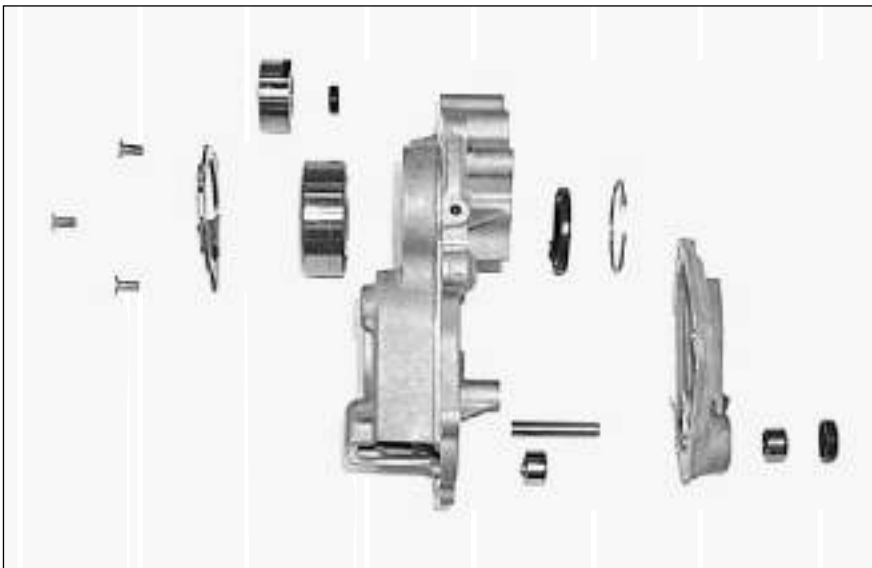
Reassembly the various parts by acting in the opposite way.
Install the 2 shafts on the n° 94792 engine simulation tool.
Install a shift pedal and check the gear box is correctly working.



Always insert a new washer and new nut every time you reassemble.

Carefully degrease the threads before reassembly.

Tighten the pinion nut at 150 Nm using a weak thread blocker. Turn the security washer again so as to avoid the accidental unscrewing of the pinion nut.



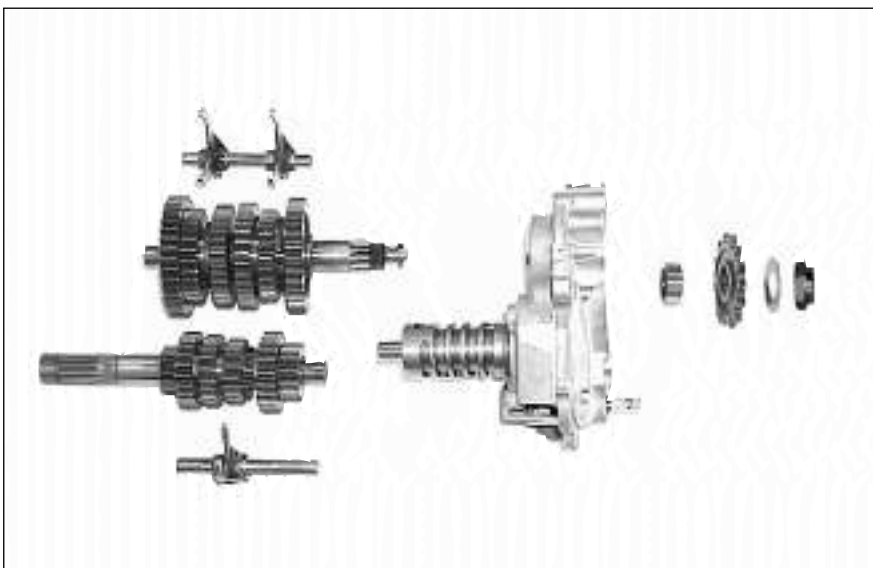
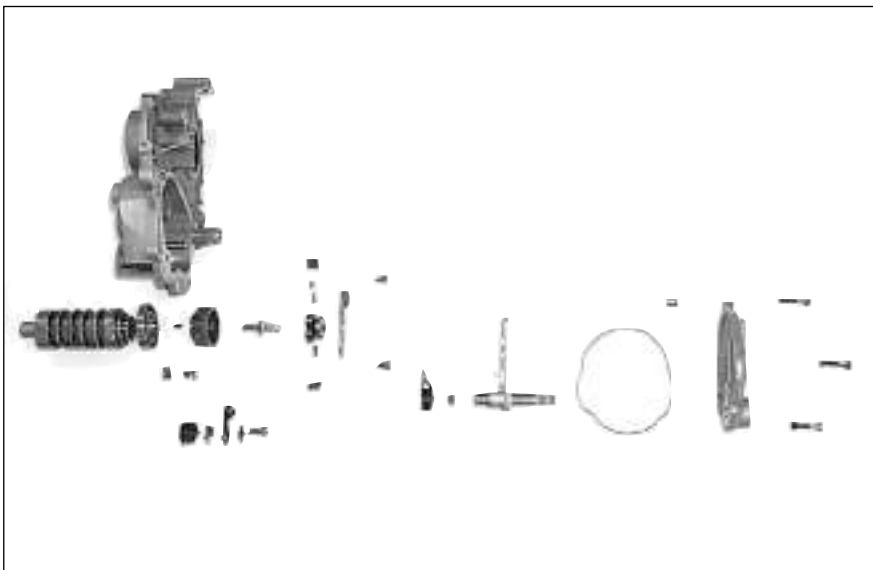
All the gears must be inserted and uninserted without stumbling.

In case of stumbling, verify that the axial play has been correctly restored.

With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to $0.2 \div 0.3 \text{ mm}$ placing it on both ends of the coupling.

The fork must be free.

Assemble the gasket on the internal end.



F

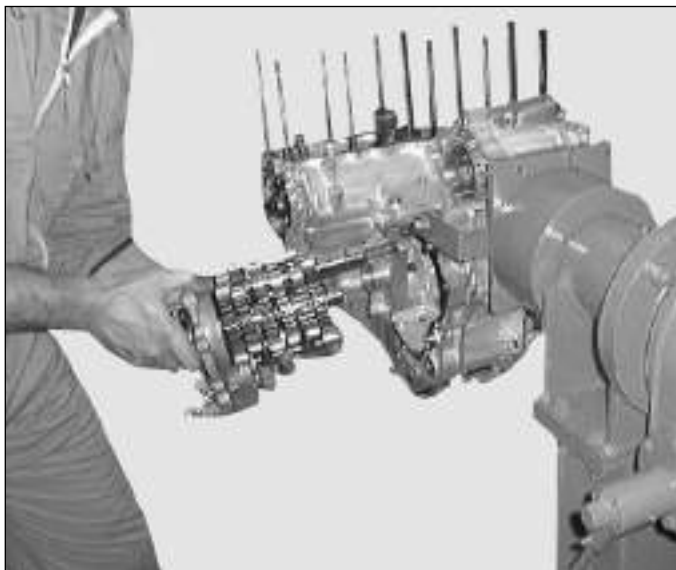


Engine F4 SPR/SR

Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.

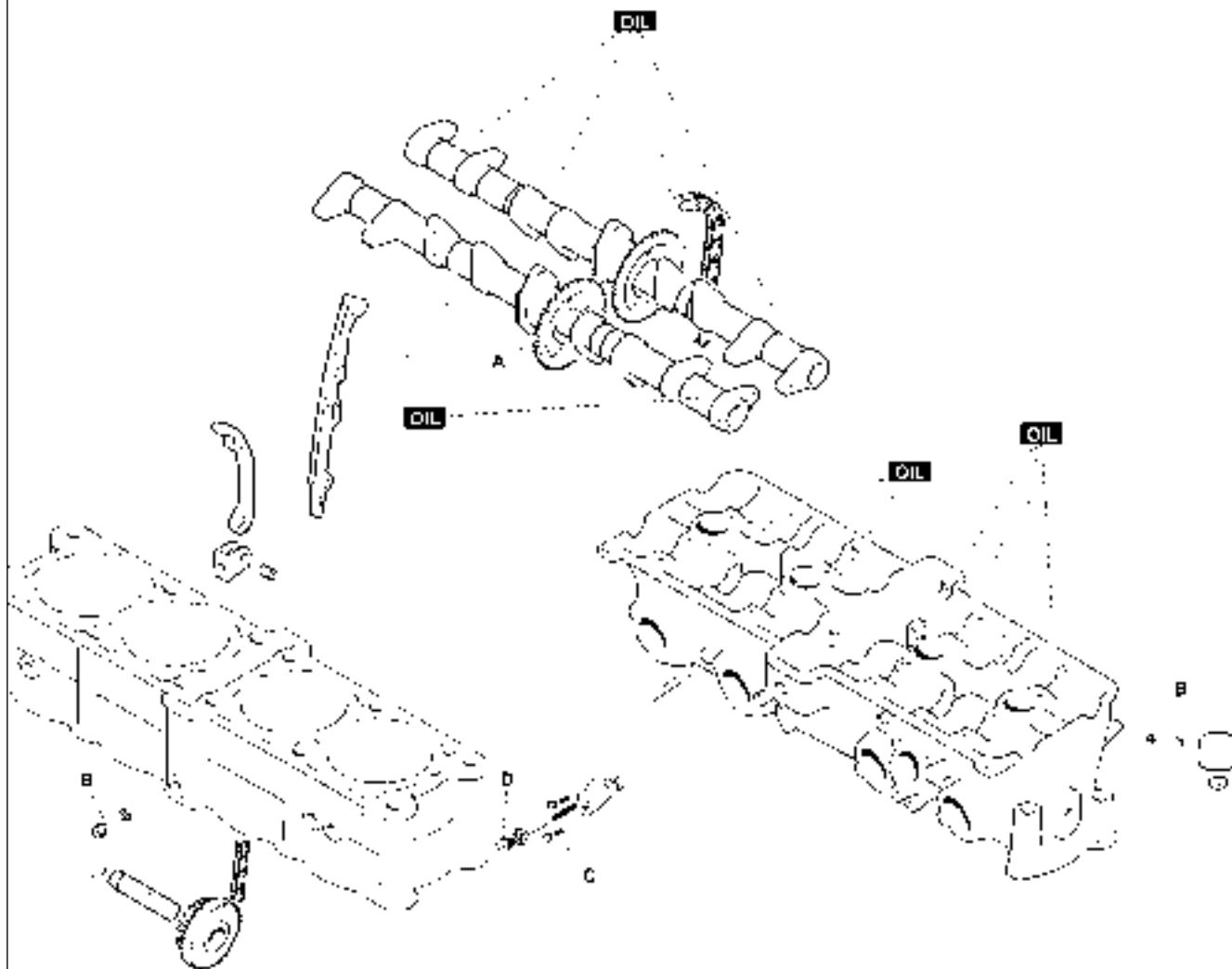


**Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.**





DISTRIBUTIO CONTROL UNITS



		A	B	C	D	E	F	G	H	I	L
Clamping Torques	N-m	12	8	8	12						
	Kg-m										
	ft-lb										
Thread blockers		Strong	Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



Engine F4 SPR/SR

In order to facilitate the detachment of the stands use a rubber hammer or delicately the end part of a flat screwdriver.



Slightly rotate without force the unloaded end of the gearshaft shifting it from its slot; by doing so, the tension on the distribution chain will loosen.

Release the distribution chain.

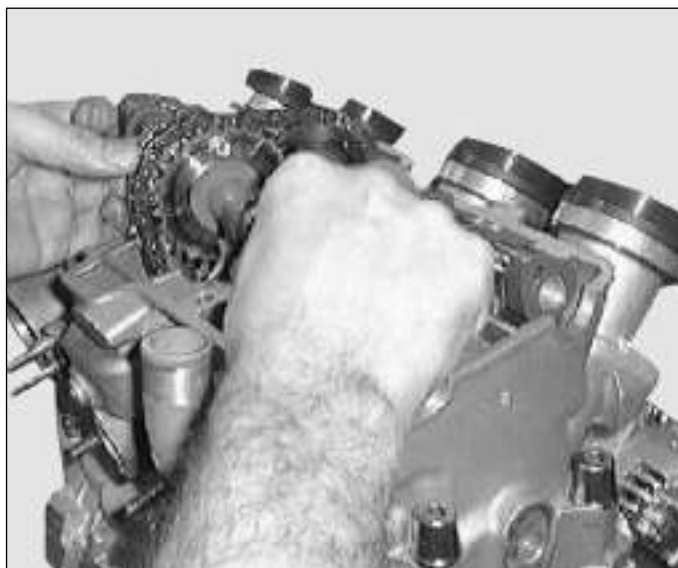
F First remove the unloaded end of the gearshaft. Fasten the distribution chain with copper thread in order to retrieve it during the following procedure.

Remove the inlet end of the camshaft.

Remove the first link block for the distribution chain by using the tightening screws.

In case it should be necessary to substitute the distribution chain at the expected mileage (see the programmed maintenance chart), it is advisable also to substitute the gears on the camshaft (INLET n° A2591 - EXHAUST n° A2592).

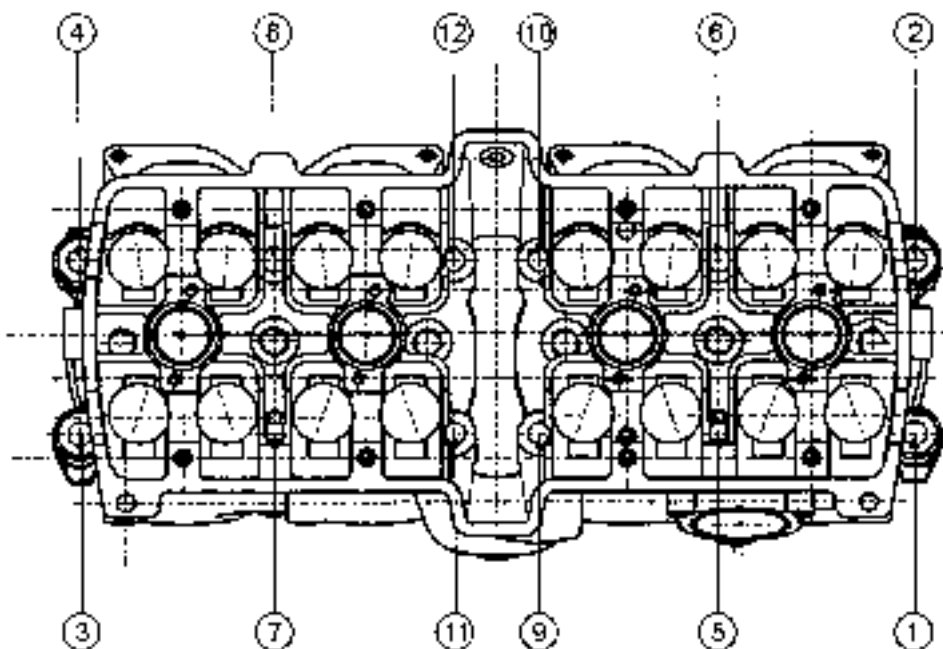
In this case carefully degrease and use LOCTITE 648 on new n°62726 screws locking them at 12Nm.



Remove the 12 tightening nuts from the head beginning from the external ones proceeding towards the internal ones, following the sequence indicated in the figure.



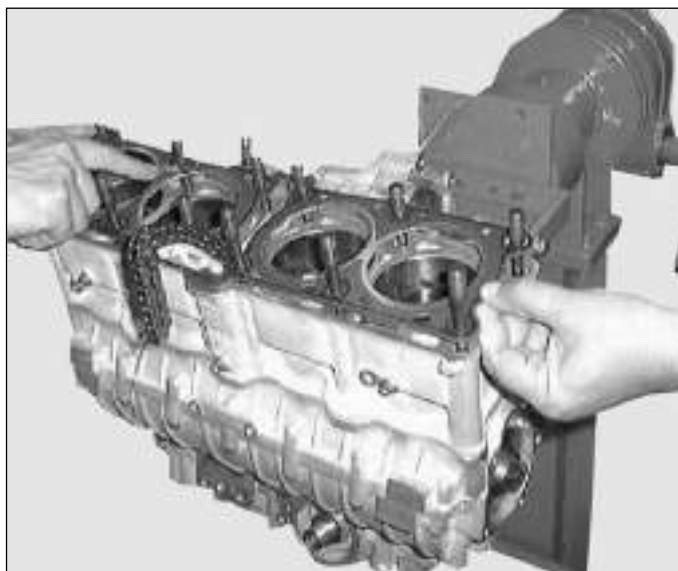
On each encarcement there is a washer. Be carefully no to let it fall into the motor, you may block the holes with clean rags.



Remove the head and place it onto a clear place

Remove the gasket which will be substituted during reassembly.

Avoid placing the head upside down.



Inspection of the head group

Remove carbon deposits from the combustion chambers. Clean away eventual encrustments from the canalizations of the cooling liquid. Check to be sure that there are no cracks and that the holding surfaces are free of crevices, runs or any other kind of damage.

Verify the planarity of the stroke surfaces.

Verify the perfect state of the spark plug threads



Head assy assembly

To execute this operation you need the following special tool:

- A) n° 94793 piston / cylinder plane distance measuring tool

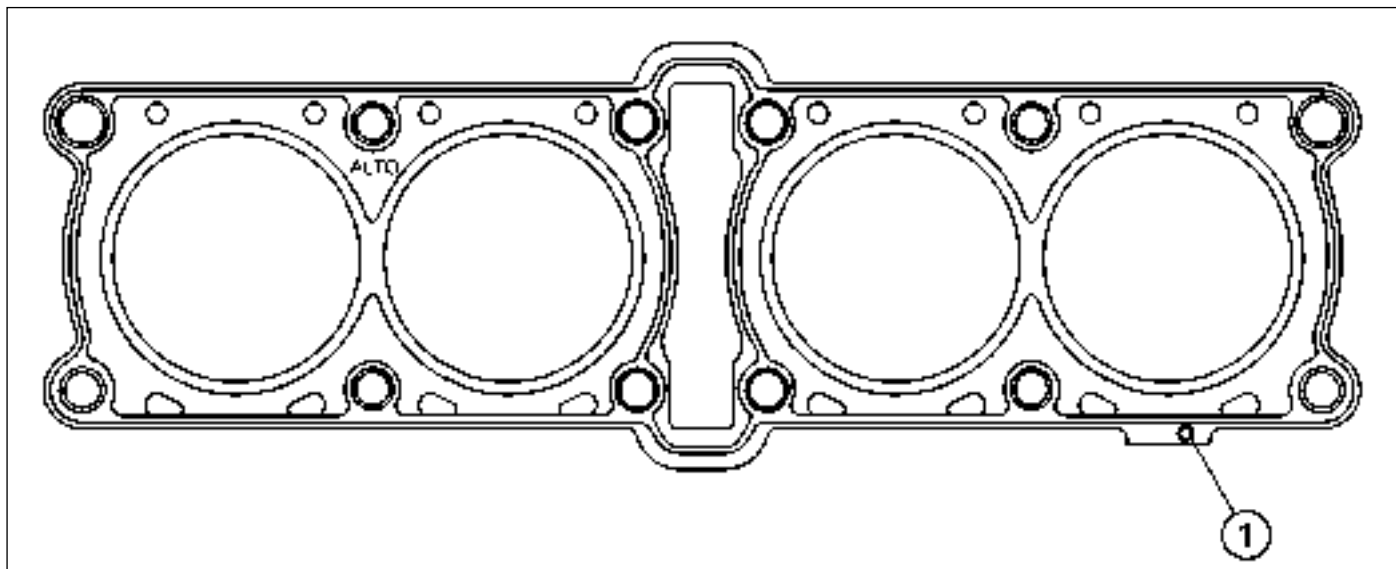
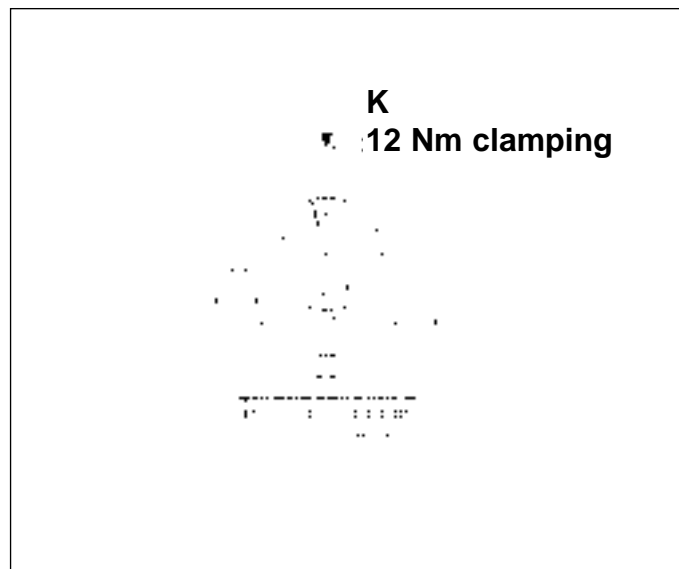
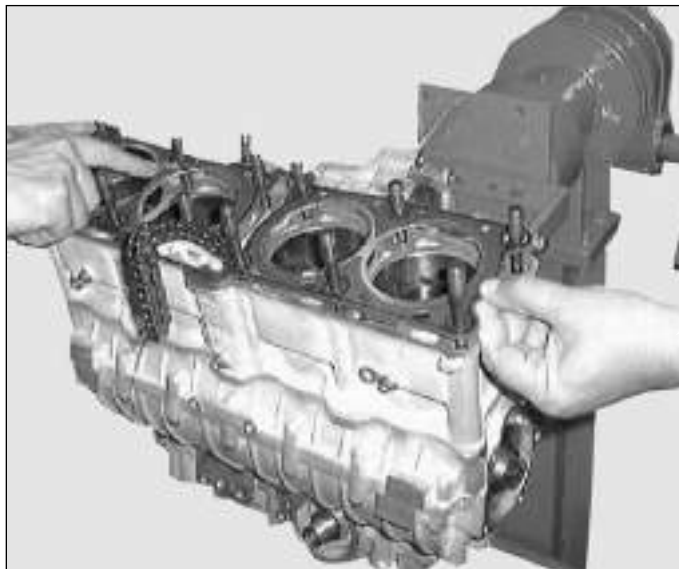
Place the new gasket on the cylinder plane.
The gasket is of the same thickness of the one installed before if no parts replacement occurred.

If replacement is necessary you'll need to measure the piston / cylinder plane distance with the n° 94793 tool, tightening the head nuts at 12 Nm. The choice is made following table below:

Piston/cylinder plane projection	Type of gasket
0.55 - 0.7 mm	Thick=> 1.45 mm
0.39 - 0.54 mm	Medium=> 1.30 mm
0.23 - 0.38 mm	Thin=> 1.20 mm

The gaskets are different for the presence of the holes (1) shown in picture.
Refer to the table below to choose the right one.

Holes numers	Compressed thickness	Part N°
2	1.20 ± 0.05 mm	8B0098679
NONE	1.30 ± 0.05 mm	8A0098679
1	1.45±0.05 mm	800098679





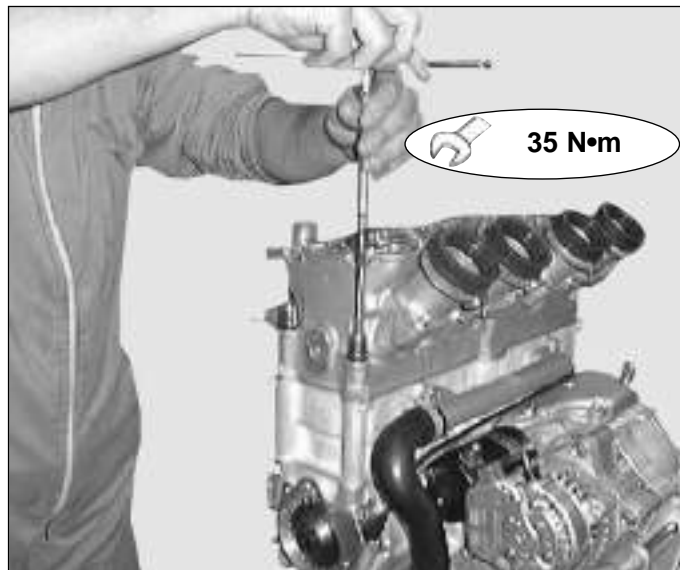
Engine F4 SPR/SR

The gasket must be assembled with the letters ALTO on the superior facade and the protrusion towards the march gear.

Insert the centering bushes between the head and the cylinder. Insert the washers on the encarcement if necessary with the help of a screw driver to guide them onto the internal encarcements.

Lubricate with antibinding grease of the HSC MOLIKOTE type only on the nut threads.

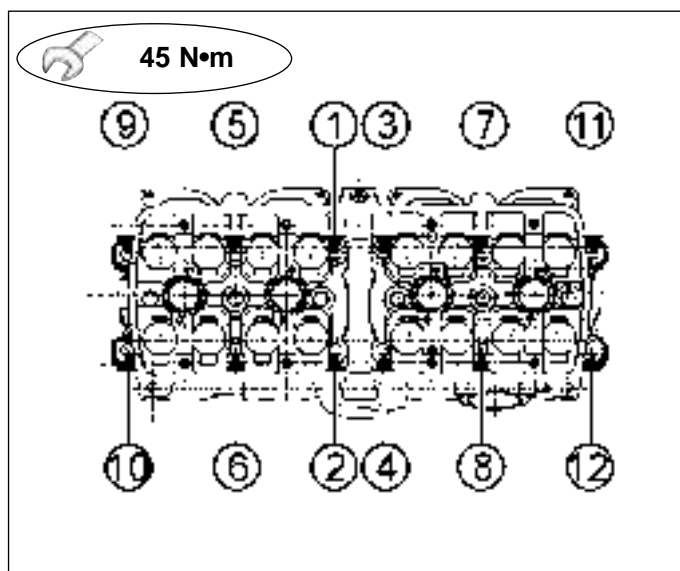
Do not apply grease on the encarcement threads, which must be well cleaned and degreased



F

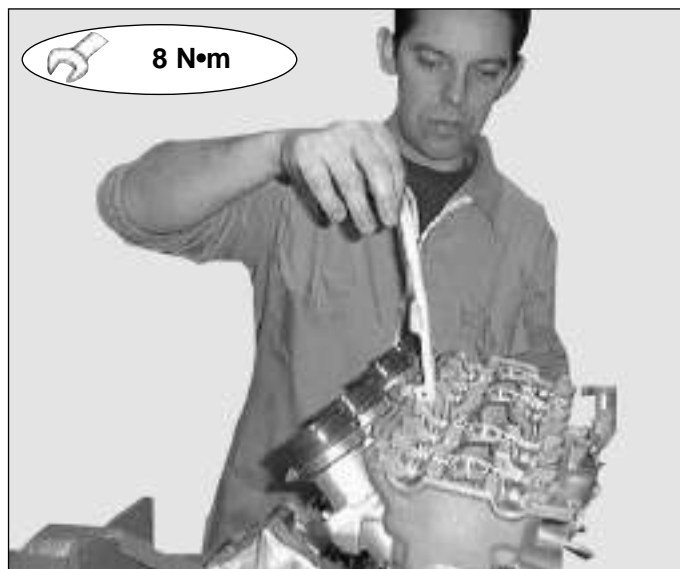
Screw the bolts with a brugle key and press them at a 35 Nm.

Tighten the bolts beginning with the internal ones towards the external ones following the outline indicated in the figure at 45 Nm.



Retrieve the distribution chain.

Insert the fixed sliding block with its screws and, after having carefully degreased it, tighten it at a torque of 8 Nm. with 242 LOCTITE



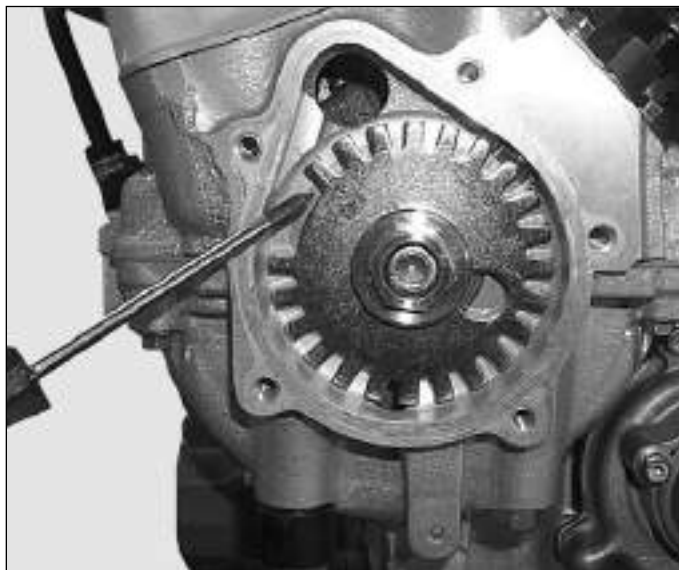


Engine F4 SPR/SR

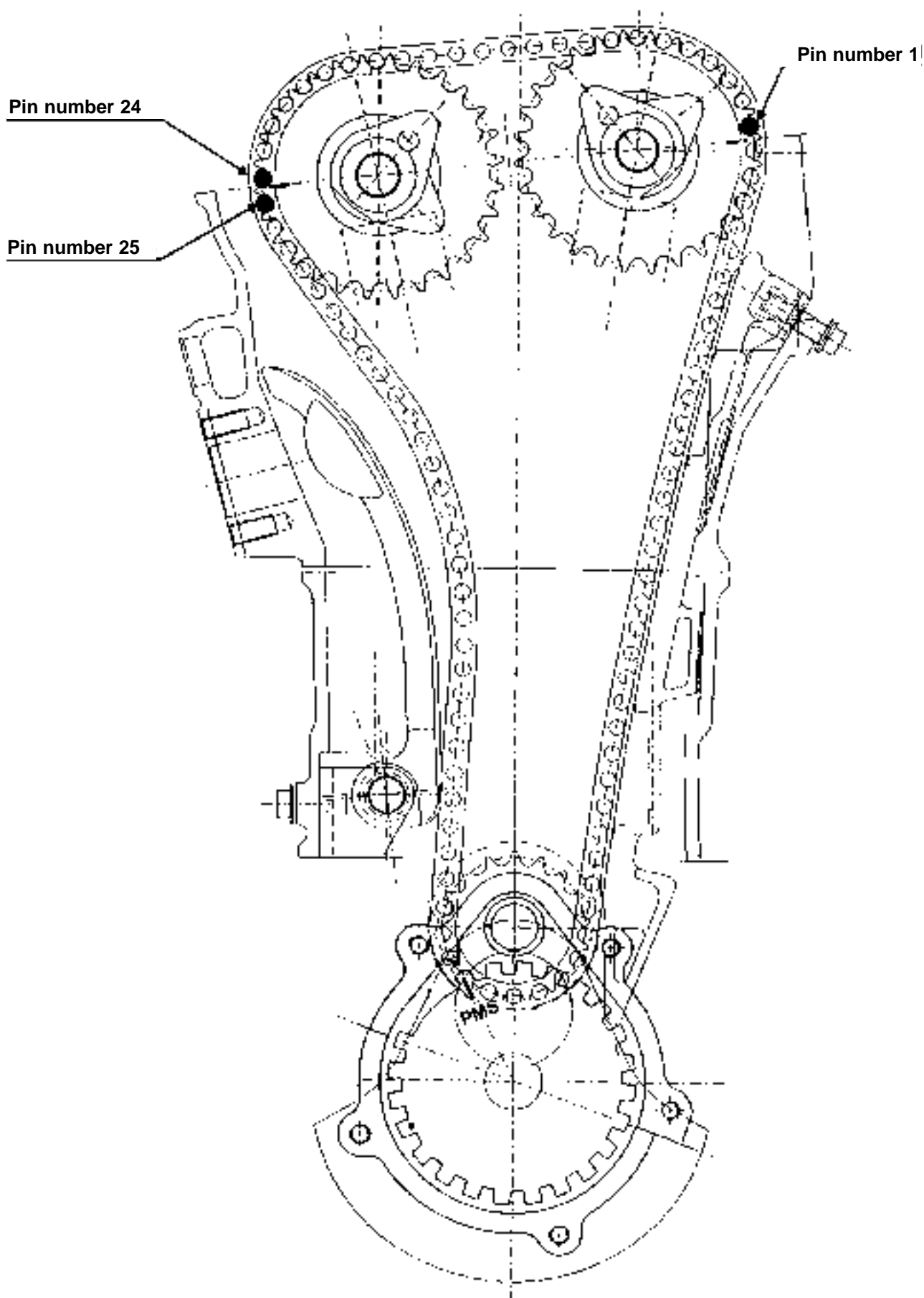
Continue with the setting as follows:

be sure that piston n° 1 is the MSP in burst phase; in this position "T" notch on the phonic wheel is in line with the reference notch on the bedplate.

Remove the copper thread from distribution chain, keep the chain tightened.



F



Insert the inlet camshaft so that the phase notch on the conveyor wheel is parallel to the head plane and facing the outside.

Insert the exhaust camshaft with the notch placed between the 24th and 25th chain distribution gudgeon, beginning to count from gudgeon after the inlet camshaft notch.

Check the correct position of all the O Rings under the head stands.



Position the n°2 and n°3 stands, referring to the numbers towards the inlet end;

Position the n°1 and n°4 stands,

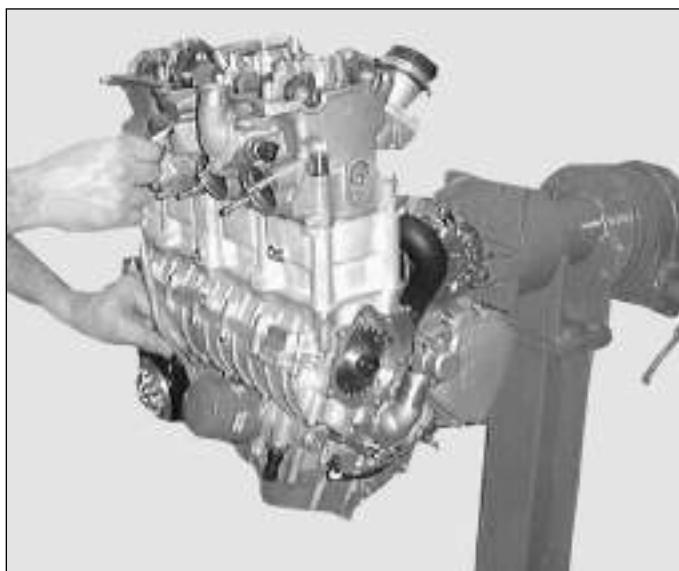
Bring the screws together manually hexagonally embedded.



Before tightening stand screws be sure that the chain tensioner is assembled.



Do not tighten the stand screws if the reaction springs are charged. Appropriately turn the camshaft so that the stand springs of which are to be tightened are uncharged and that the cams are positioned on the base radius.



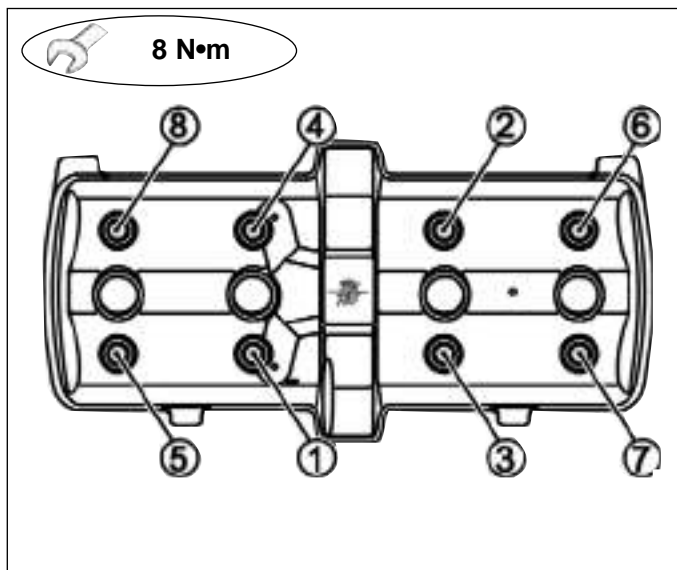


Engine F4 SPR/SR

Progressively move the internal hexagonal screws close. Tighten the screws at a torque of 12 Nm., always beginning from n°2 and n°3 stands.

Check to be sure that the valve cap gaskets are in good condition.

Apply a layer of gasket 5552 silicone on the semi moons on the head in correspondence with the camshaft.



Position the valve cap.

Manually position the screws, thus tighten at 8 Nm.

Place the adduction oil tube at the head greasing the O-Rings.

Dismounting cylinder head pieces

In order to carry out this procedure the following tools are necessary:

tool n° 94796 to disassemble valves

tool n°95179 to remove semi cones



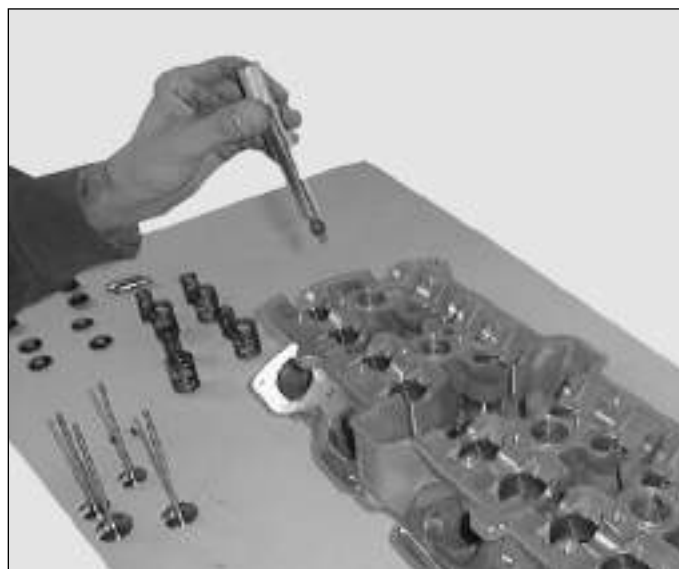
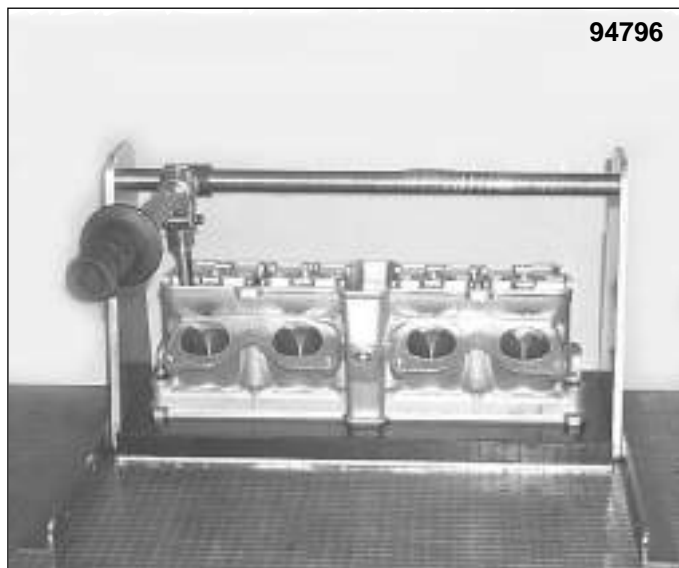
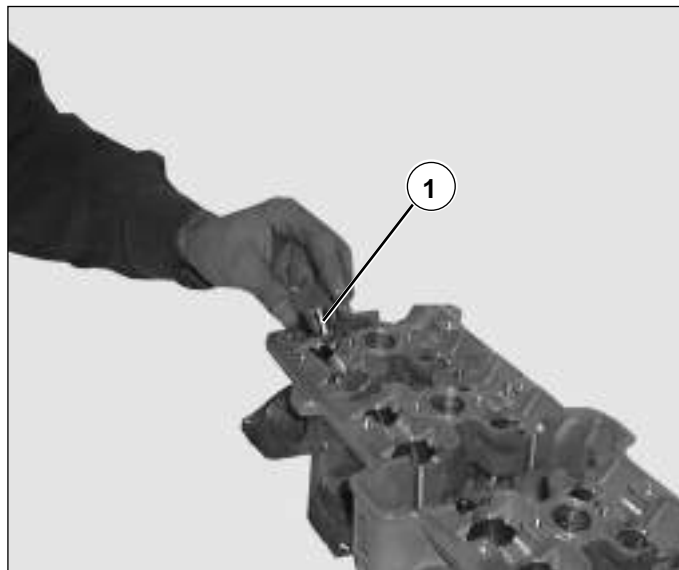
Each piece relative to the same valve (cup, spring, semi cone, etc.) must be reassembled onto the same valve from which it came off.

Remove the cylinder head as indicated the paragraph "cylinder assay removal".



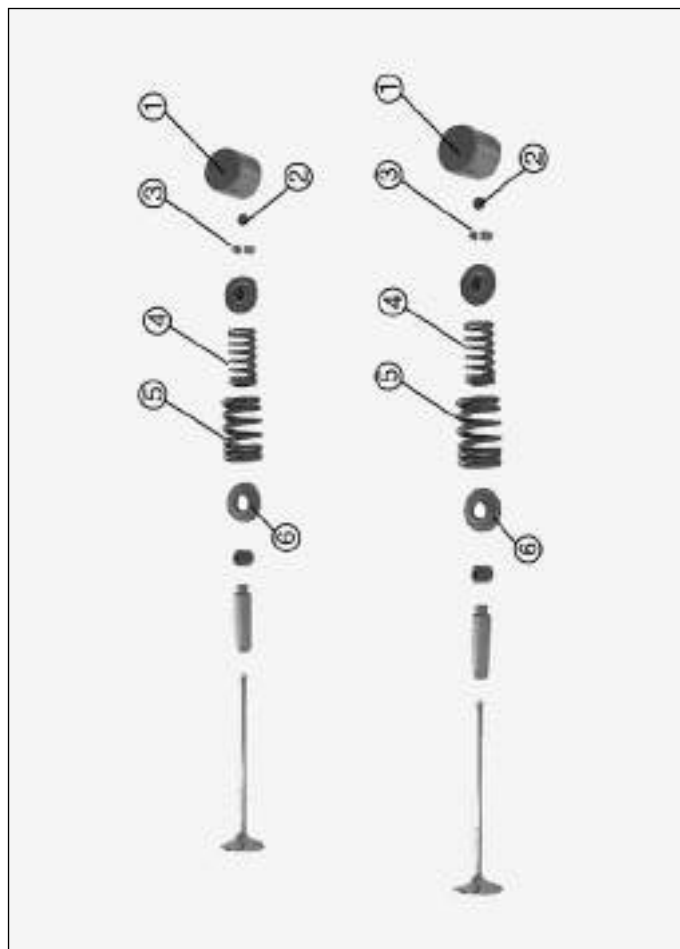
Valve removal

- A) Take out the cups (1) with the help of a magnet and number them with a marker so as to reassemble them in the same position.
- B) Remove the tablets (2) of play adjustment with a magnet and place them inside the relative cup so as to reassemble them in the same position. To remove the semi cones (3) exclusively use tool n° 95179 so as to avoid bending the valves:
- C) Assemble the head on tool n° 94796
- D) Hammer on the superior disk with a rubber hammer to unblock the semi cones
- E) Press the springs on the superior disk
- F) Take out the semi cones with a magnet
- G) Slowly release the disk pusher.



Then remove in the following order:

- A) Semicones
- B) The 2 coaxial springs (4 and 5);
- C) If necessary remove the rubber holdings;
- D) Remove the inferior disk (6);
- E) Slide the valve out of the combustion chamber.



Maintenance of the valve slot

Check the stroke surface [A] between the valve [B] and the slot [C] : no traces of pitting or cracks must appear. Measure the external diameter [D] of the stroke surface on the valve slot.

If this should appear to be too elevated it is possible to repair the slot.

External diameter of the stroke surface of the valve slot

Standard : exhaust $24.6^{+0}_{+0.3}$ mm
inlet $28.6^{+0}_{+0.3}$ mm

Measure the width of the stroke [E] with a varnished gauge or with Prussian blue.

If it should turn out to be too wide, too thin or irregular it will be necessary to repair it.

Area thickness of the stroke STD

standard : exhaust $0.9^{+0}_{+0.3}$ mm
inlet $0.7^{+0}_{+0.3}$ mm [E]

Value limit [E]: inlet 1.3 max
exhaust 1.5 max

The repair must be carried out by milling the slots using the appropriate monocutting milling machines at 78° (1), 45° (2) and 25° (3).

Ten proceed with the grinding of the valves and verification of the holding.



Remove the minimum quantity of material from the slot.

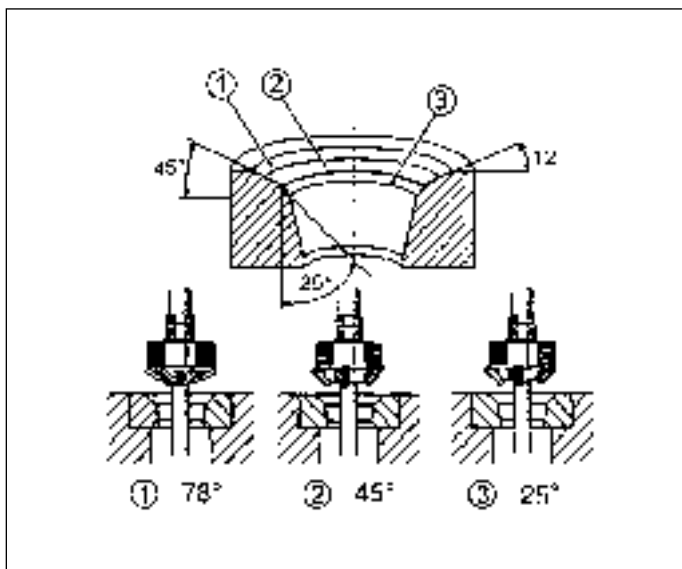
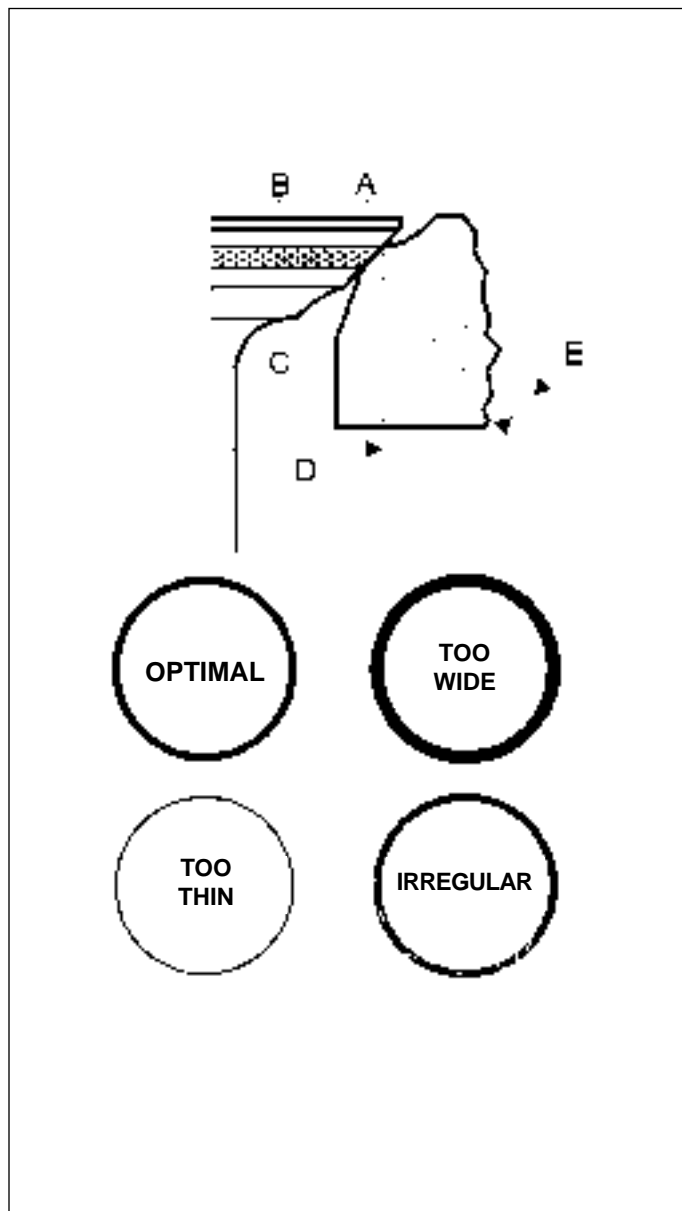
Inlet max 0.5 mm (vertical)
Exhaust max 0.5 mm (vertical)

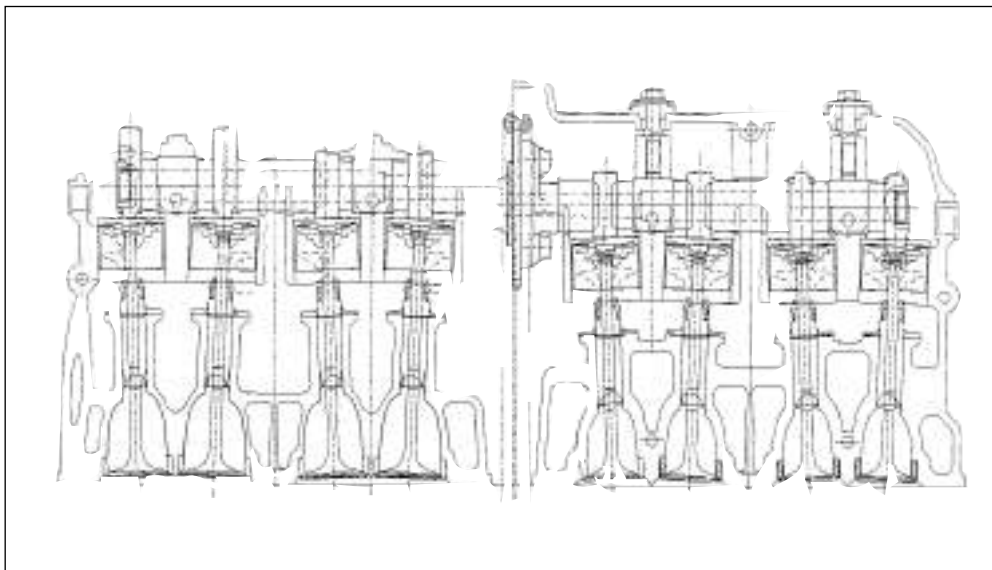
Verify that there is no leakage filling the inlet and exhaust of the gas canalization.

If so, check the quality of repair with Prussian blue.



When reassembling never use calibrated tablets of a thickness inferior to 1.6 mm.



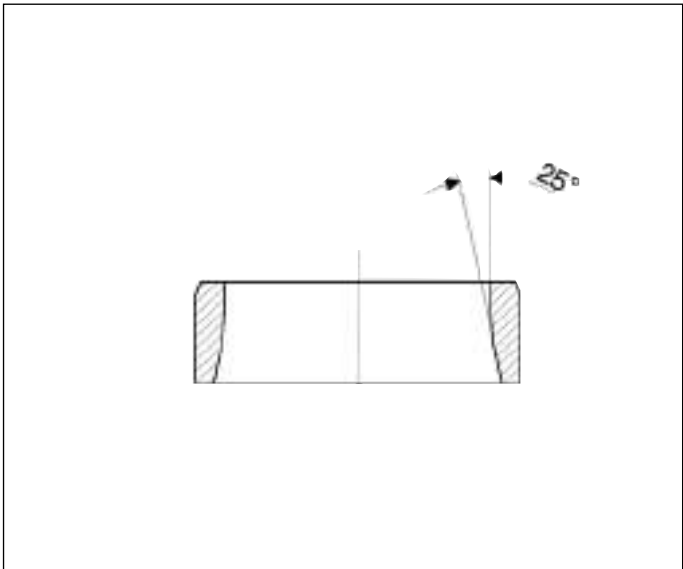


F Substitution of the valve slot

The following tools are necessary for this procedure:
 prick-puncher n°95319 for inlet slot
 prick-puncher n°95318 for exhaust slot

- Proceed as follows:
- A) Remove the worn slots carefully milling them so as not to damage the head lodging
 - B) Check the lodging diameter on the head and choose the oversized valve slot considering that the **assembling interference should be 0,10÷0,15 mm.**
 - C) Valve slots are furnished with an increased replacement part of 0.03 mm on the external diameter.
 - D) Slowly and evenly heat the head at a max temperature of 180°C and cool the new slots with dry ice.
 - E) Place the slots perfectly in frame into its lodging, using the special n°95319 prick-puncher (INLET) and n°95318 (EXHAUST)
 - F) Let cool and proceed with the milling of the slots and grinding the valves referring to the following quotients:

Ø A	28,60 ^{+0.3} ₋₀
Ø S	24,6 ^{+0.3} ₋₀
[E]	INLET 0.7 ^{+0.3} ₀ EXHAUST 0.9 ^{+0.3} ₀



Valve guide check and maintenance

In order to carry out this procedure the following tools are necessary:

Control tampon n°95429

Tampon n°95320

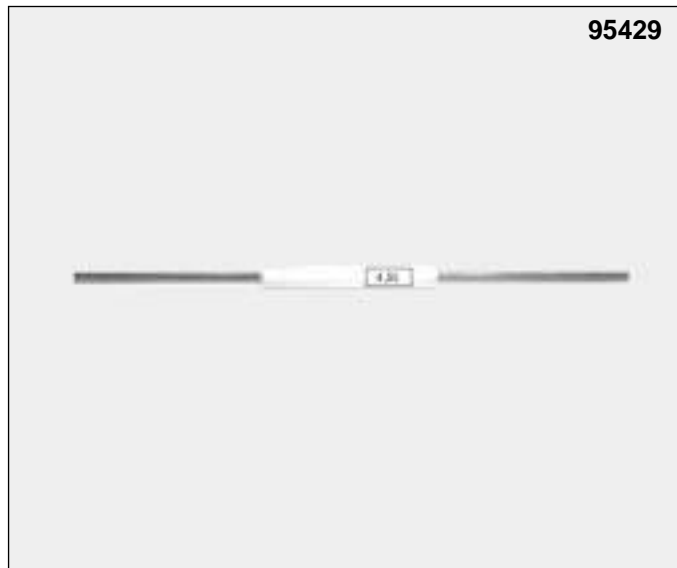
STD stem play

Valve-guide valve: **0.01÷0.037 mm inlet**
0.02÷0.047 mm exhaust

coupling limit: **0.08 mm inlet**
0.09 mm exhaust

internal guide Ø limit: **4.55 mm**

95429



Proceed with an accurate visual check of the valve guide.

In order to determine the coupling wear between guide and valve stem it is necessary to measure the play using a control tampon and micrometer.

[NOTE] The control tampon 95429 (Ø 4,55) must not pass.

[NOTE] In the case of substituting the guide valve it is necessary to check and if necessary also substitute the valve.



Removal of the valve guide

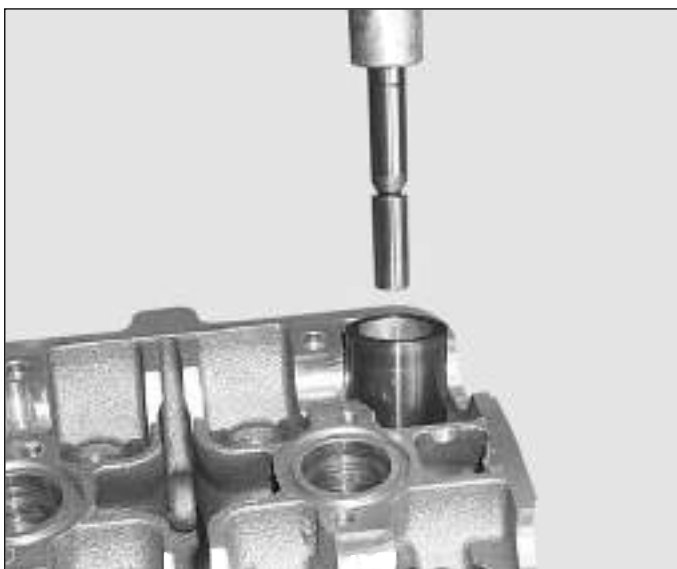
After having removed the valves and rubber holdings as described in the relative paragraph, continue as follows:

Slowly and evenly heat the cylinder head up to 100°.

Using tampon n°- see sliding out guide-valve at the bottom of the page.

Continue with a visual check of the slot to verify its State.

For motors with progressive numbers from 4911 to 5951 included, use tool A2383 to slide guide-valves out and tool A2385 to assemble the spare part. For motors with progressive numbers higher than 5952 use tool A2385 to slide guide-valves out as well as to assemble the spare part.



Guide valve installation

Assemble an oversized valve guide as follows:

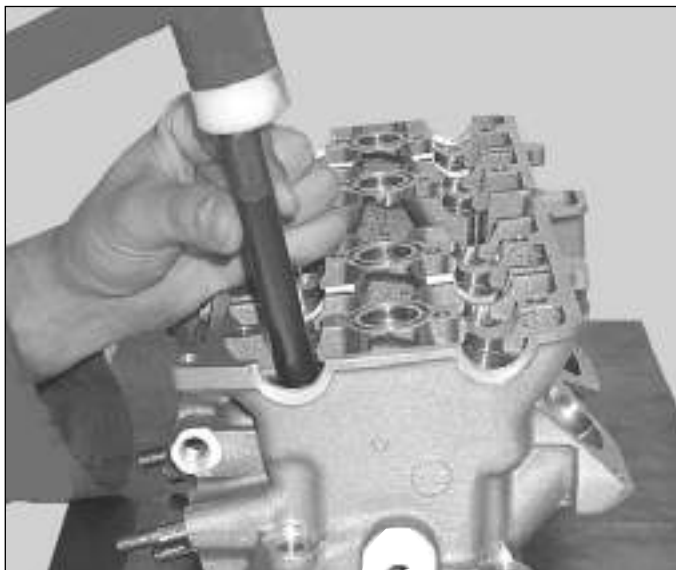
Oil the external valve guide surface.

Slowly and evenly heat the cylinder head up to 150°.

If necessary cool the valve guides with (N2) nitrogen liquid; or dry ice.

Insert the valve guide using the special tampon up to the stroke and let rest until the temperature has stabilized.

Check to be sure the valve slides freely in the valve guide otherwise coat it with a 4.5 H7 reamer or broach N°8000 A2625.



Valve

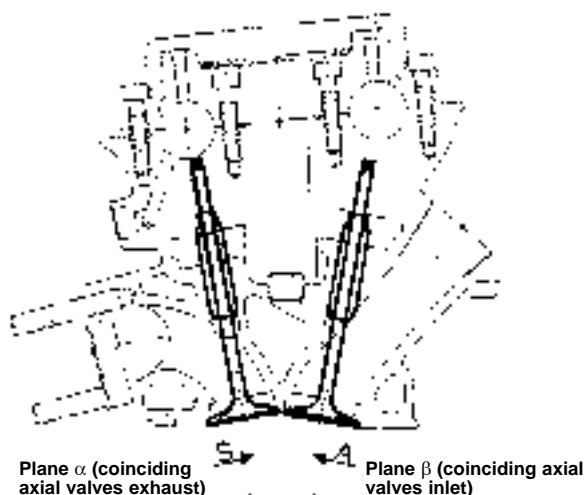
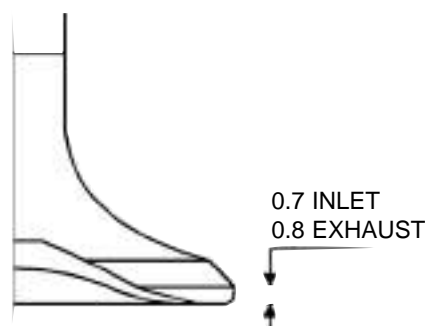
The stem diameters must not fall below:

4.470 mm inlet

4.460 mm exhaust

The minimum distance of the holding position at 45° on the valve plane must not be lower than 0.7 mm inlet - 0.8 mm exhaust (see figure).

Check to be sure that the stem and the surface in contact with the valve slots are in good condition. No traces of pitting, cracking, deformations or traces of wear should appear. Verify that the stem is perfectly rectilinear.



Valve-guide valve coupling

Coupling play at assembly must be:

0.01 ÷ 0.037 mm inlet

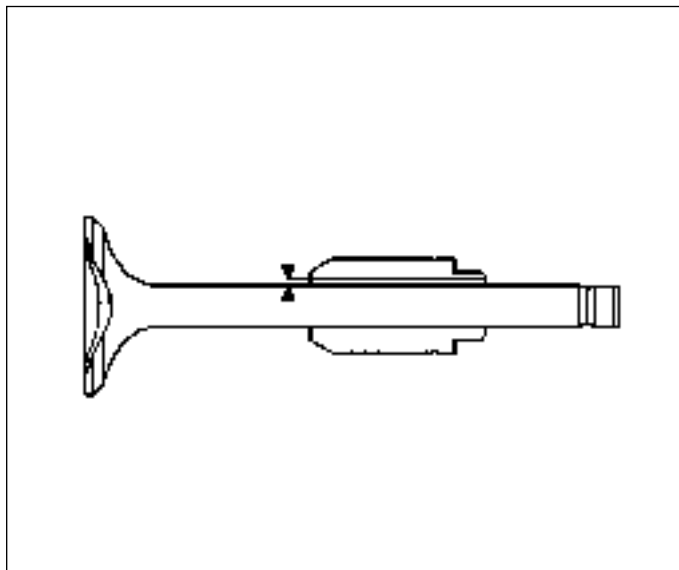
0.02 ÷ 0.047 mm exhaust

The maximum coupling limit permitted is even to

0.09 mm inlet

0.10 mm exhaust

If a major play should result, substitute valve and valve guide.



Springs

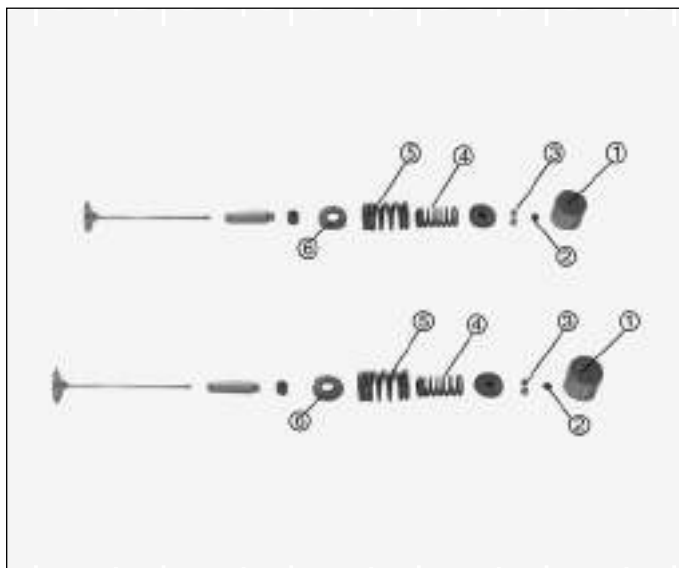
Check to be sure that the free value of length is not inferior to the suggested limit and in such case substitute the springs:

Internal spring l = 33,8 mm.

Service limit: 33,5 mm

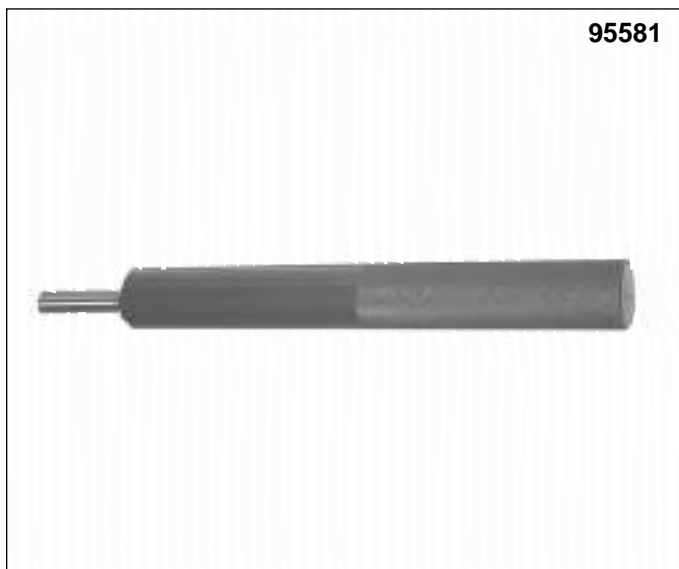
External spring l = 37,9 mm.

Service limit: 37,5 mm



Valve reassembly

- Carefully degrease the guide
- Insert the disk (6) and make sure that it is in beat.
- Assembly the rubber holdings, always new, on the valve guide using tool n°95581;
- Sprinkle the valve stem with oil.
- Assembling the valve.



95581

Execute the following procedures in the indicated order:

A) Insert the two coaxial springs. These springs must be assembled with the spirals close together pointed out with a coloured sign turned downwards.

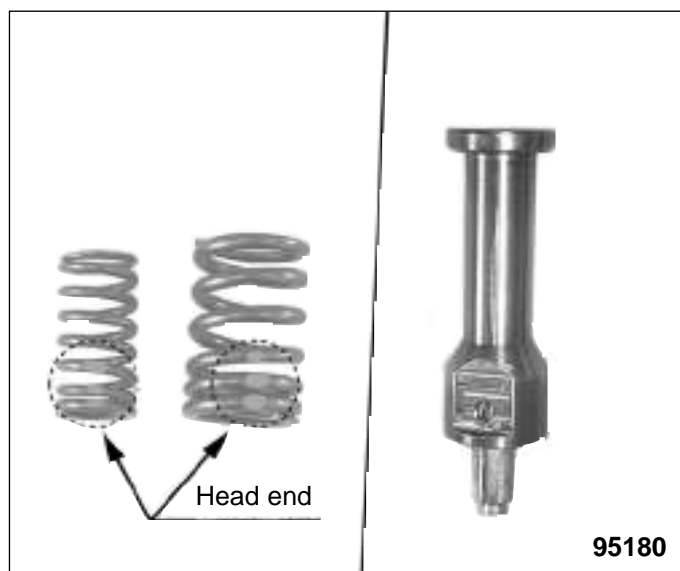
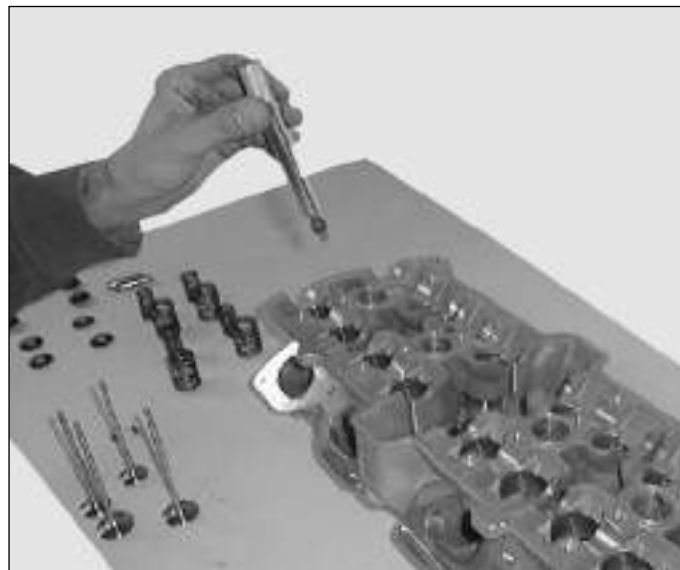
NOTE **Attention: The SPR inlet springs could have the coloured mark on the coils which are not close to each other. Always verify that the coils close to each other are assembled downwards aside from the position of the coloured point.**

B) Slide the semi cones into the superior disk slot and thus place the disk on the springs

C) Assemble the head on the disassembling valve tool n°94796 and compress the spring with tool n° 95180 until the semi cones are inserted

D) Using a rubber hammer strike a slight blow on the valve so as to place the semi cones.

NOTE **Before placing the semi cones be sure that the head is not resting on a plane in order to avoid distorting the valve. Place it onto two bases which allow the valve to move.**



E) Insert the tablet of the correct thickness and lubricate its surface

F) Make sure it easily turns in its slot

G) Insert the cup after lubricating the slot

Insert the cylinder head as described in the paragraph "Head assay assembly".



Regulating valve play

Verify that the spark plugs have been disassembled.



Should this procedure be carried out with the head assembled on the motor, block the spark plug holes with clean rags and assemble plate n°95191 to avoid the pieces accidentally falling into the chain distribution opening.

A) Rotate the drive shaft until completely unwinding the springs relative to the valves on which intervening (MSP in burst phase).

B) Measure valve play with a thickometer.

Inlet valve play	Exhaust valve play
$0.15 \div 0.24 \text{ mm}$	$0.20 \div 0.29 \text{ mm}$

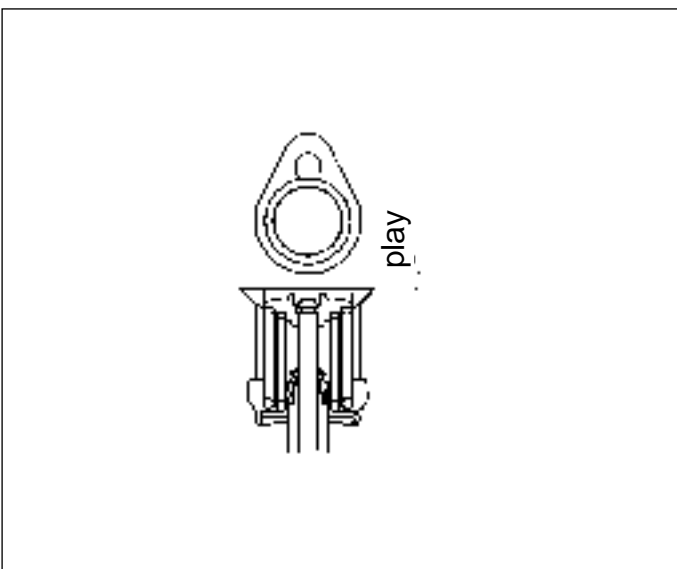
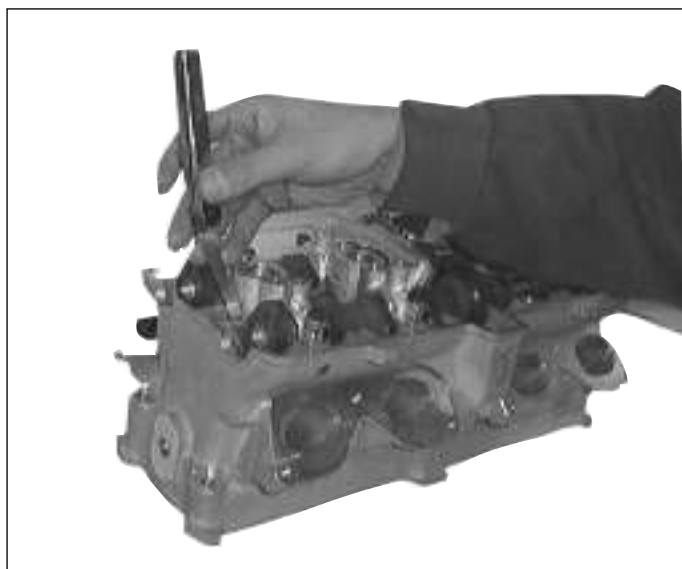
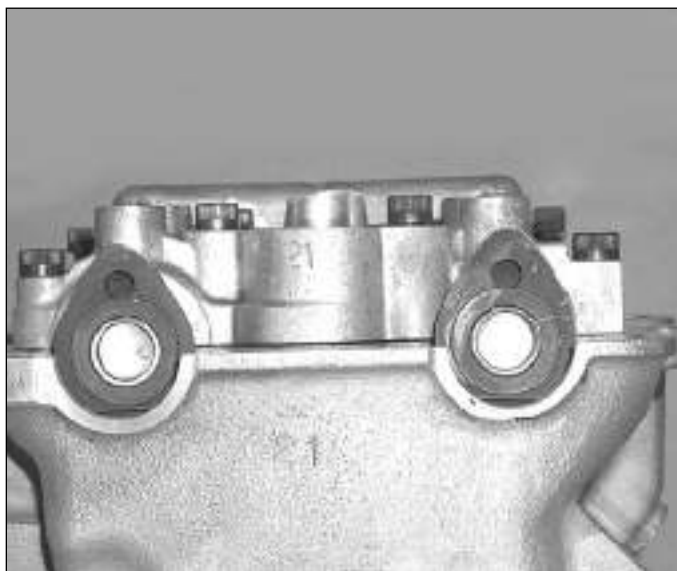
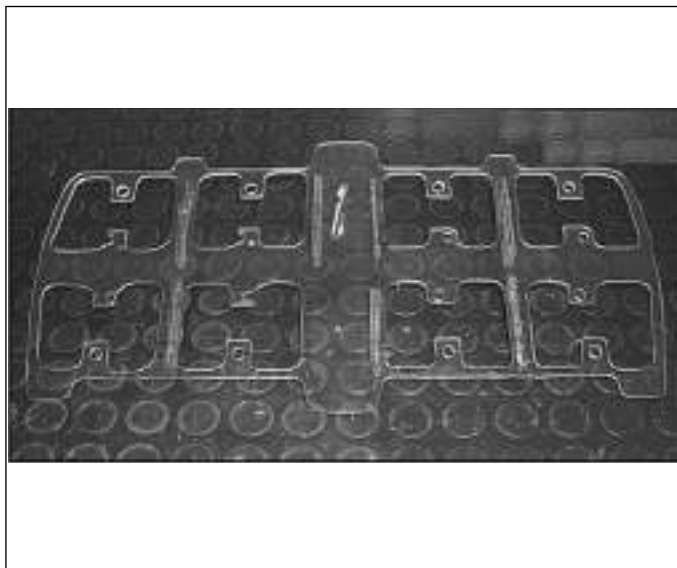
C) Calculate the D difference between the compared play and optimal play shown on the chart

D) Read the value of S thickness on the tablet;

E) Choose a new tablet with an S+D thickness.



During reassembly never use a tablet with a thickness less than 1.6 mm.



Chain tensioner

Remove the central screw-cap and withdraw the spring and the pin.

Remove the screws fixing the chain tensioner to the head.

Remove the chain tensioner.

Disassembly the chain tensioner and check the correct working of each part.

The internal pin must run clearly and the inner spring must give a quick response.

Replace the assembly in case of malfunction.

If everything works properly lubricate the parts and install the assembly with the chain tensioner in the minimum extension position (all in the main body)

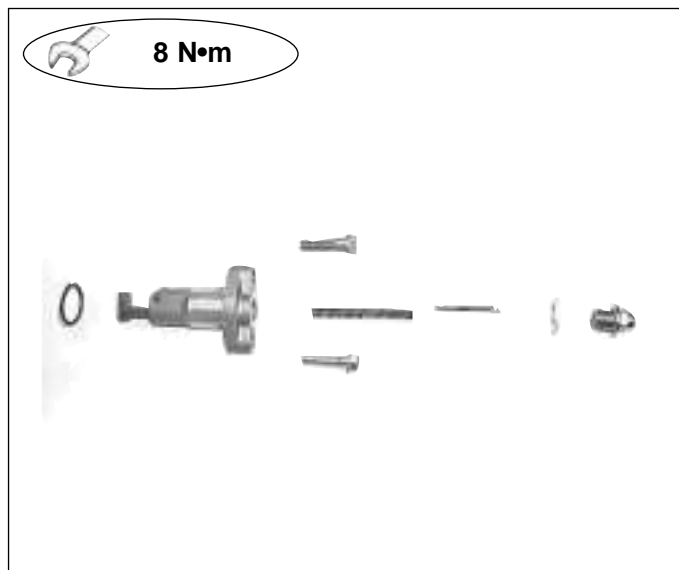
Install the chain tensioner body locking the 2 socket

head screws using a T wrench with a 8 Nm torque

Install in this order: the pin in the spring, the spacer and the screw cap.

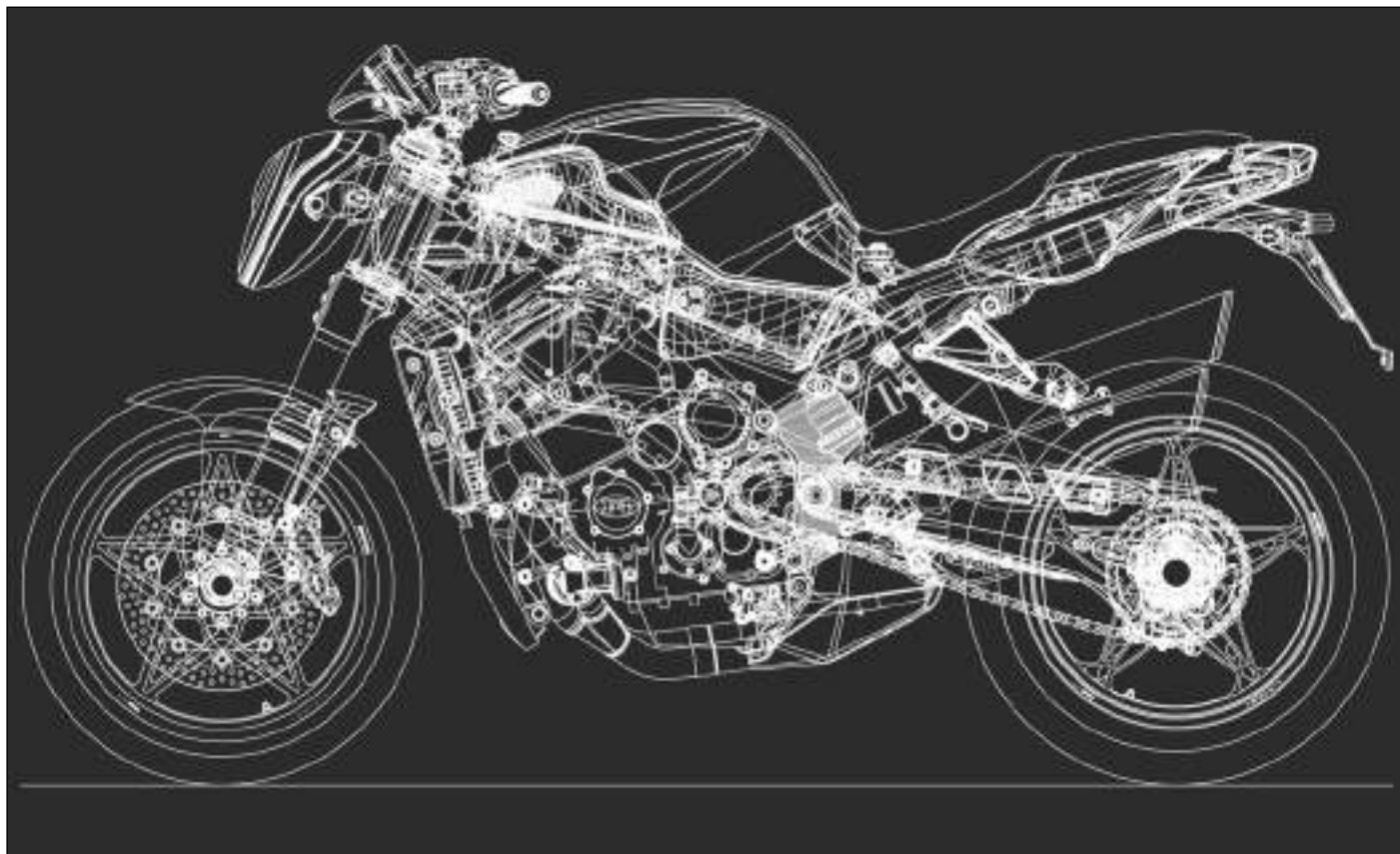
Lock the screw cap by hand till you feel the tensioner extend, then lock it with a 8 Nm torque

Acting this way the chain tensioner is adjusted.





Engine F4 BRUTALE MY 2003



G

SECTION G

Revision 0



Engine F4 BRUTALE MY 2003

SUMMARY

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NOTE For sub-assemblies that are not listed, refer to the “F4 S MY 2002” model.



Engine F4 BRUTALE MY 2003

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	150	14.25	Medium
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	150	14.25	Medium
Gear selection drum tightening screws	12 If M6 thread 25 If M8 thread	1.2 2.5	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	



Engine F4 BRUTALE MY 2003

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws (mat n° from 546)	10+60°	1.0+60°	
Plate screws	10	1	
Oil filter support screw	40	4	
Cooler oil inlet/outlet unions	30	3.0	medium
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate the thread with a minimu quantity of Molikote HSC Plus.
Do not use too much of this product.



Engine F4 BRUTALE MY 2003

MAINTENANCE TABLE

Slip			Pre-delivery	A		B		C	
Frequency		km	0	1000	6000	12000	18000	24000	30000
Procedure									
Cooling liquid level	C		•	•	•	•	•	•	•
Cooling liquid substitution	S			Substitute every 2 years				•	
Motor oil level	C		•	Check every 1000 km					
Motor oil	S	6000 km or 12 months		•	•	•	•	•	•
Motor oil filter	S			•	•	•	•	•	•
Valve play	C			•	Check every 12000 km				
Distribution chain	S								•
Mobile distribution block	C/S					•		•	
Chain tightening block	C/S					•		•	
Spark plugs				Substitute every 12000 km					
	S					•			
Minimum synchronizing regime	C			•	•		•		•
Fluttering body: synchronization, minimum, CO control	C/P			•	•		•		•

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions

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Engine F4 BRUTALE MY 2003

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter		
Exhaust.....	24.6 $^{+0.3}_0$ mm	
Inlet.....	28.6 $^{+0.3}_0$ mm	
Sealing face thickness.....		
Inlet.....	0.9 $^{+0}_{+0.3}$ mm	limit 1.5 mm
Sealing face thickness.....	0.7 $^{+0}_{+0.3}$ mm	limit 1.3 mm
Stem-guide clearance		
Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	4.5 $^{+0}_{+0.012}$ mm.....	4.55 mm
Valve stem		
Exhaust.....	4.5 $^{-0.02}_{-0.035}$ mm.....	4.460 mm
Inlet.....	4.5 $^{-0.01}_{-0.025}$ mm.....	4.470 mm
Valve spring		
Internal.....	33.8 mm.....	33.5 mm
External.....	37.9 mm.....	37.5 mm
Valve-cam clearance		
Exhaust.....	0.20 ÷ 0.25	
Inlet.....	0.15 ÷ 0.20	



Engine F4 BRUTALE MY 2003

ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.014 ÷ 0.046 mm	0.10 mm
Piston-pin play.....	0.002 ÷ 0.010 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	1 ^{-0.01 -0.03} mm.....	0.96 mm
2 nd	1 ^{-0.01 -0.030} mm.....	0.96 mm
Oil scraper.....	2 ^{-0.010 -0.025} mm.....	1.95 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	38.8 mm



Engine F4 BRUTALE MY 2003

ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Engine F4 BRUTALE MY 2003

Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

- Heat the motor to the usual functioning temperature (of regime);
- Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;
- Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

<i>Cylinder compression control (280 rpm-min)</i>		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- carbon deposits on the walls of the combustion chamber and on the piston ceiling;
- the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- The seat of one or more valves is damaged and the valves do not maintain the compression pressure;
- One or more valves have null functioning play;
- The piston, cylinder play is excessive;
- The cylinder head is twisted and/or the head gasket is damaged;
- Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.



Engine F4 BRUTALE MY 2003

THROTTLE BODY ADJUSTMENT AND TUNING (Tickover check, CO synchronisation and check)

Check and adjust → First 1000 kilometres and then every 6000 kilometres

The throttle body adjusting should be performed starting the engine of the motorcycle, therefore you should use a flue gas exhauster in order to not saturate the environment with burnt gas.

The following described operations are fundamental for the correct functioning and the maximum performance of the engine.

When carrying out operations on throttle bodies, it is advisable to remove certain parts of the bodywork such as:

- Passenger seat
- Rider seat
- Tank side panels
- Ignition switch cover
- Fuel tank

Attention: before adjusting the throttle body verify accurately:

- the absence of any cracks or damages on the pipes to check the depression;
- the absence of gas leakages from drain pipes joint;
- that the fuel pipe unions are not buckled and crushed.



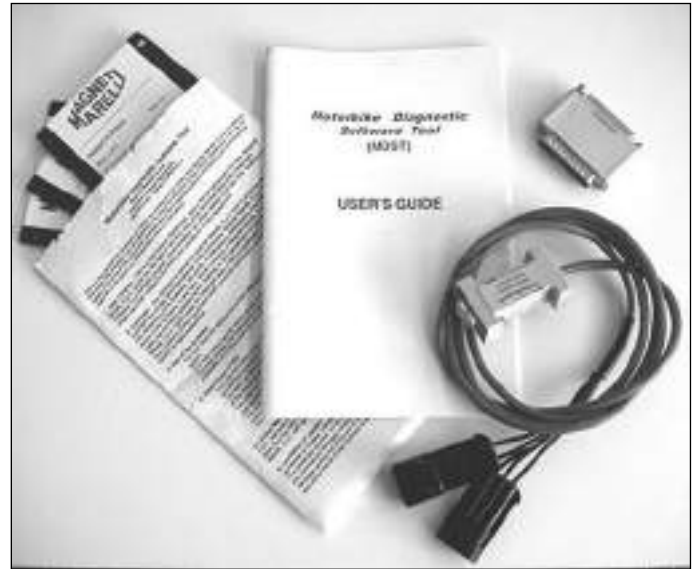
You should provide the motorcycle with tank placed on an auxiliary support. Therefore you should connect the hydraulic extensions of the fuel pipes and the electrical extension for feeding fuel pump.





Engine F4 BRUTALE MY 2003

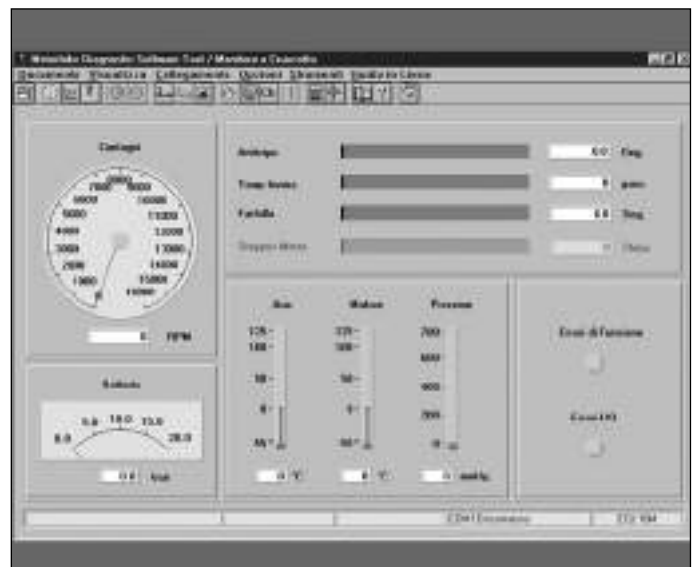
Verify the parameters of the injection-ignition system by the MDST diagnosis software.



Connect the tool cable of the MDST diagnosis with the "Diagnostics" tap on the right side of the motorcycle near the expansion tank of the coolant.



Start the MDST diagnosis software and go to the "Display instrument panel" screen.
Set the ignition switch to ON.
Select the "Connect" option from the toolbar. Now the software displays the main operating parameters of the injection-ignition system: verify that the temperature and pressure sensors have coherent readings.





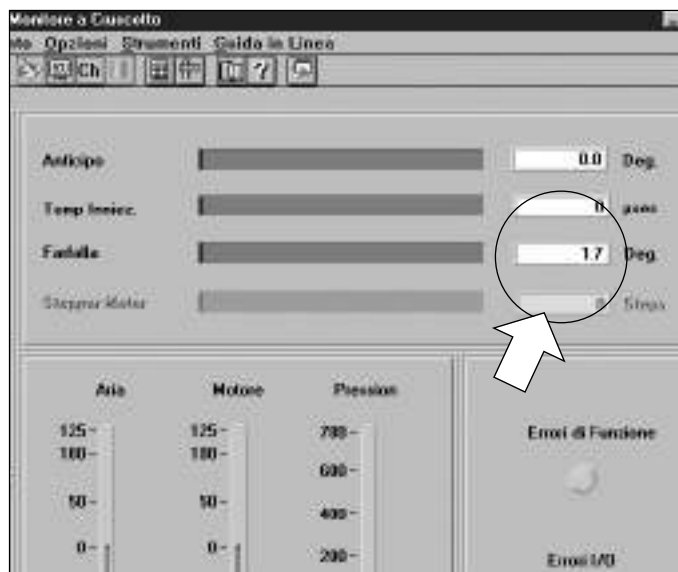
Engine F4 BRUTALE MY 2003

Check the throttle angle when the throttle is completely closed.

The nominal throttle opening angle is **1.7°**.

Huntings between **1.5°** and **1.7°** are allowed only if the engine is started.

Huntings between **1.7°** and **1.9°** and between **1.3°** and **1.5°** are not allowed.



If necessary adjust the throttle opening using only the appropriate screw on the throttle opening pulley.

It is recommended not modify the throttle potentiometer position because the throttle has been set during the production to the optimal value.



Remove the sealing caps of the small tubes to check the vacuum pressure.

The number of the cylinder to which the caps are connected is written on the caps.

The small tubes for checking the vacuum pressure are situated on the left and right side of the motorcycle.





Engine F4 BRUTALE MY 2003

Connect the depression pipes with the vacuumometer complying with the match between the pipe and the cylinder which is connected to.



In order to perform the following operations, you should provide with the specific tool kit for setting CO.

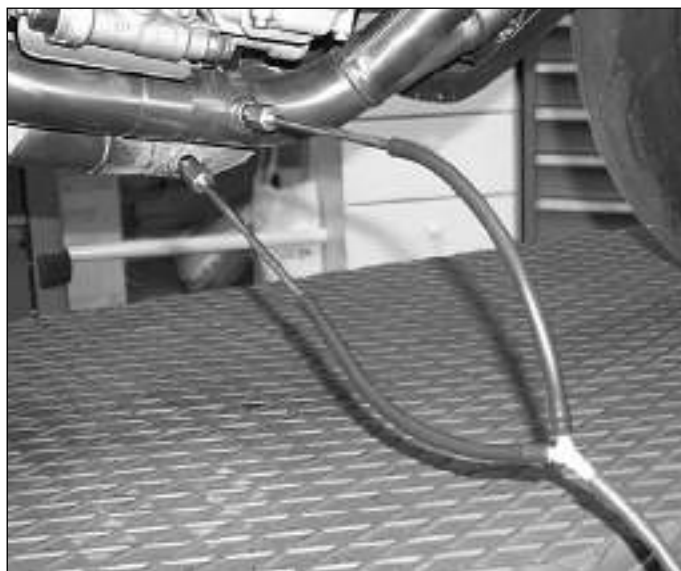
Specific tool: Part code 8000A4686

Remove the sealing caps of the CO drives placed on the exhausts.

Insert and screw the 2 probes registering CO inside the specific tool kit (code 8000A4686).

Assemble the 2 pipes with their Y union, also supplied with tool kit, code 8000A4686, on the probes registering CO.

Connect the Y union with a rubber pipe to the exhaust gas analyser.



Verify that the ignition switch is set to OFF.

Disassemble the injection-ignition gearcase placed on the air filter compartment unscrewing the four fixing nuts.

Reset the earth bonding on the gearcase by using a nut and a M6 screw (for the correct performance of the adjusting operations, it is important the gearcase is earthed).





Engine F4 BRUTALE MY 2003

Remove the seal plate and then the gearcase sealing cap.



Operate the by-pass screws in order to return to a known condition.
Close completely the screws and then open them for 1 turn again.



Start the engine and warm it up. During this phase you should not accelerate because the high depression created in the induction lines could pipe the mercury from vacuumeter.

The engine rotation can be supported by using the starter.

The attainment of the correct thermal speed is given by the intervention of the cooling fan.





Engine F4 BRUTALE MY 2003

Balance the depressions in the cylinders: the thermometers should get to the same height (reference level = 2).

Se all engine parameters are correctly set, the position of the adjusting screws should be between 1 and 1.5 rpms from the fully closed position.

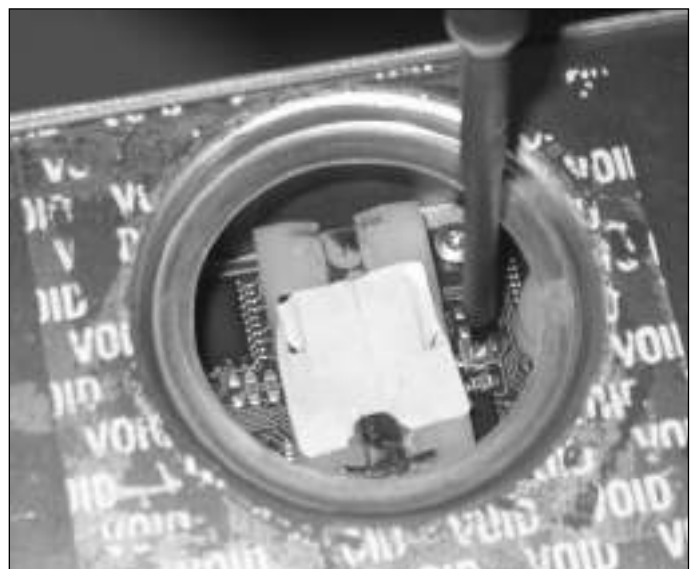
Keeping the depressions aligned, adjust the engine speed (with fan connected and light on) so it is between 1100 and 1200 rpms.



Check the CO value using the exhaust gas analyser. This value must be between 3% and 4%.



If the CO value does not fall into the established values, operate the trimmer inside the gearcase until the values fall into the tolerance range.





Engine F4 BRUTALE MY 2003

The attainment of the correct CO value could involve a variation of the engine speed at minimum. In this case you should operate the by-pass screws again to return the speed to the desired value and then repeat the trimmer adjustment.



After having finished the adjustment operations, perform in the order as follows:

- assemble the rubber plug on the gearcase lower side;
- apply a new seal plate;
- assemble the gearcase on the air filter compartment restoring the earth bonding;
- disassemble the exhaust gas probes and tighten the fixing screws;
- restore the sealing caps of drives for checking depression;
- reassemble tank, tank side panels, ignition switch cover, rider seat and passenger seat.

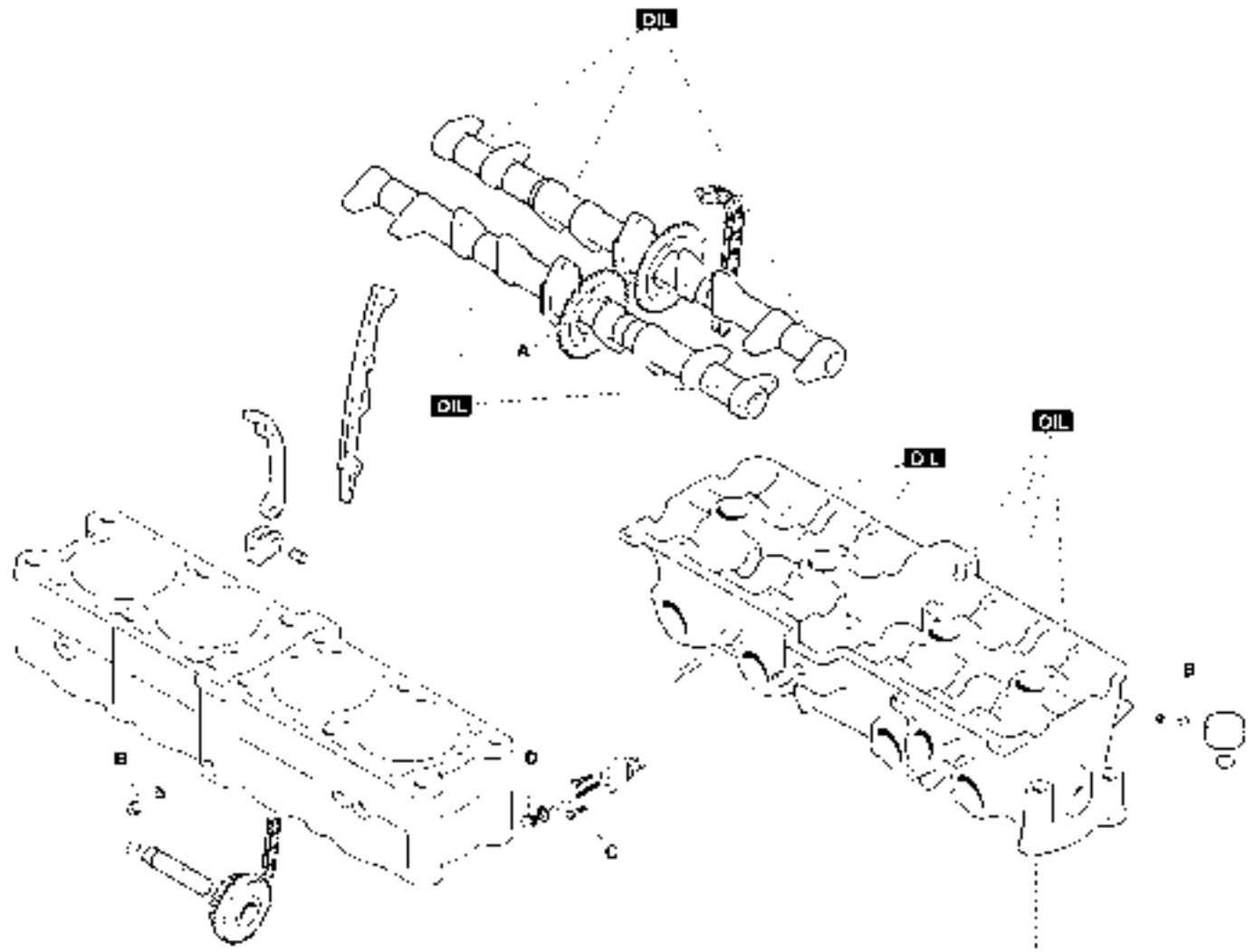


After reassembling all parts, carry out a final check to ensure that everything has been correctly replaced.





DISTRIBUTION CONTROL UNITS



G

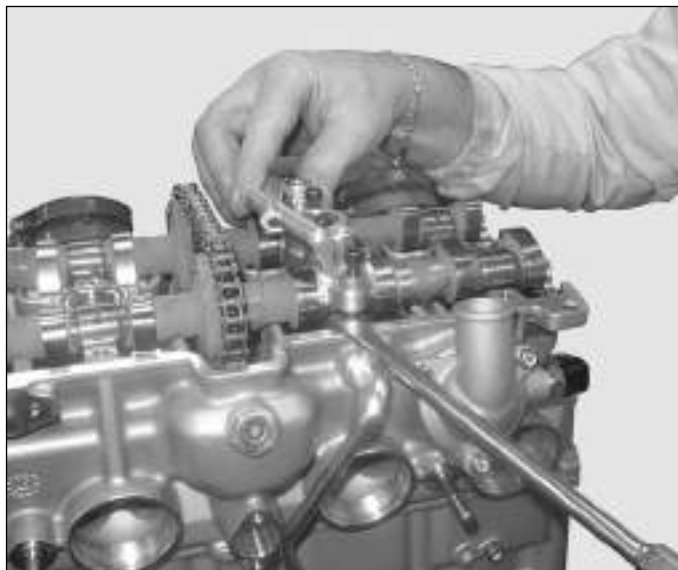
		A	B	C	D	E	F	G	H	I	L
Tightening torque	N-m	12	8	8	8						
	Kg-m										
	ft-lb										
Thread blockers		Strong	Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

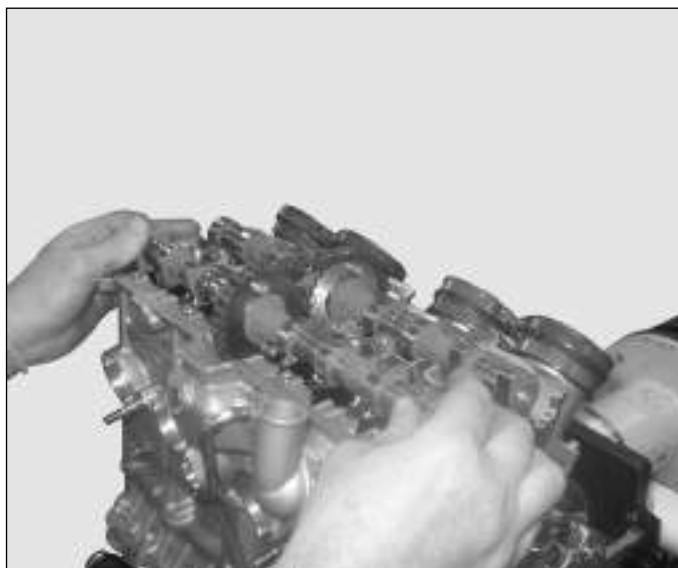


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In order to facilitate the detachment of the stands use a rubber hammer or delicately the end part of a flat screwdriver.



Slightly rotate without force the unloaded end of the gearshaft shifting it from its slot; by doing so, the tension on the distribution chain will loosen.



G Release the distribution chain.
First remove the unloaded end of the gearshaft. Fasten the distribution chain with copper thread in order to retrieve it during the following procedure.

Remove the inlet end of the camshaft.

Remove the first link block for the distribution chain by using the tightening screws.

In case it should be necessary to substitute the distribution chain at the expected mileage (see the programmed maintenance chart), it is advisable also to substitute the gears on the camshaft (ASP n° A3983 - SCA n° A3984).

In this case carefully degrease and use LOCTITE 648 on new n°62726 screws locking them at 12Nm.

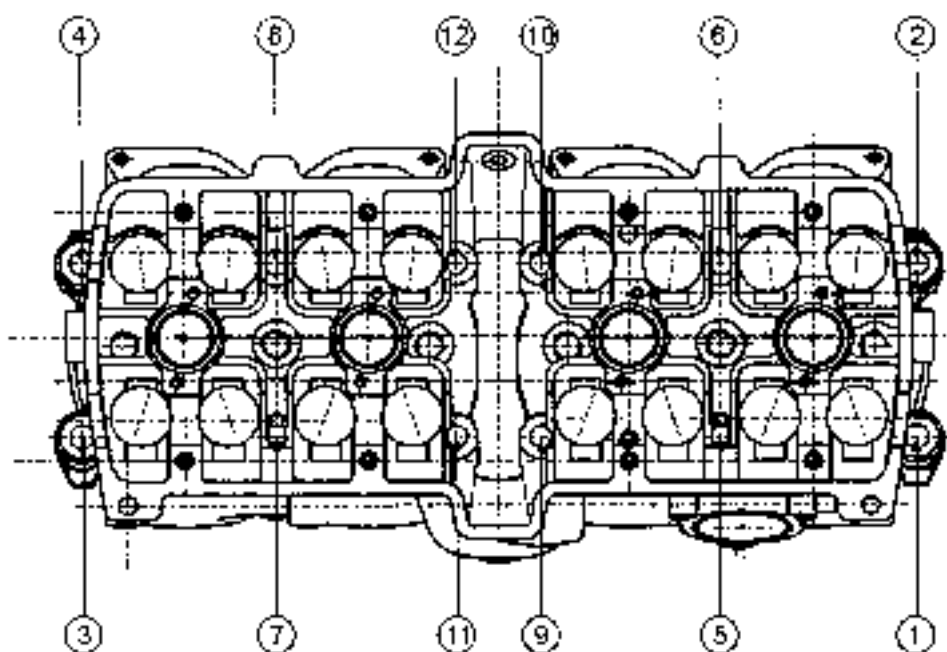
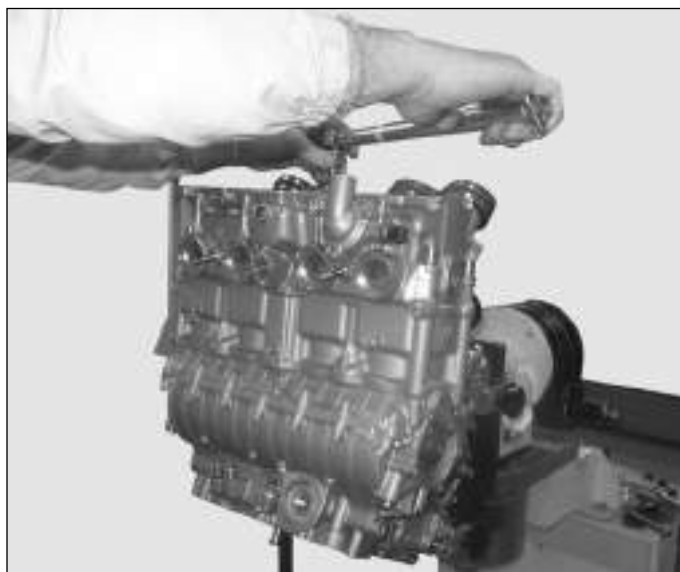


NOTA Gears on camshaft as well as fixing screws can be updated to MY'04 (nordlock - NL6SS type): in order to carry out this operation, refer to the MY'04 manual.

Remove the 12 tightening nuts from the head beginning from the external ones proceeding towards the internal ones, following the sequence indicated in the figure.



On each encarcement there is a washer. Be carefully no to let it fall into the motor, you may block the holes with clean rags.





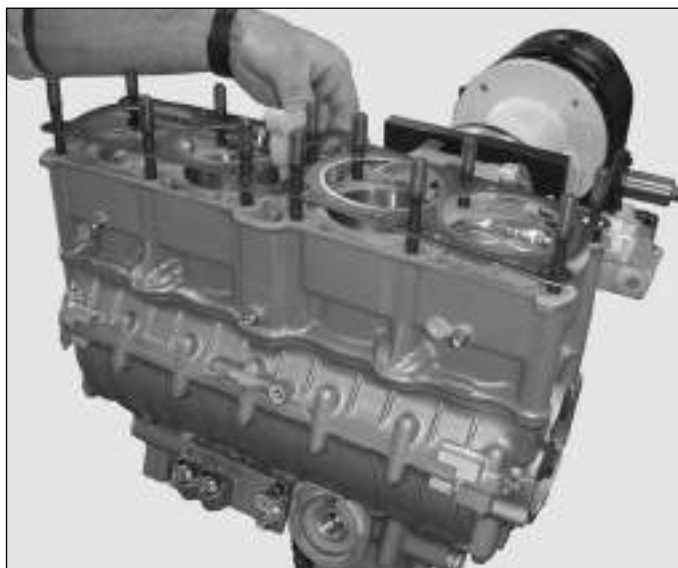
Engine F4 BRUTALE MY 2003

Remove the head and place it onto a clear place



Remove the gasket which will be substituted during reassembly.

Avoid placing the head upside down.



Inspection of the head group

Remove carbon deposits from the combustion chambers. Clean away eventual encrustments from the canalizations of the cooling liquid. Check to be sure that there are no cracks and that the holding surfaces are free of crevices, runs or any other kind of damage.

Verify the planarity of the stroke surfaces.

Verify the perfect state of the spark plug threads

Head assy assembly

To execute this operation you need the following special tool:

- A) n° 94793 piston / cylinder plane distance measuring tool

Place the new gasket on the cylinder plane.
The gasket is of the same thickness of the one installed before if no parts replacement occurred.

If replacement is necessary you'll need to measure the piston / cylinder plane distance with the n° 94793 tool, tightening the head nuts at 12 Nm. The choice is made following table below:

Piston/cylinder plane projection	Type of gasket
0.55-0.7 mm	Thick= >1.45 mm
0.39-0.54 mm	Medium= >1.30 mm
0.23-0.38 mm	Thin= >1.20 mm

The gaskets are different for the presence of the holes (1) shown in picture.

The presence of the holes identifies the thicker gasket as shown on the chart.

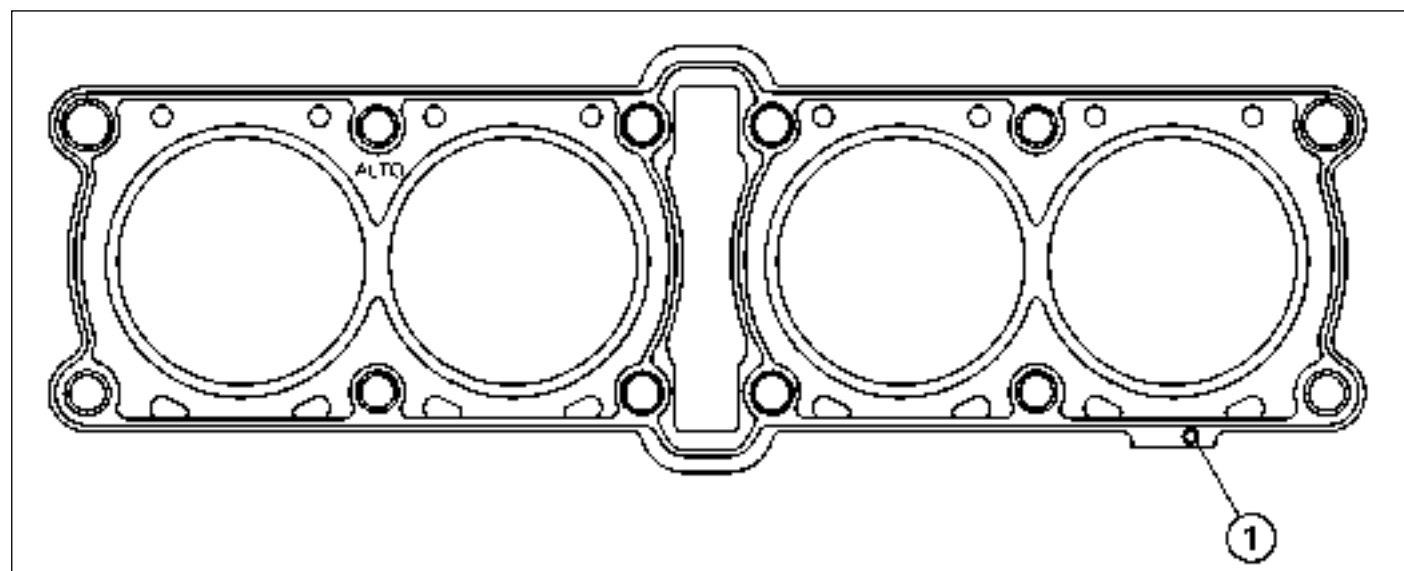
Holes numers	Compressed thickness	Part N°
2	1.20 ± 0.05 mm	8B0098679
NONE	1.30 ± 0.05 mm	8A0098679
1	1.45 ± 0.05 mm	800098679



K
12 Nm clamping



G





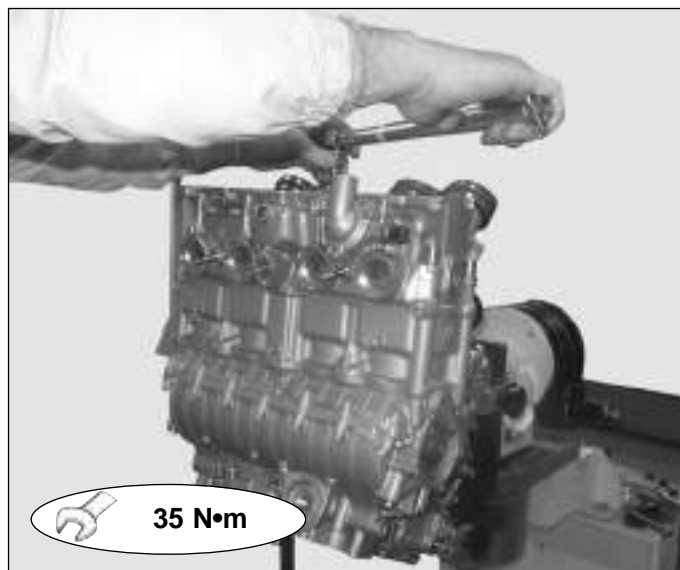
Engine F4 BRUTALE MY 2003

The gasket must be assembled with the letters ALTO on the superior facade and the protrusion towards the march gear.

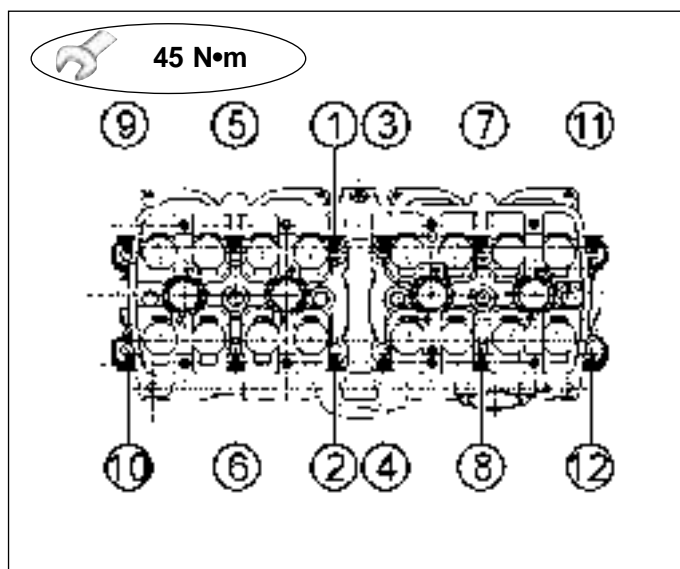
Insert the centering bushes between the head and the cylinder. Insert the washers on the encarcement if necessary with the help of a screw driver to guide them onto the internal encarcements.

Apply engine oil on stud bolt threading.

Screw the bolts with a brugle key and press them at a 35 Nm.

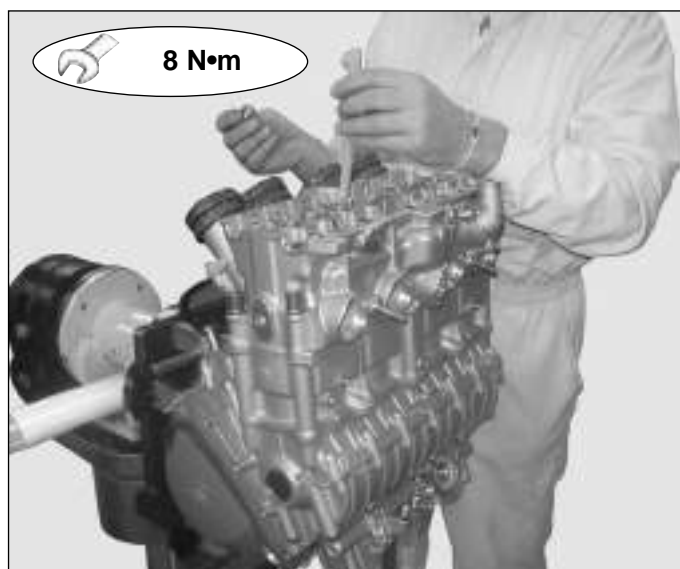


Tighten the bolts beginning with the internal ones towards the external ones following the outline indicated in the figure at 45 Nm.



Retrieve the distribution chain.

Insert the fixed sliding block with its screws and, after having carefully degreased it, tighten it at a torque of 8 Nm. with 243 LOCTITE



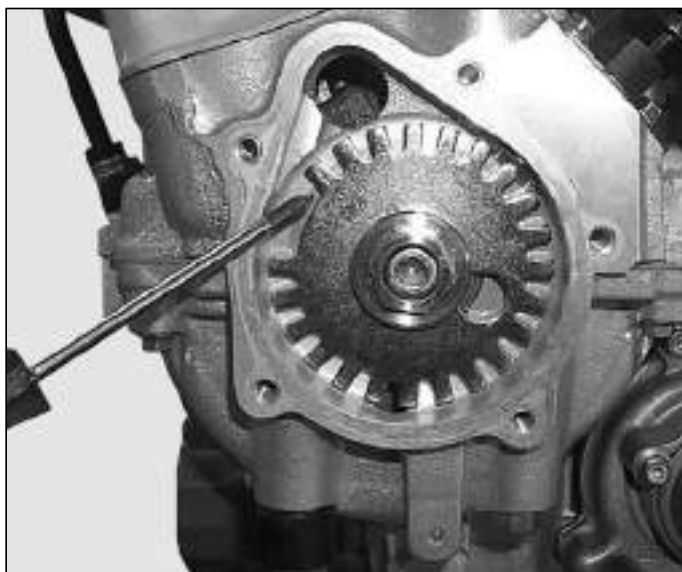


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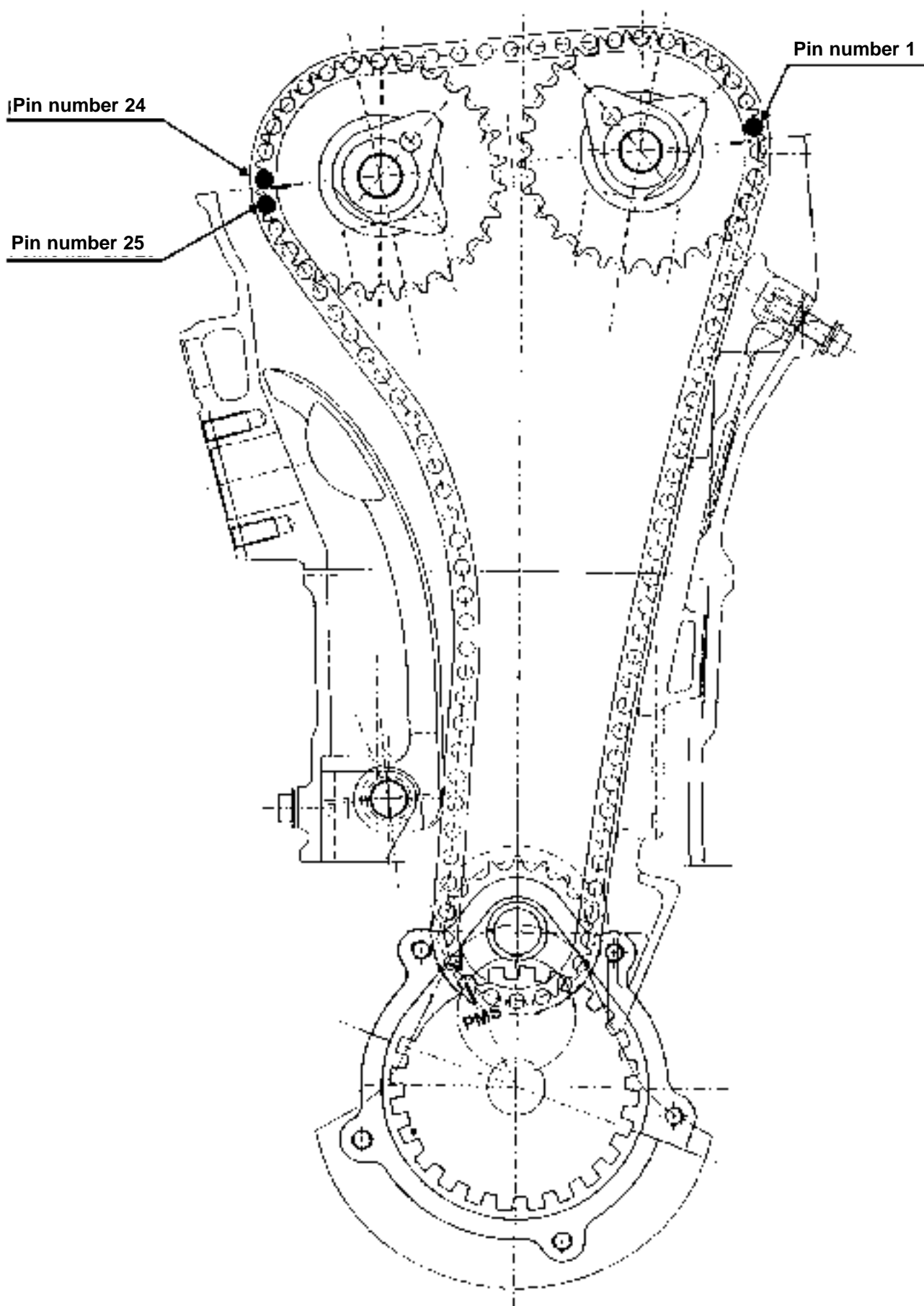
Continue with the setting as follows:

be sure that piston n° 1 is the MSP in burst phase; in this position "T" notch on the phonic wheel is in line with the reference notch on the bedplate.

Remove the copper thread from distribution chain, keep the chain tightened.



G



G

Insert the inlet camshaft so that the phase notch on the conveyer wheel is parallel to the head plane and facing the outside.

Insert the exhaust camshaft with the notch placed between the 24th and 25th chain distribution gudgeon, beginning to count from gudgeon after the inlet camshaft notch.

Check the correct position of all the O Rings under the head stands.



Position the n°2 and n°3 stands, referring to the numbers towards the inlet end;

Position the n°1 and n°4 stands,

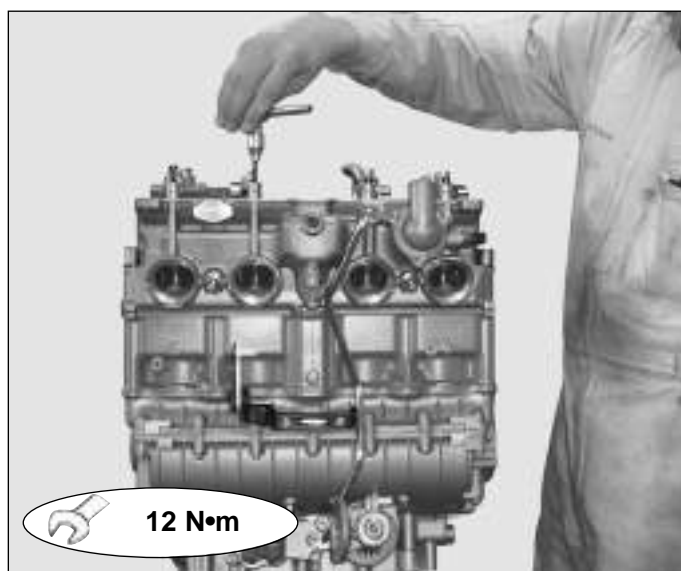
Bring the screws together manually hexagonally embedded.



Before tightening stand screws be sure that the chain tensioner is assembled.



Do not tighten the stand screws if the reaction springs are charged. Appropriately turn the camshaft so that the stand springs of which are to be tightened are uncharged and that the cams are positioned on the base radius.



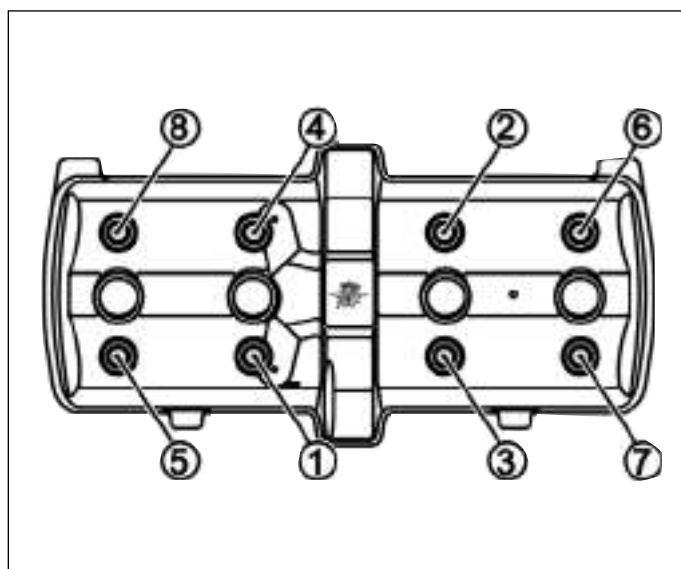
Progressively move the internal hexagonal screws close. Tighten the screws at a torque of 12 Nm., always beginning from n°2 and n°3 stands.

Check to be sure that the valve cap gaskets are in good condition.

Apply a layer of gasket 5552 silicone on the semi moons on the head in correspondence with the camshaft.

Position the valve cap.

Manually position the screws, thus tighten at 8 Nm.





Engine F4 BRUTALE MY 2003

Place the adduction oil tube at the head greasing the O-Rings.



G

Dismounting cylinder head pieces

In order to carry out this procedure the following tools are necessary:

tool n° 94796 to disassemble valves

tool n°95179 to remove semi cones



Each piece relative to the same valve (cup, spring, semi cone, etc.) must be reassembled onto the same valve from which it came off.

Remove the cylinder head as indicated the paragraph "cylinder assay removal".

95179

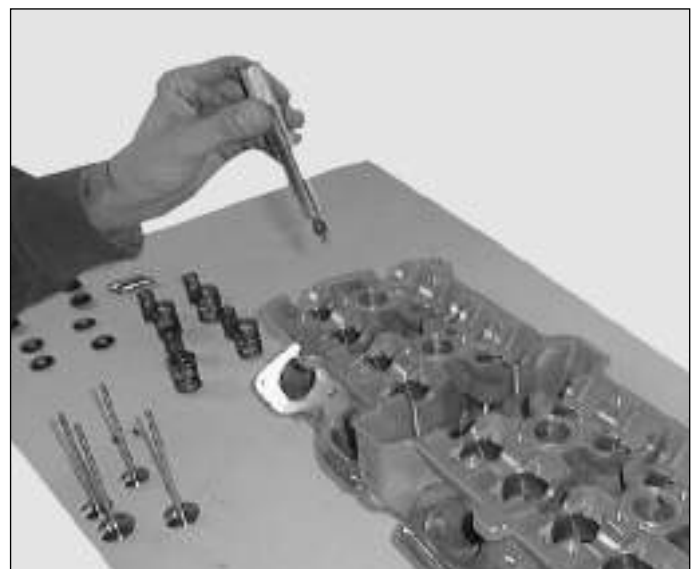
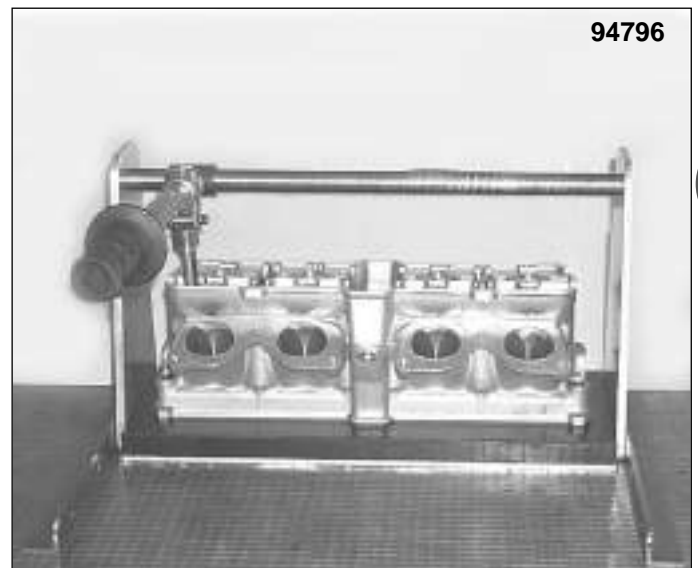
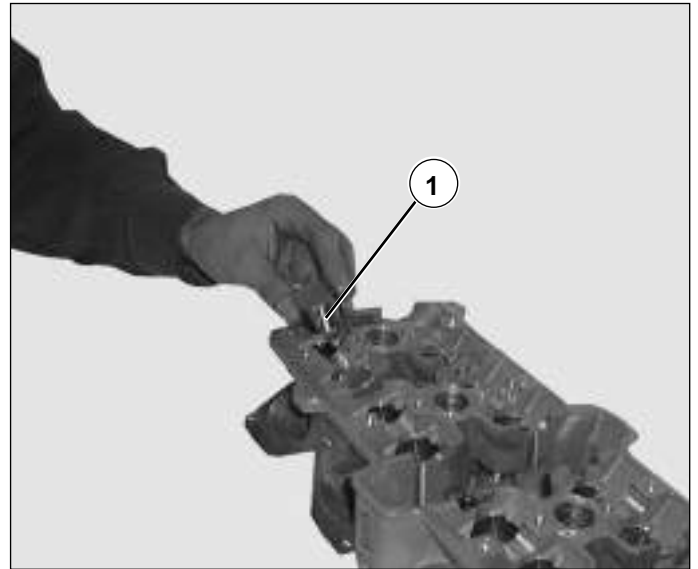




Engine F4 BRUTALE MY 2003

Valve removal

- A) Take out the cups (1) with the help of a magnet and number them with a marker so as to reassemble them in the same position.
- B) Remove the tablets (2) of play adjustment with a magnet and place them inside the relative cup so as to reassemble them in the same position. To remove the semi cones (3) exclusively use tool n° 95179 so as to avoid bending the valves:
- C) Assemble the head on tool n° 94796
- D) Hammer on the superior disk with a rubber hammer to unblock the semi cones
- E) Press the springs on the superior disk
- F) Take out the semi cones with a magnet
- G) Slowly release the disk pusher.





Engine F4 BRUTALE MY 2003

Then remove in the following order:

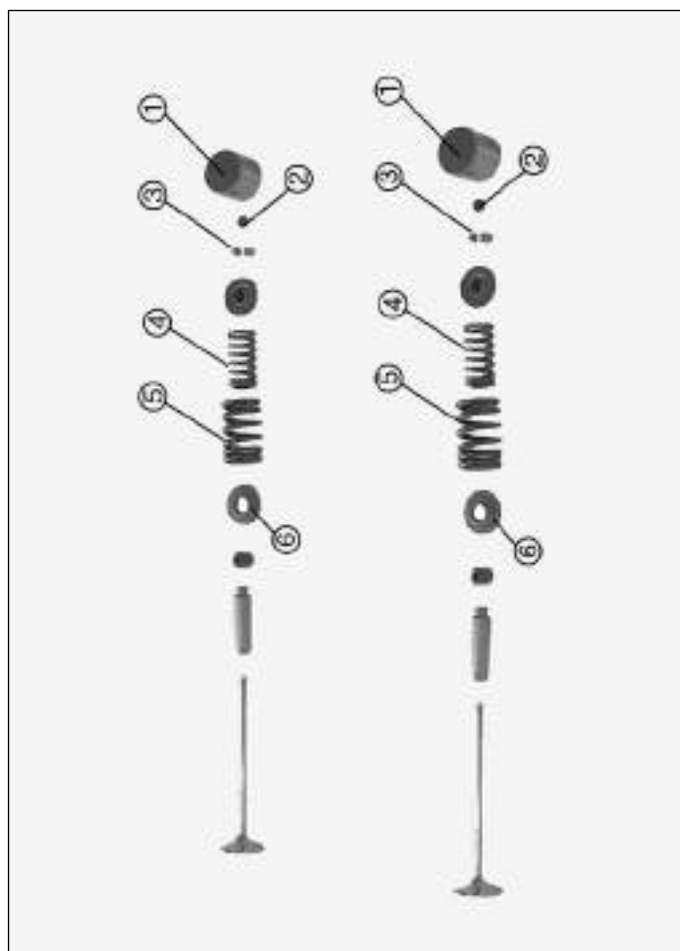
A) Semicones

B) The 2 coaxial springs (4 and 5);

C) If necessary remove the rubber holdings using tool n°94798

D) Remove the inferior disk more grazingly (6)

E) Slide the valve out of the combustion chamber



G

Maintenance of the valve slot

Check the stroke surface [A] between the valve [B] and the slot [C] : no traces of pitting or cracks must appear. Measure the external diameter [D] of the stroke surface on the valve slot.

If this should appear to be too elevated it is possible to repair the slot.

External diameter of the stroke surface of the valve slot

Standard : exhaust $24.6^{+0}_{+0.3}$ mm
inlet $28.6^{+0}_{+0.3}$ mm

Measure the width of the stroke [E] with a varnished gauge or with Prussian blue.

If it should turn out to be too wide, too thin or irregular it will be necessary to repair it.

Area thickness of the stroke STD

standard : exhaust $0.9^{+0}_{+0.3}$ mm [E]
inlet $0.7^{+0}_{+0.3}$ mm [E]

Limit value mm [E] exhaust 1.3 max
inlet 1.7 max

The repair must be carried out by milling the slots using the appropriate monocutting milling machines at 78° (1), 45° (2) and 25° (3).

Ten proceed with the grinding of the valves and verification of the holding.



Remove the minimum quantity of material from the slot.

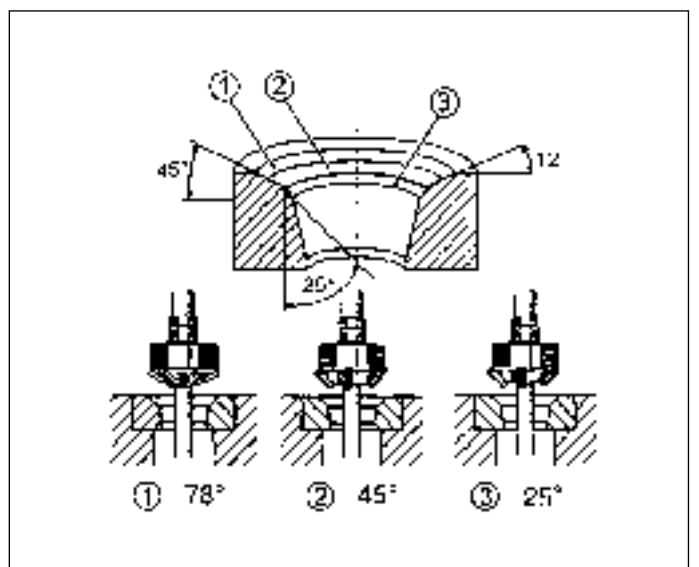
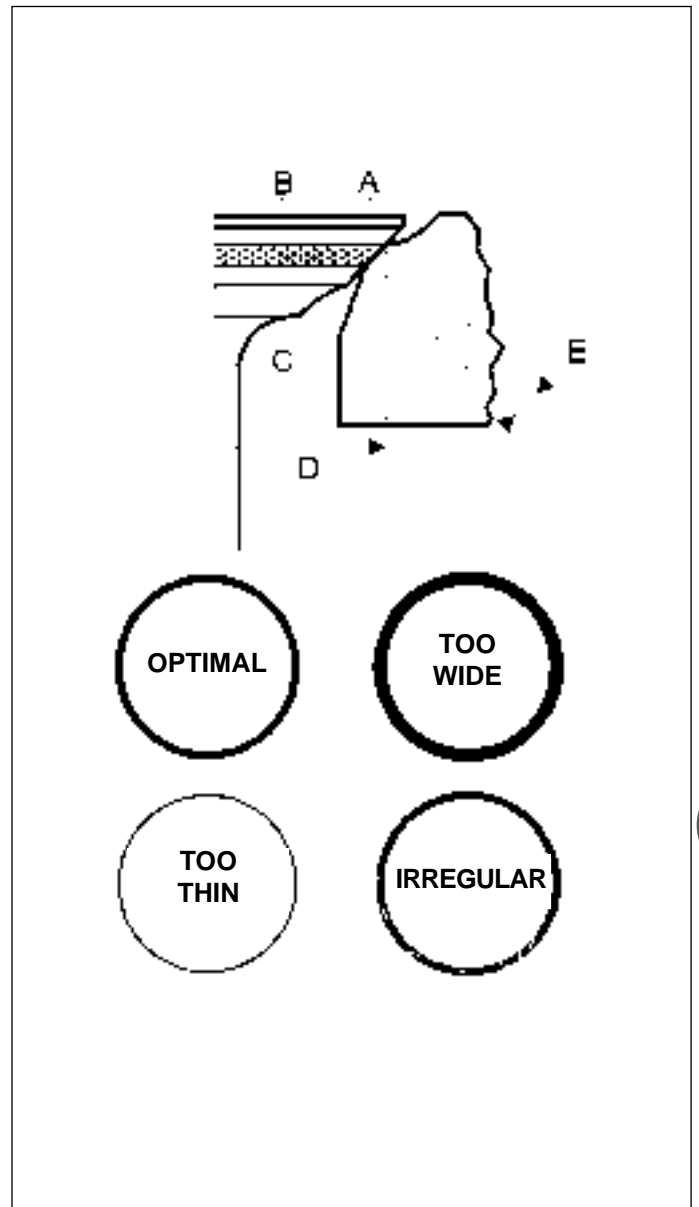
Inlet max 0.5 mm (vertical)
Exhaust max 0.5 mm (vertical)

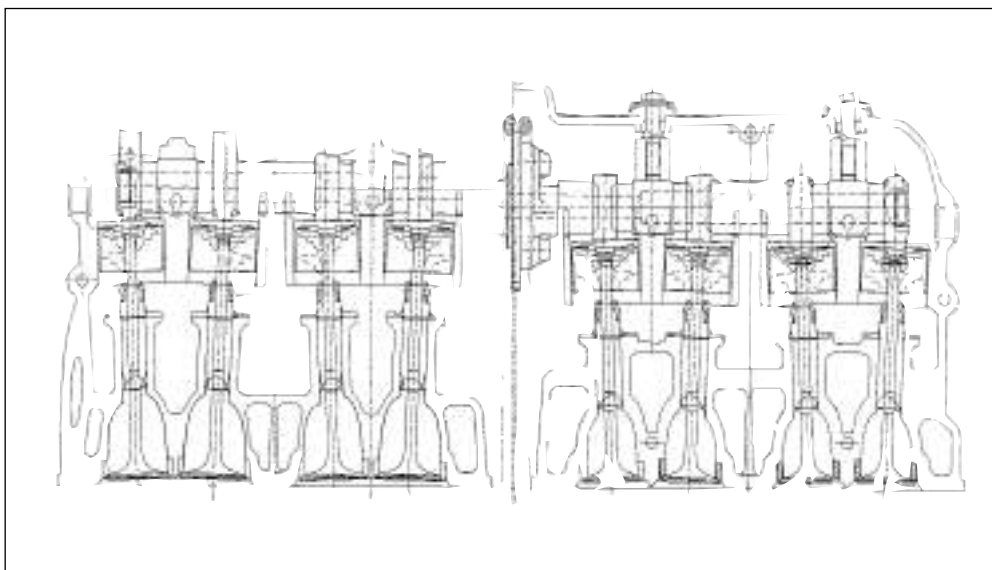
Verify that there is no leakage filling the inlet and exhaust of the gas canalization.

If so, check the quality of repair with Prussian blue.



When reassembling never use calibrated tablets of a thickness inferior to 1.6 mm.





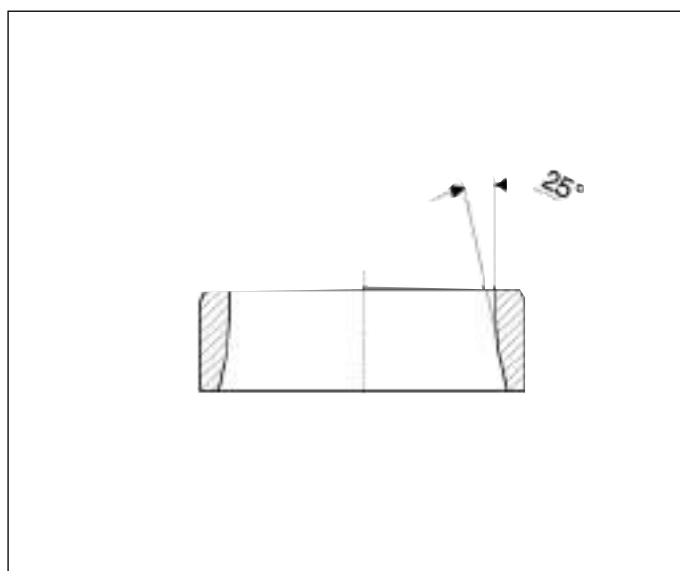
Substitution of the valve slot

The following tools are necessary for this procedure:
prick-puncher n°95319 for inlet slot
prick-puncher n°95318 for exhaust slot

Proceed as follows:

- Remove the worn slots carefully milling them so as not to damage the head lodging
- Check the lodging diameter on the head and choose the oversized valve slot considering that the **assembling interference should be 0.10÷0.15 mm.**
- Valve slots are furnished with an increased replacement part of 0.03 mm on the external diameter.
- Slowly and evenly heat the head at a max temperature of 180°C and cool the new slots with dry ice.
- Place the slots perfectly in frame into its lodging, using the special n°95319 prick-puncher (INLET) and n°95318 (EXHAUST)
- Let cool and proceed with the milling of the slots and grinding the valves referring to the following quotients:

Ø A	28,60 $^{+0.3}_{-0}$
Ø S	24,6 $^{+0.3}_{-0}$
[E]	ASP. 0.7 $^{+0.3}_{0}$ SCAR. 0.9 $^{+0.3}_{0}$





Engine F4 BRUTALE MY 2003

Valve guide check and maintenance

In order to carry out this procedure the following tools are necessary:

Control tampon n°95429
Tampon n°95320

valve stem-valve guide play: **0.01÷0.037 mm inlet**
 0.02÷0.047 mm exhaust
coupling limit: **0.08 mm inlet**
 0.09 mm exhaust
internal guide Ø limit: **4.55 mm**

Proceed with an accurate visual check of the valve guide.

In order to determine the coupling wear between guide and valve stem it is necessary to measure the play using a control tampon and micrometer.

NOTA The control tampon 95429 (Ø 4.55) must not pass.

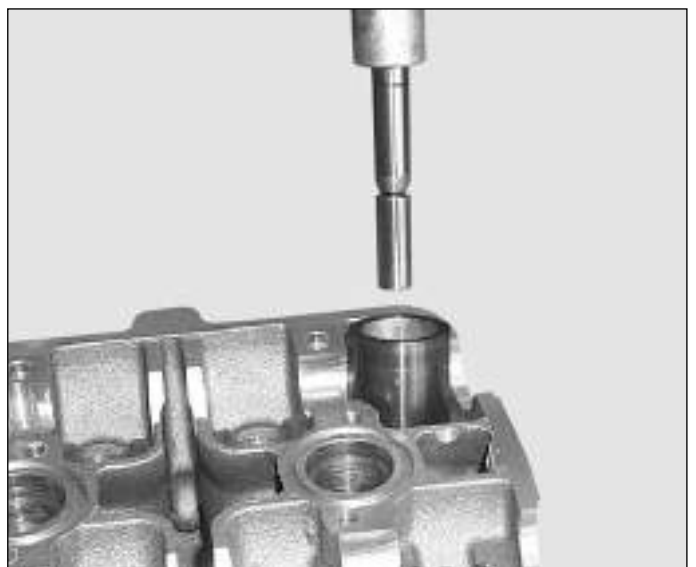
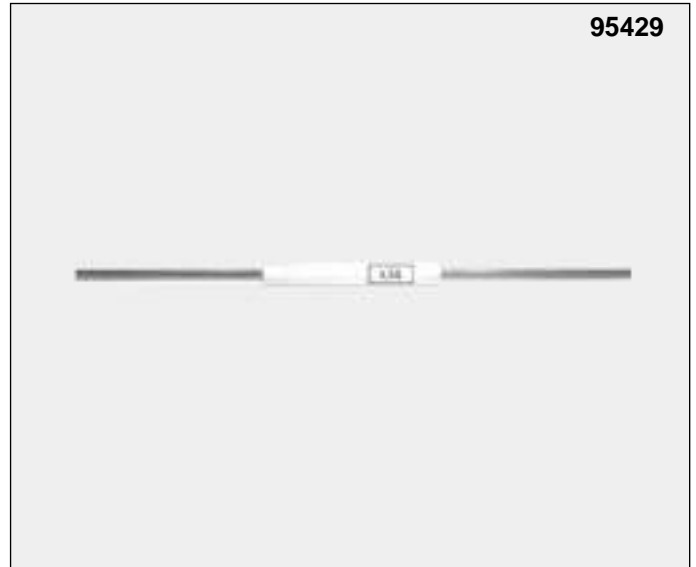
NOTA In the case of substituting the guide valve it is necessary to check and if necessary also substitute the valve.

Removal of the valve guide

After having removed the valves and rubber holdings as described in the relative paragraph, continue as follows: Slowly and evenly heat the cylinder head up to 100°. Using the pad No. - see note at the bottom of the page remove the valve guide. Continue with a visual check of the slot to verify its State.

For engines with numbers from 4911 to 5951, use the A2383 tool for removing the valve guides, and the A2385 tool for mounting the spare part. For engines with numbers higher than 5952, use the A2385 tool, both for removing the valve guides and for mounting the spare part.

95429





Engine F4 BRUTALE MY 2003

Guide valve installation

Assemble an oversized valve guide as follows:

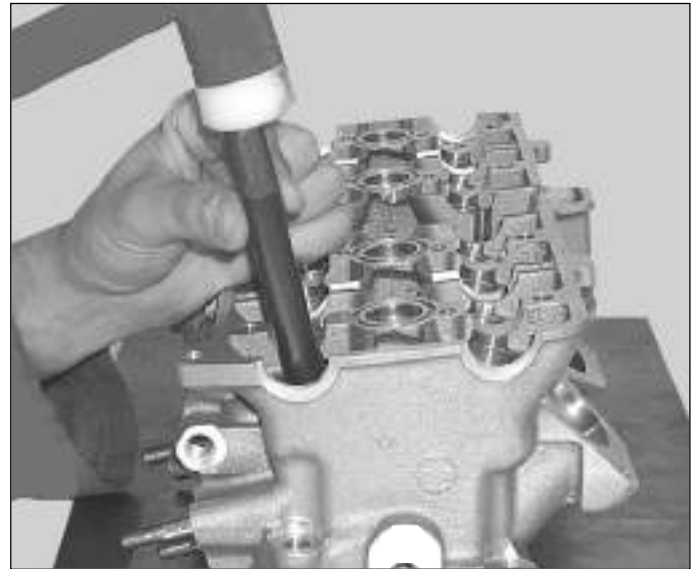
Oil the external valve guide surface.

Slowly and evenly heat the cylinder head up to 150°.

If necessary cool the valve guides with (N2) nitrogen liquid; or dry ice.

Insert the valve guide using the special tampon up to the stroke and let rest until the temperature has stabilized.

Check to be sure the valve slides freely in the valve guide otherwise coat it with a 4.5 H7 reamer or broach N°8000 A2625.



Valve

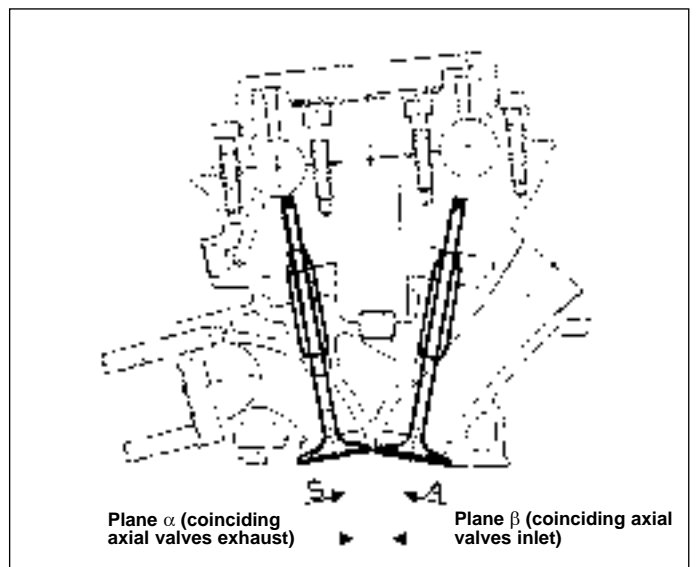
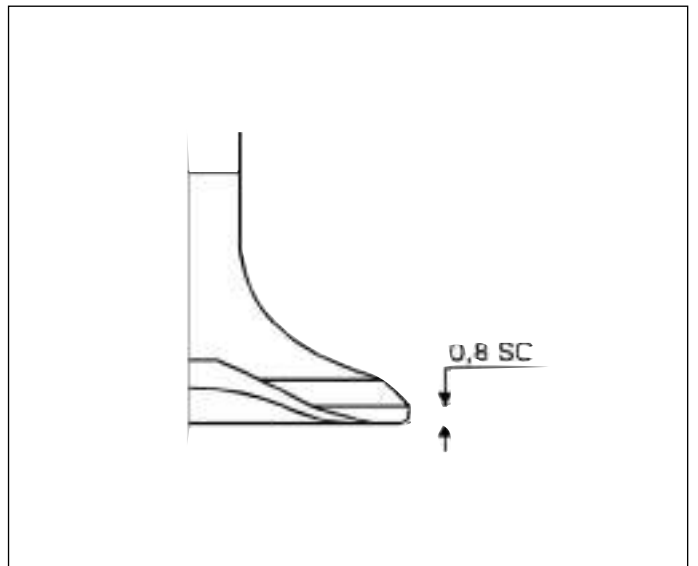
The stem diameters must not fall below:

4.470 mm inlet

4.460 mm exhaust

The minimum distance of the holding position at 45° on the valve plane must not be lower than 0.7 mm ASP.- 0.8 mm SCAR (see figure).

Check to be sure that the stem and the surface in contact with the valve slots are in good condition. No traces of pitting, cracking, deformations or traces of wear should appear. Verify that the stem is perfectly rectilinear.



Valve-guide valve coupling

Coupling play at assembly must be:

0.01 ÷ 0.037 mm inlet.

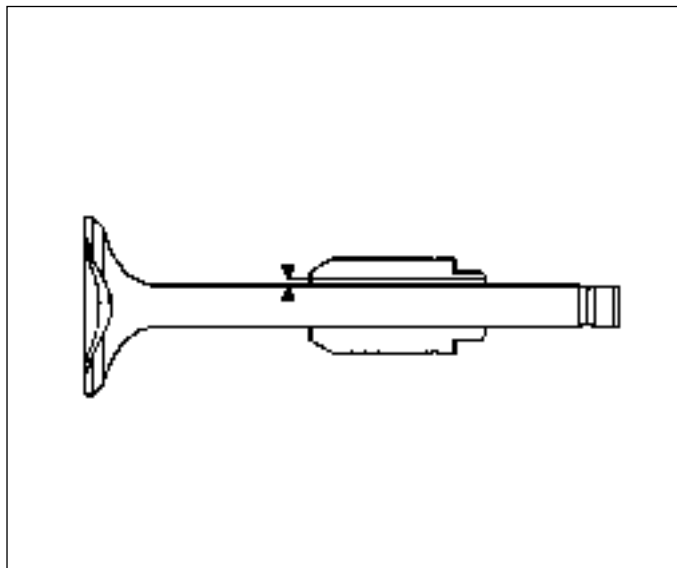
0.02 ÷ 0.047 mm exhaust

The maximum coupling limit permitted is even to

0.09 mm inlet

0.10 mm exhaust

If a major play should result, substitute valve and valve guide.



Springs

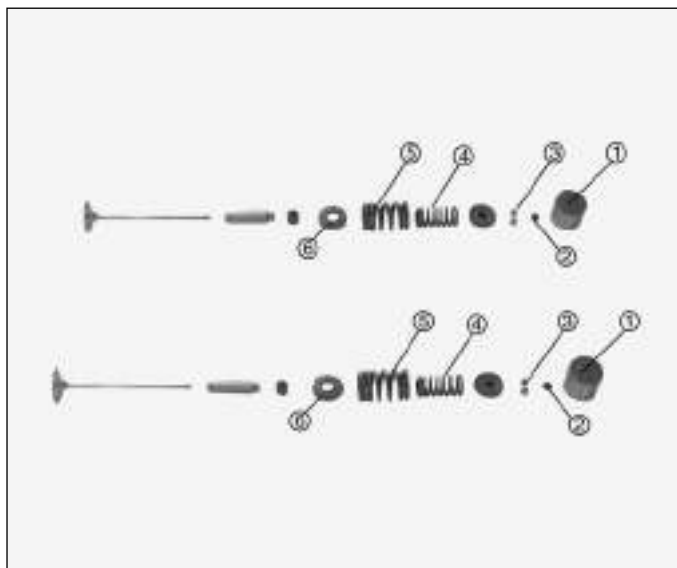
Check to be sure that the free value of length is not inferior to the suggested limit and in such case substitute the springs:

Internal spring l = 33.8 mm.

Service limit: 33.5 mm

External spring l = 37.9 mm.

Service limit: 37.5 mm



Valve reassembly

A) Carefully degrease the guide

B) Insert the inferior basement disk (6) and be sure that it is in beat.

C) Assemble the rubber holdings, always new, on the valve guide using tool n°95581;

D) Sprinkle the valve stem with oil.

E) Assembling the valve.

95581

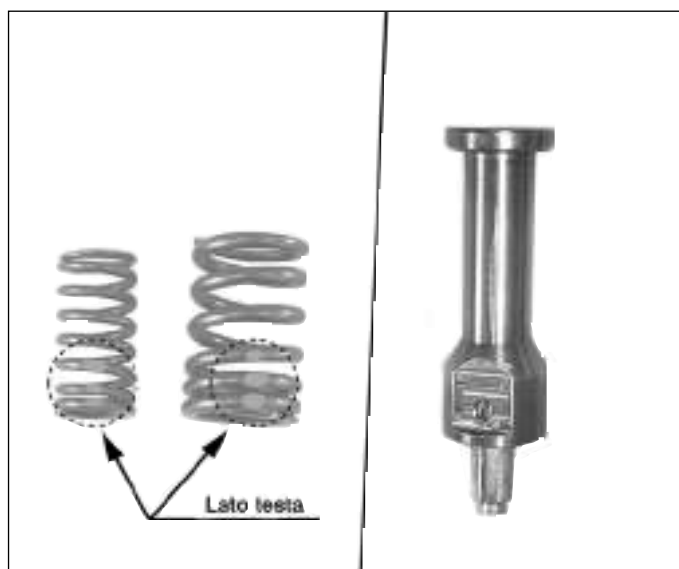




Insert in the order of:

- A) Insert the two coaxial springs
- B) Slide the semi cones into the superior disk slot and thus place the disk on the springs
- C) Assemble the head on the disassembling valve tool n°94796 and compress the spring with tool n° 95180 until the semi cones are inserted
- D) Using a rubber hammer strike a slight blow on the valve so as to place the semi cones.

NOTA Before placing the semi cones be sure that the head is not resting on a plane in order to avoid distorting the valve. Place it onto two bases which allow the valve to move.



- E) Insert the tablet of the correct thickness and lubricate its surface
- F) Make sure it easily turns in its slot
- G) Insert the cup after lubricating the slot

Insert the cylinder head as described in the paragraph "Head assay assembly".



Regulating valve play

Verify that the spark plugs have been disassembled.



Should this procedure be carried out with the head assembled on the motor, block the spark plug holes with clean rags and assemble plate n°95191 to avoid the pieces accidentally falling into the chain distribution opening.

A) Rotate the drive shaft until completely unwinding the springs relative to the valves on which intervening (MSP in burst phase).

B) Measure valve play with a thickometer.

Inlet valve play	Exhaust valve play
0.15 ÷ 0.24 mm	0.20 ÷ 0.29 mm

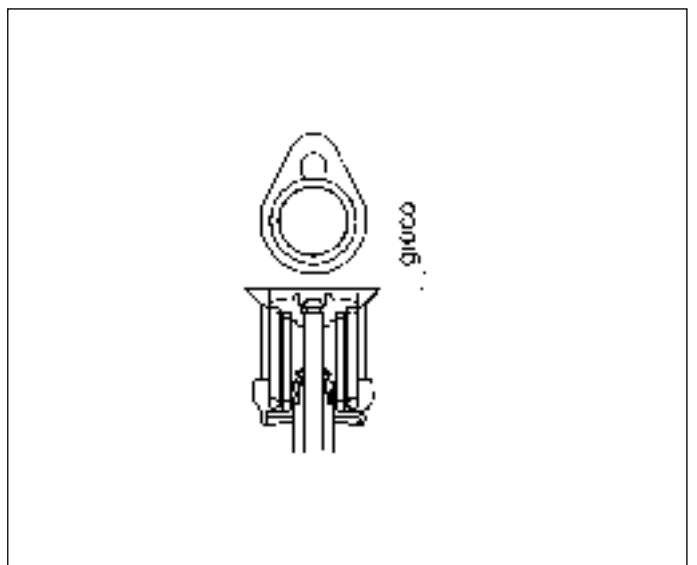
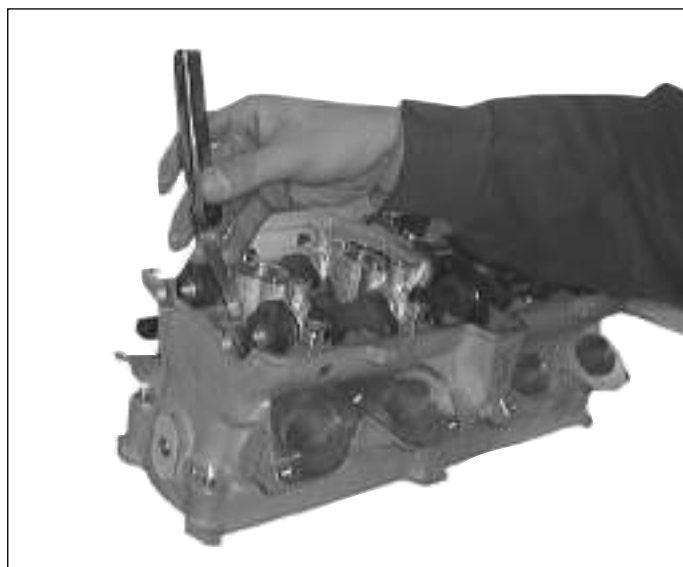
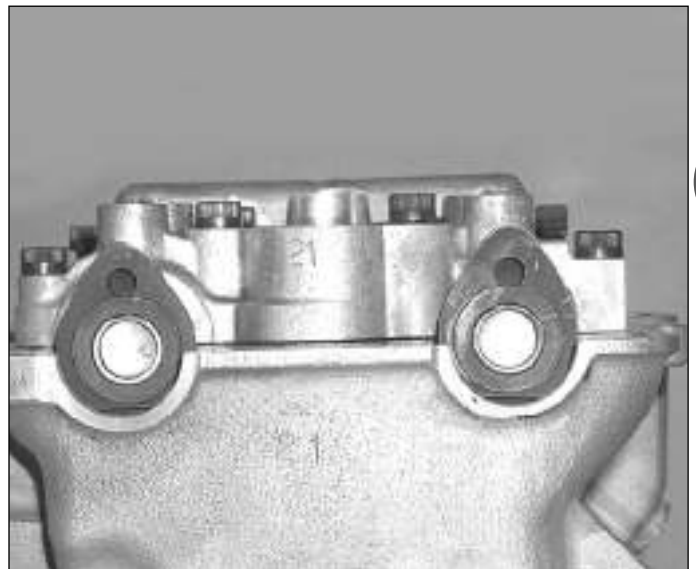
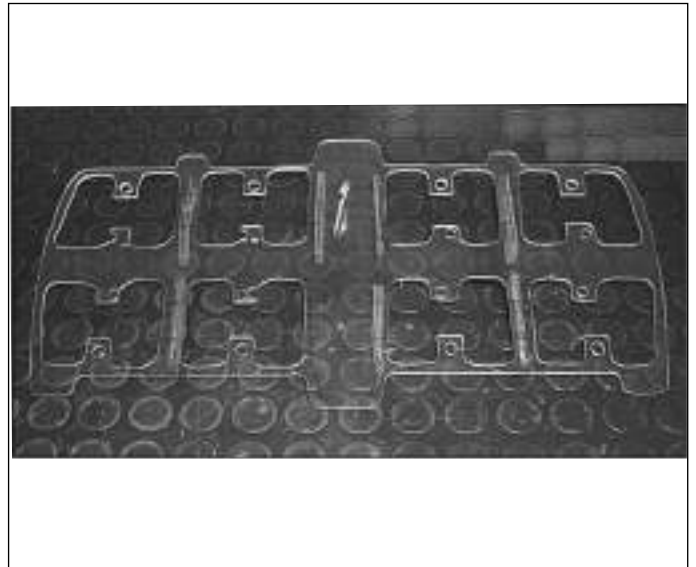
C) Calculate the D difference between the compared play and optimal play shown on the chart

D) Read the value of S thickness on the tablet;

E) Choose a new tablet with an S+D thickness.



During reassembly never use a tablet with a thickness less than 1.6 mm.





Engine F4 BRUTALE MY 2003

Chain tensioner

Remove the central screw-cap and withdraw the spring and the pin.

Remove the screws fixing the chain tensioner to the head.

Remove the chain tensioner.

Disassembly the chain tensioner and check the correct working of each part.

The internal pin must run clearly and the inner spring must give a quick response.

Replace the assembly in case of malfunction.

If everything works properly lubricate the parts and install the assembly with the chain tensioner in the minimum extension position (all in the main body)

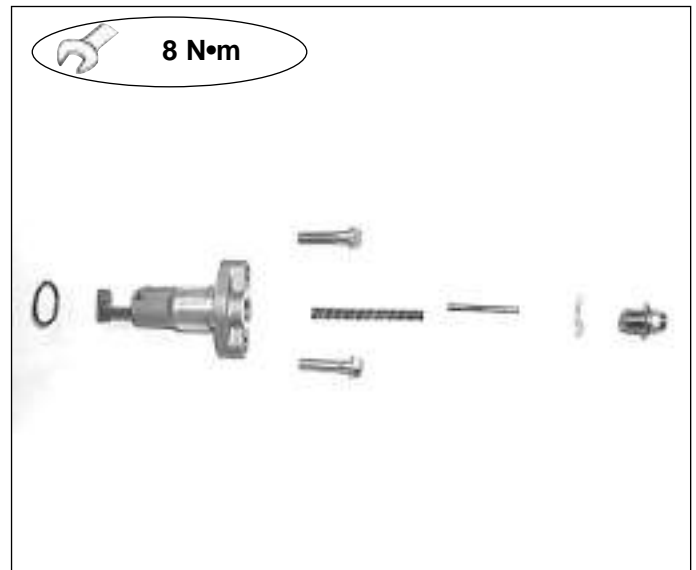
Install the chain tensioner body locking the 2 socket

head screws using a T wrench with a 8 Nm torque

Install in this order: the pin in the spring, the spacer and the screw cap.

Lock the screw cap by hand till you feel the tensioner extend, then lock it with a 8 Nm torque

Acting this way the chain tensioner is adjusted.





Engine F4 BRUTALE MY 2003

GEAR AND GEAR CONTROL



		A	B	C	D	E	E	F	G	H	I
Tightening torque	N·m	100	8	8	6	12 (M6)	25 (M8)	25			
	Kg·m										
	ft·lb										
Thread blockers		Medium	Medium			Medium	Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Disassembling gear group

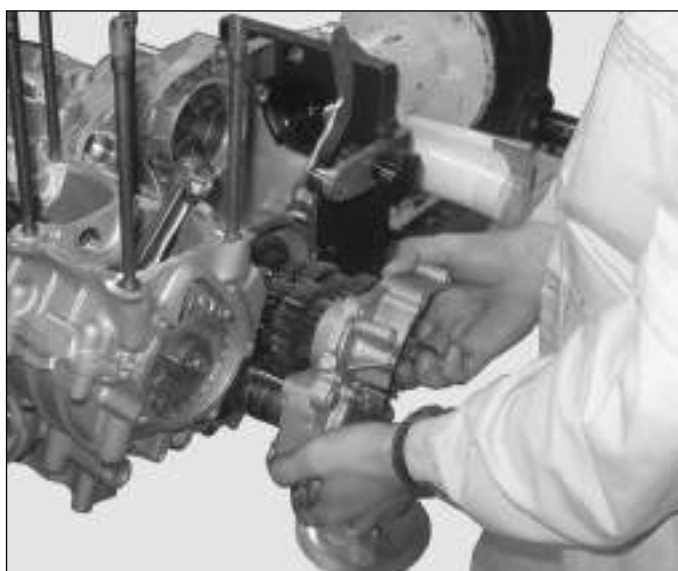
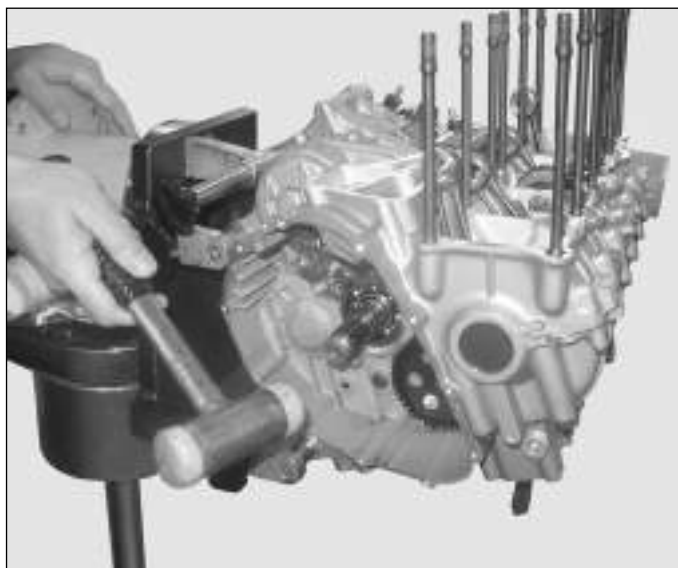
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.

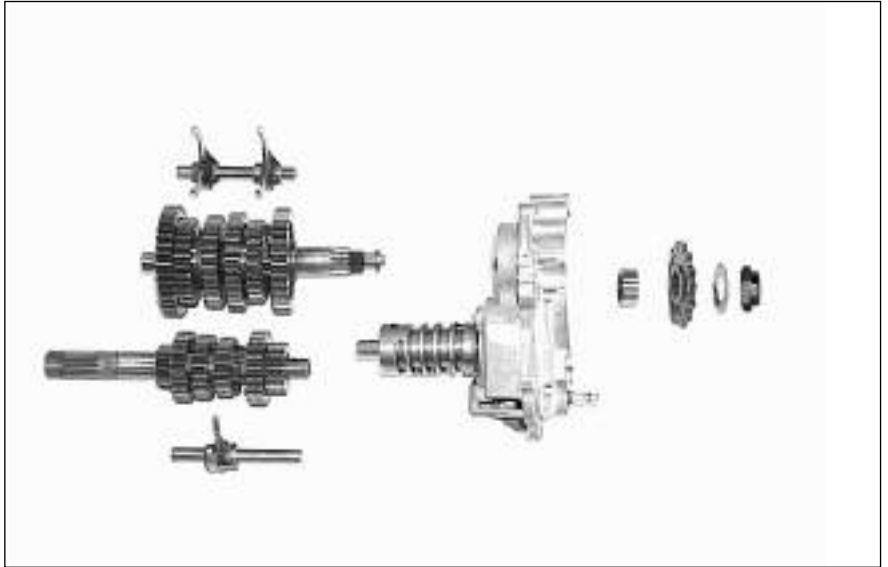


Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear of irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

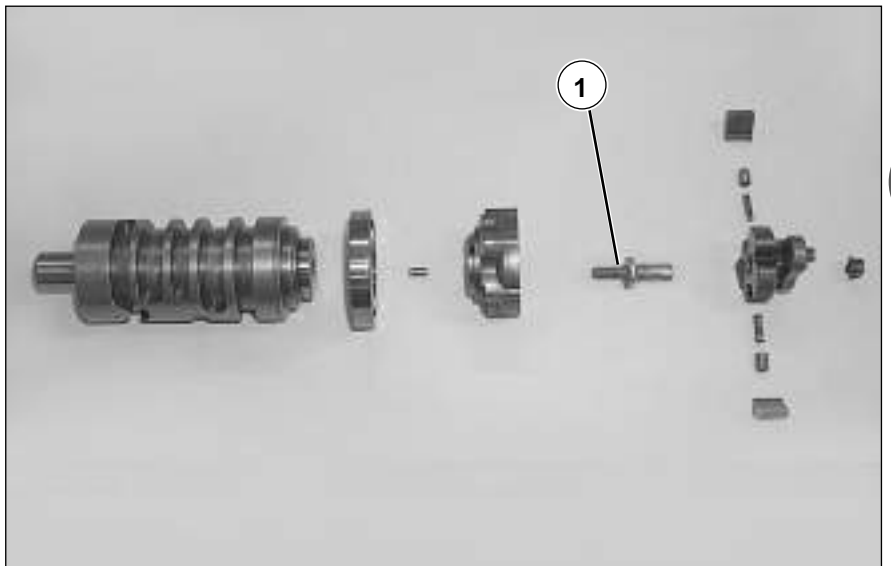
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.



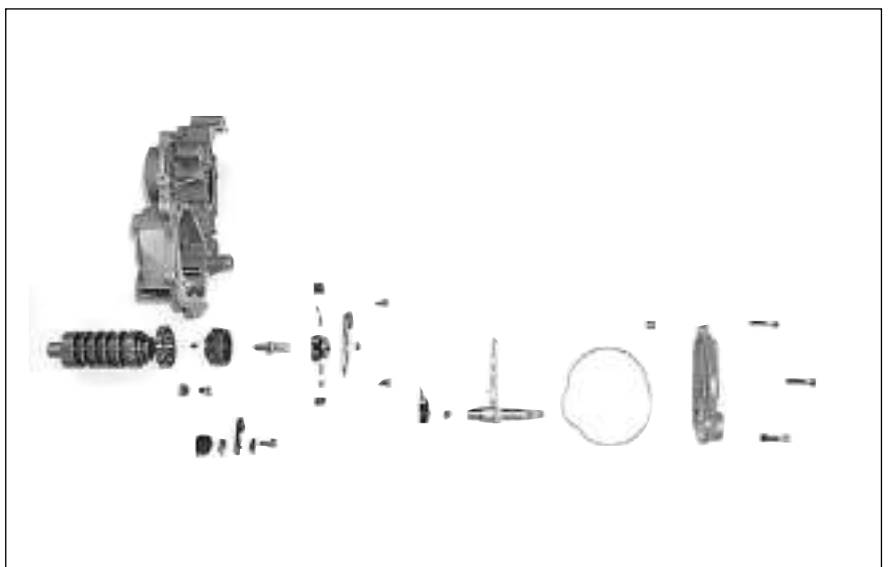
Verify the gear locker pawl free movement.

Reassemble the various parts by acting in the opposite way.



Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly.

Lock all the screws at a 10 Nm torque but the screw 1, needing a 25 Nm torque.



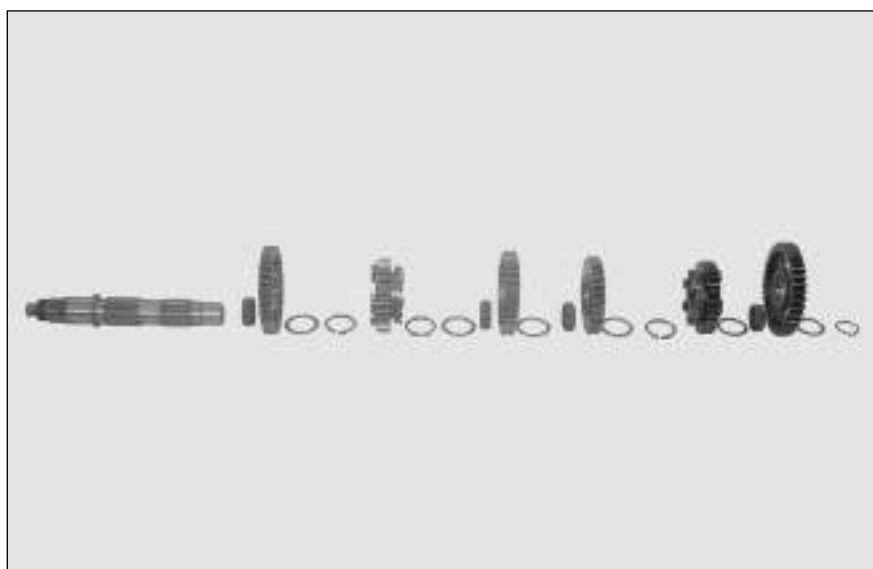
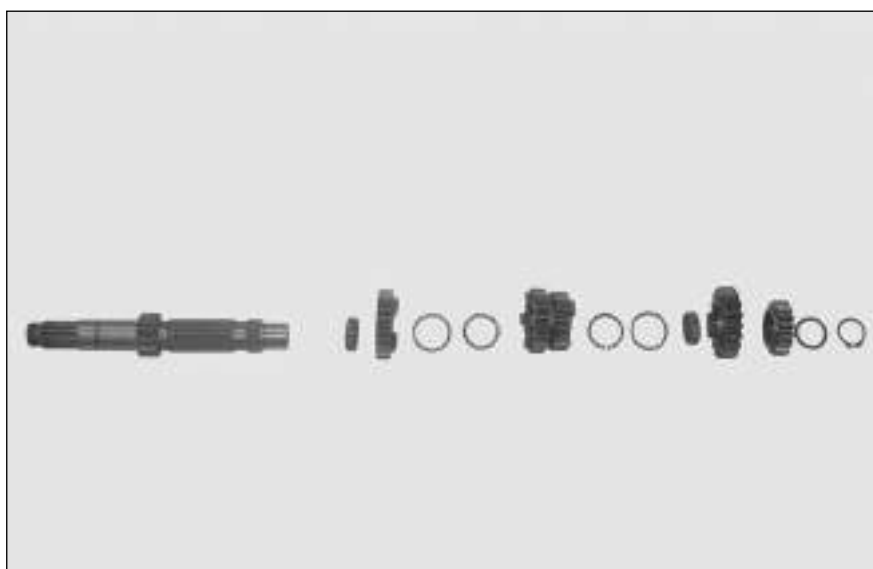


Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.





Engine F4 BRUTALE MY 2003

Gear group revision

In order to carry out the following procedure the following special tool is necessary:

Motor simulation utensil n° 94792 (for $\varnothing 25$ bearings) No. 8000-94792 (engines with registration numbers from F4A206446 to F4A309191 and from F4A410410 to F4A410760) engine simulation tool (for $\varnothing 27$ bearings) No 8A00-94792 (engines with registration numbers from F4A309192 to F4A30410409)

Disassemble the gear group from the motor and reassemble it on the special utensil n° 8000-94792 o n° 8A00-94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.

Gear selection forks

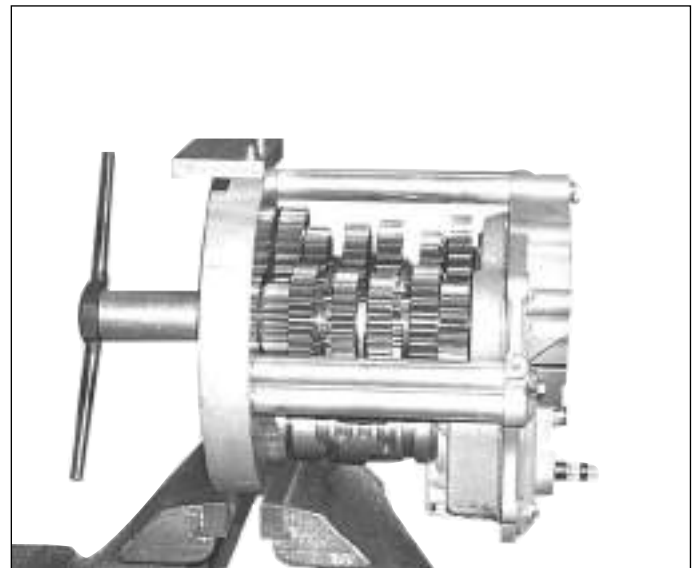
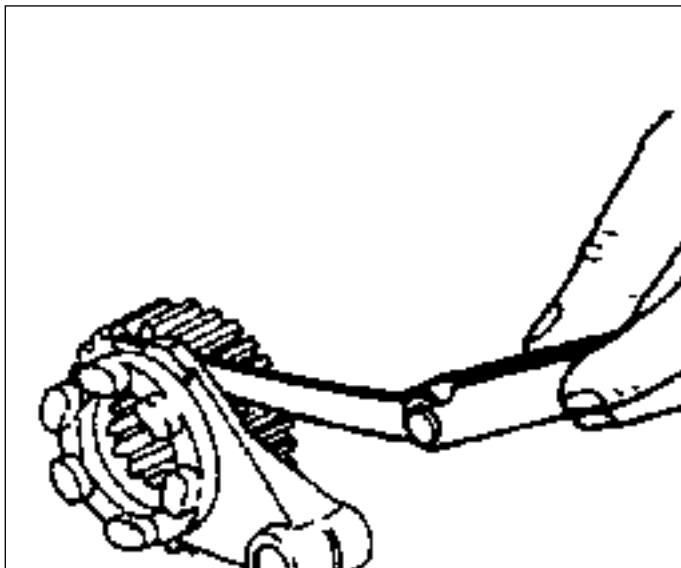
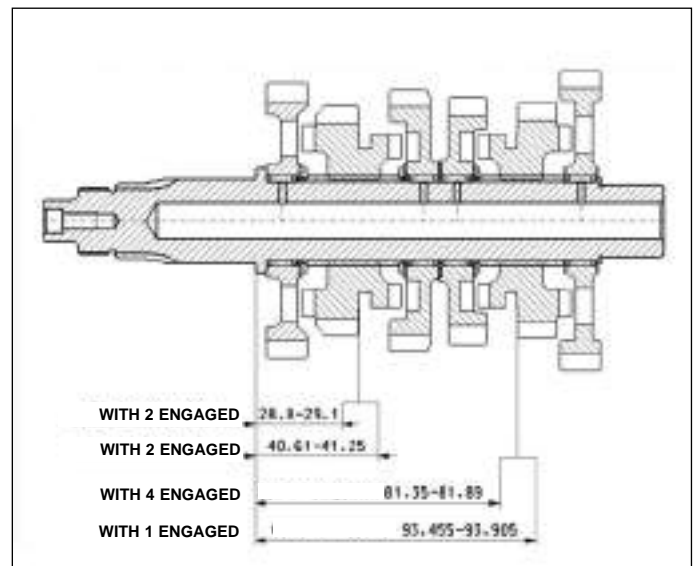
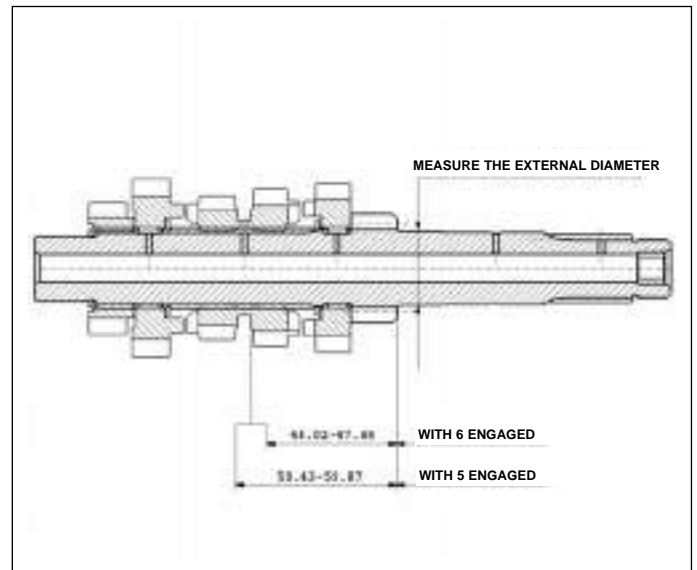
Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm	Primary
	4.6 mm	Secondary
Fork limits	4.65 mm	Primary 5-6 gear
	3.65 mm	Secondary 1-2, 3-4 gear

The fork must be able to move without force.

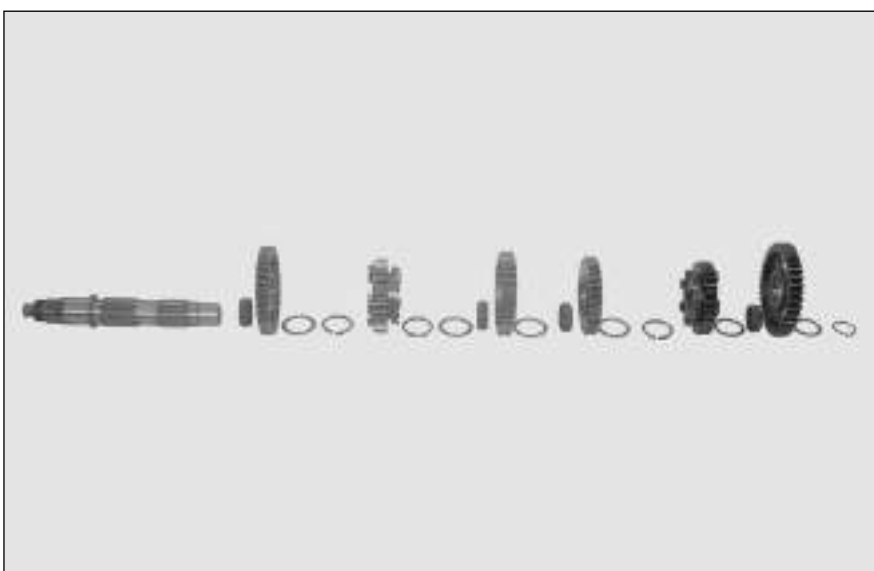
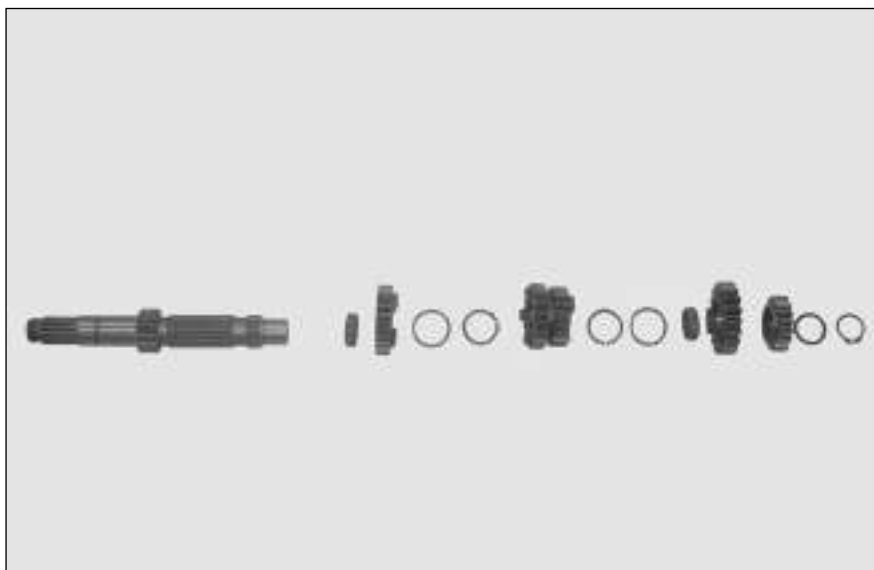
Grippage of the gears must flow without impediments and without excessive attritions.



Installation

To execute this operation you need the following special tools:

n° 8000-94792 o n° 8A00-94792 gear-box tool



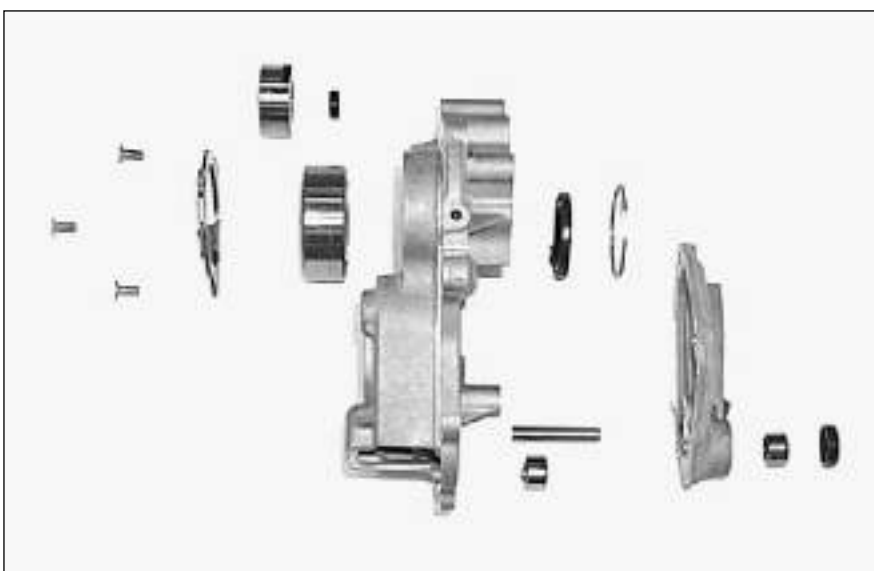
Reassembly the various parts by acting in the opposite way.

Install the 2 shafts on the n° 8000-94792 o n° 8A00-94792 engine simulation tool. Install a shift pedal and check the gear box is correctly working.

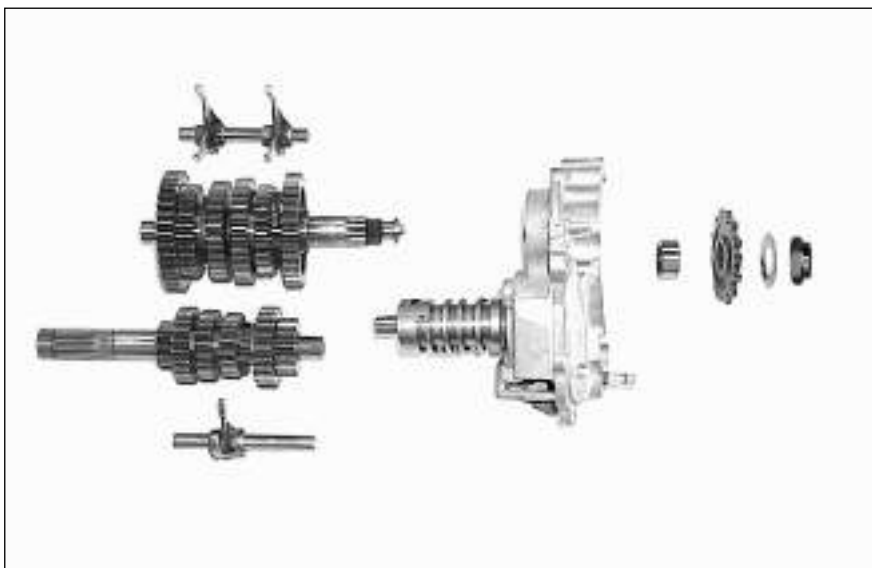
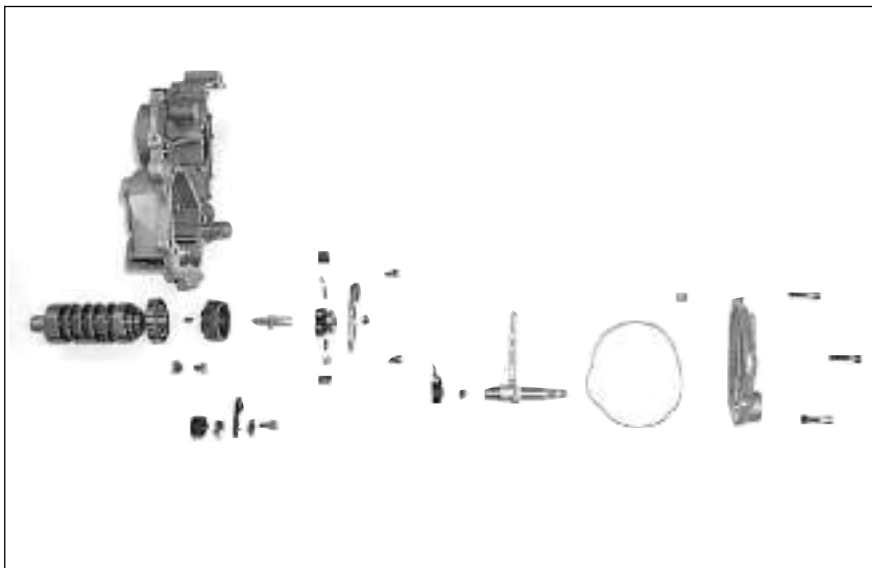


Always install a new washer under the pinion at reassembly. Carefully degrease the threads before reassembly.

Tighten the pinion nut at 150 Nm using a medium thread blocker (Loctite 243). Turn the security washer again so as to avoid the accidental unscrewing of the pinion nut.



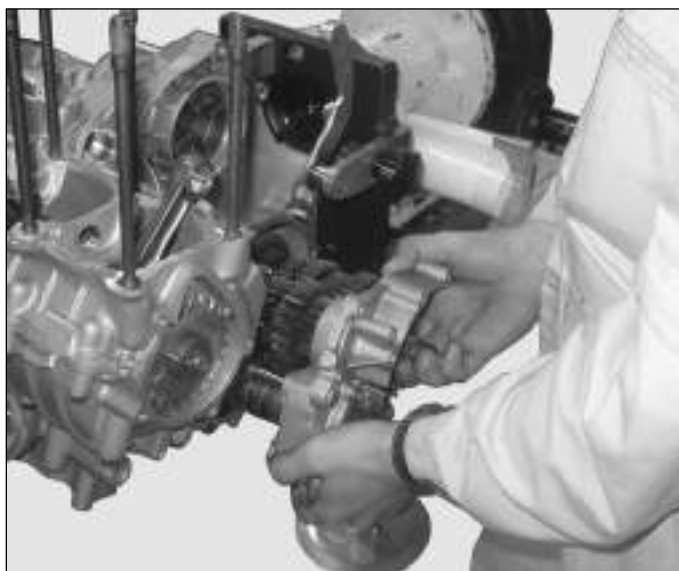
All the gears must be inserted and uninserted without stumbling.
In case of stumbling, verify that the axial play has been correctly restored.
With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to $0.2 \div 0.3 \text{ mm}$ placing it on both ends of the coupling.
The fork must be free.
Assemble the gasket on the internal end.



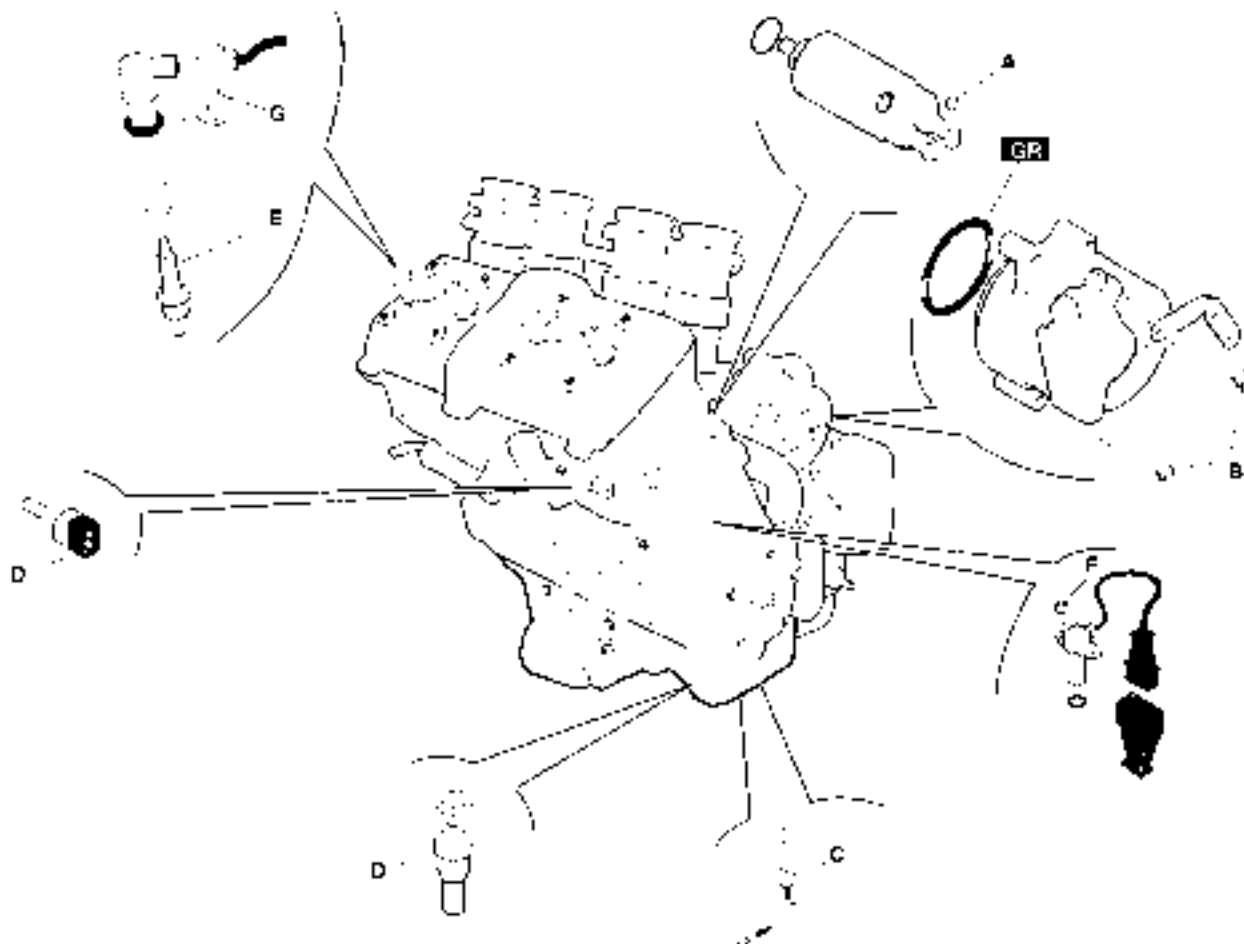
Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.



Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.



ELECTRICAL COMPONENTS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	25	10	22	12	6	8			
	Kg·m										
	ft·lb										
Thread blockers					Medium		Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Remove the pick-up from the phonic wheel.

Alternator

- Removal:

Working on the left side of the motor, remove the three alternators and the stiffening stirrup tightening nuts.

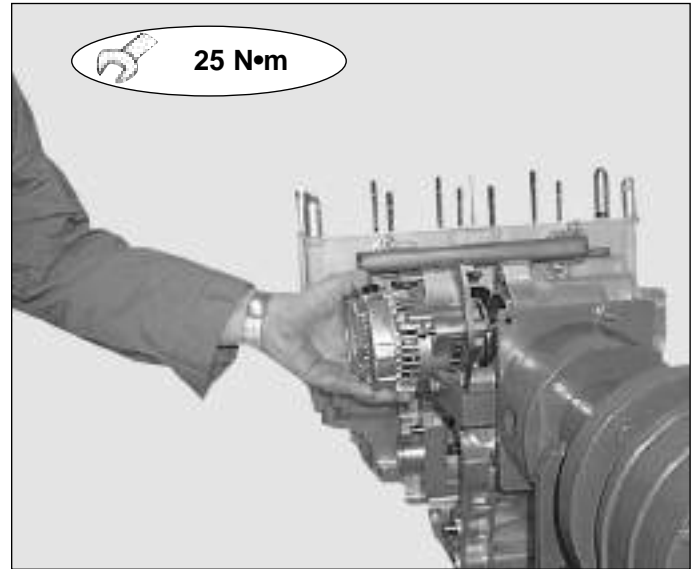
Slide the alternator out being careful not to let the rubber torsions fall .

Assembly:

Grease the torsions and O-Rings.

Insert the pallets together with the torsions.

Manually bring the screws together, thus tighten them at 25 Nm.



Starter motor



- Removal:

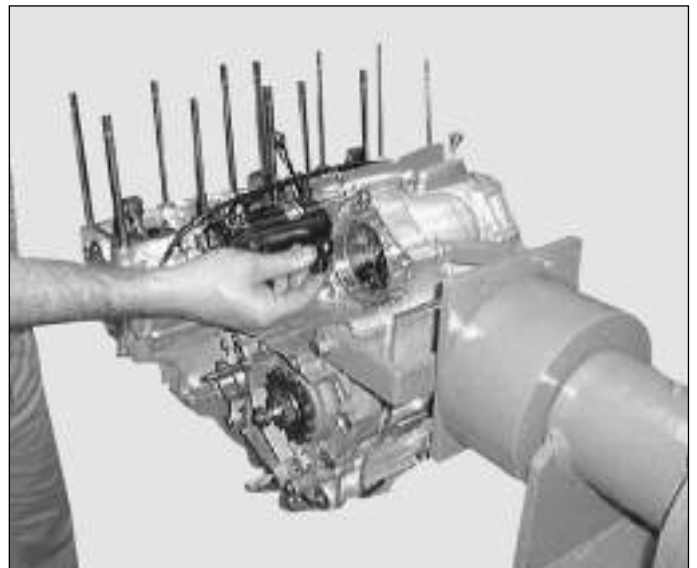
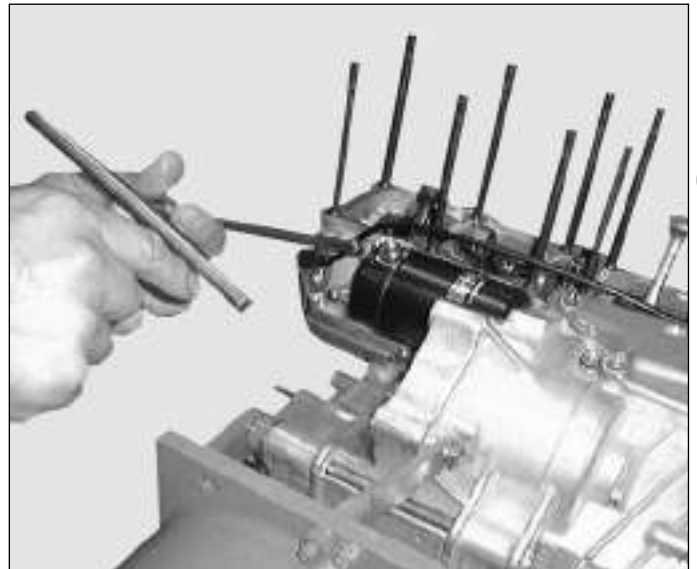
Remove the two tightening screws.

Slide the starter motor out, being careful not to damage the O-Rings on the shaft.

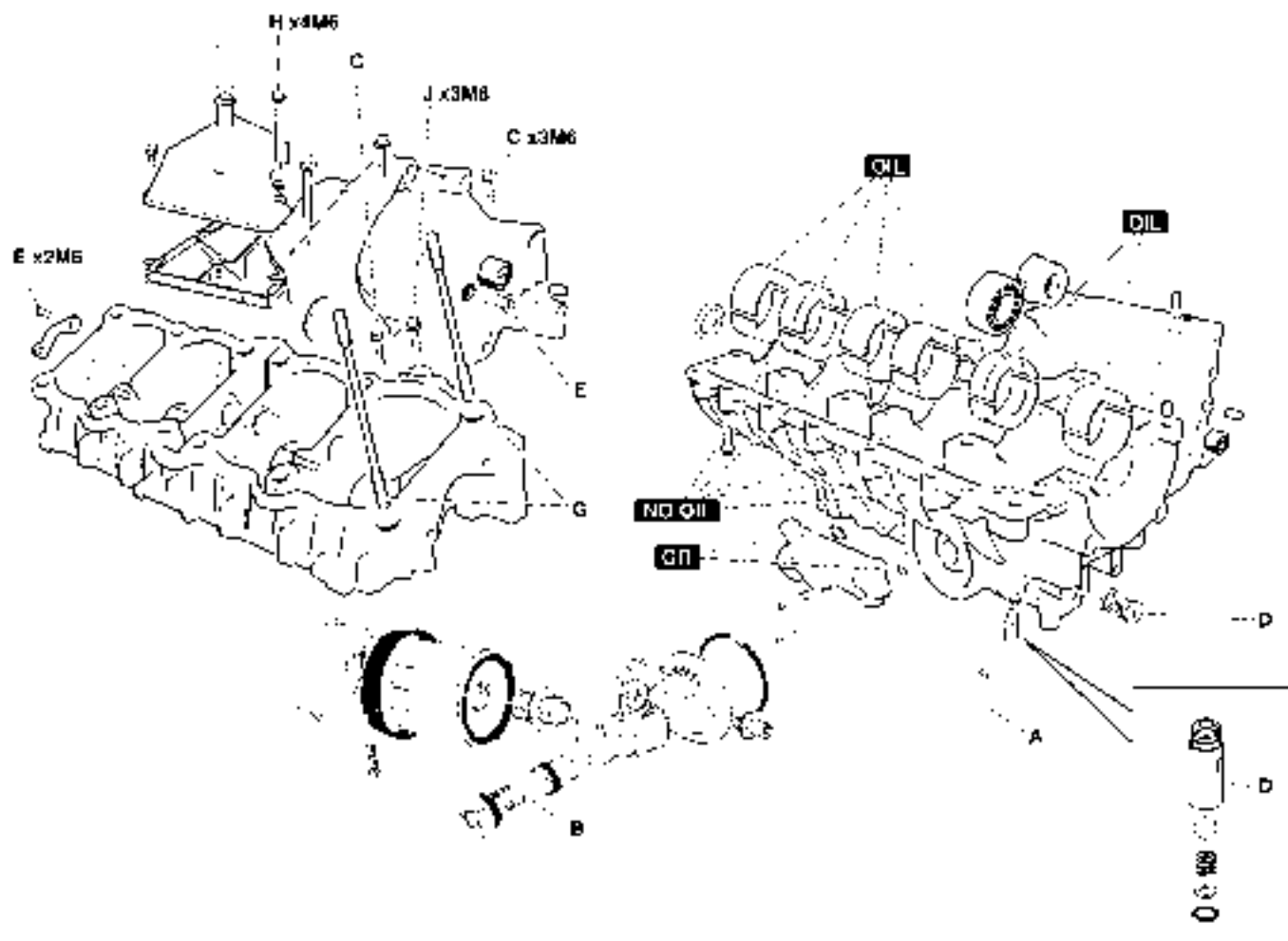
Assembly:

Reassemble the motor on the bedplate.

Manually bring the two screws together, thus tighten them at the prescribed coupling.



BEDPLATE



		A	B	C	D	E	F*	G	H	I	J	K
Tightening torque	N·m	25	40	10	25	10	10+60°	22	8	14	25	30
	Kg·m											
	ft·lb											
Thread blockers					Medium	Medium		Medium				Medium

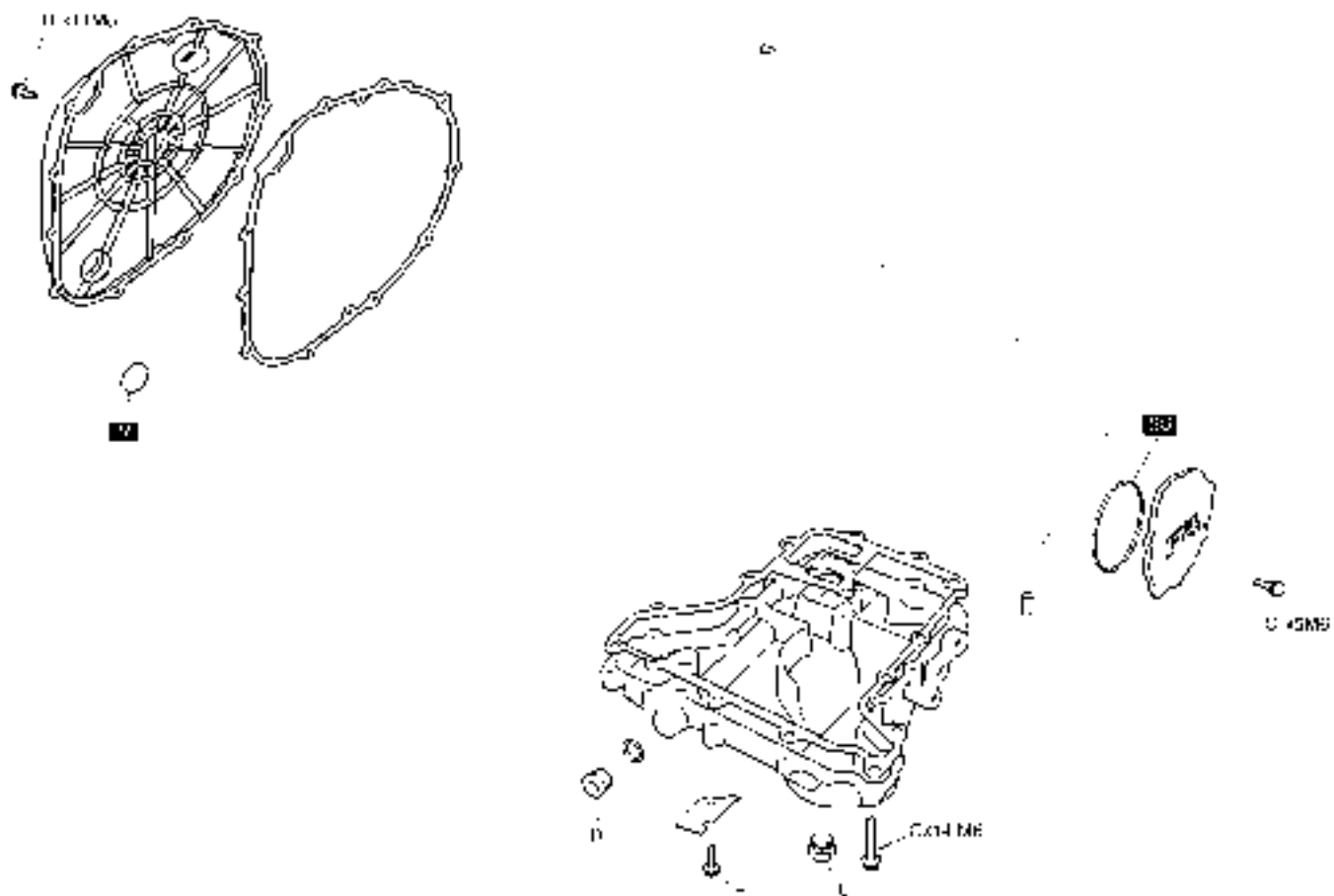
* See text.

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



Engine F4 BRUTALE MY 2003

CAPS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m			10	25	10			8		35
	Kg·m										
	ft·lb										
Thread blockers					medium	medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

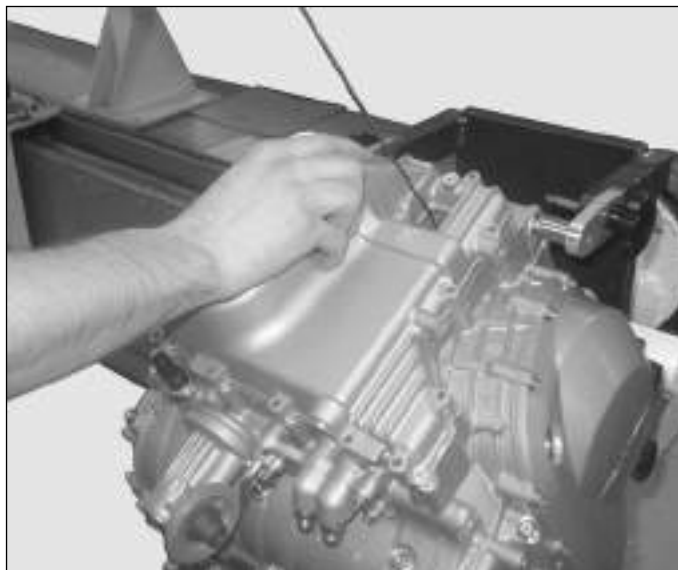
Oil sump

Disassembling and reassembling

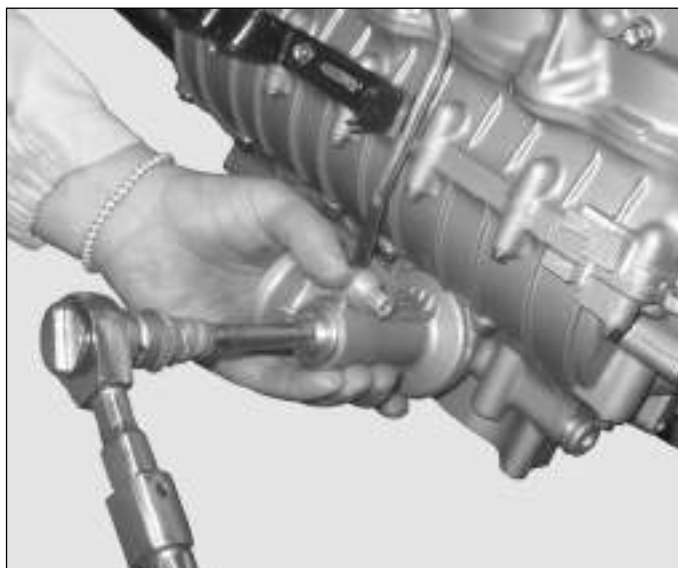
Remove the oil sump by unscrewing the 6mm fixing screws.

Always substitute the gasket when reassembling.

Check the condition of the oil intake filter and make sure that it is free of cracks or clefts; clean it by using compressed air at a low pressure, blown from inside to outside.

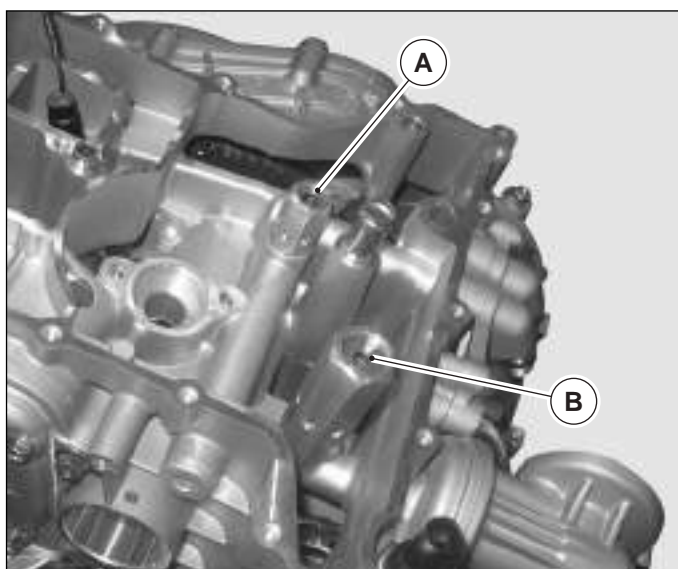


Remove the oil filter support by unscrewing the relative screw.



Check that oil pressure adjusting valves (A) and (B) are also free of cracks or clefts, verifying that they are in good condition; remove them, if necessary. Clean with compressed air blown from inside to outside.

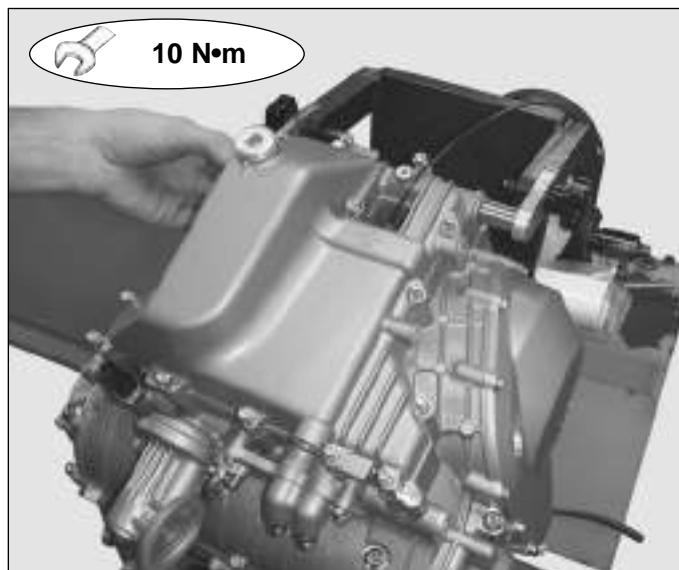
Once the check has been carried out, reassemble them on the base as shown in the figure.



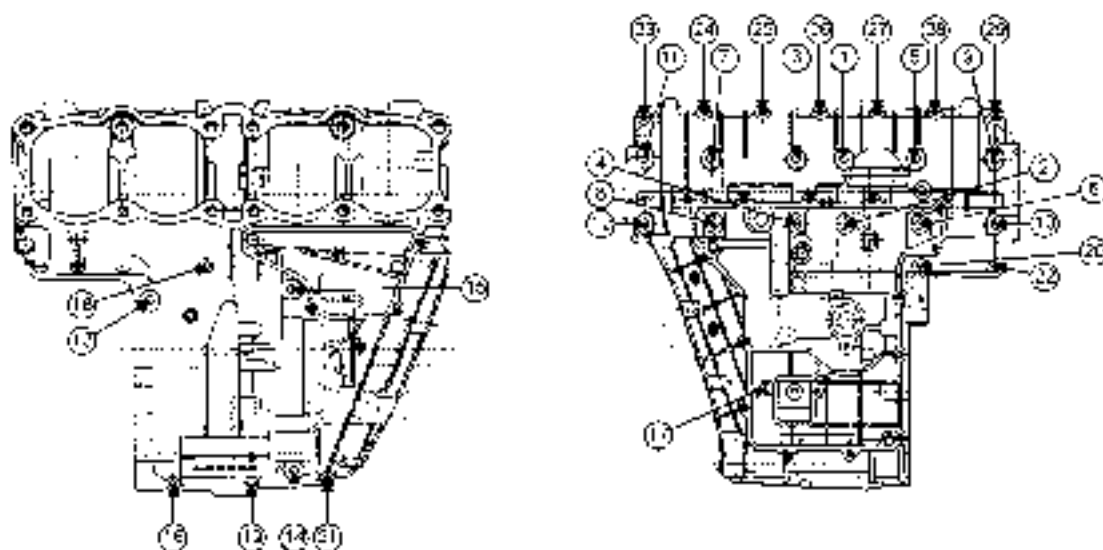


Engine F4 BRUTALE MY 2003

Position the gasket and move the screws close manually.
Tighten the sump screws to 10 Nm.



G



Disassembly

Remove the oil filter exchanger with heat relative bearing.

Remove as follows as indicated in the relative paragraphs:

- A) The head
- B) The cylinder group
- C) The pistons
- D) The clutch
- E) The gear

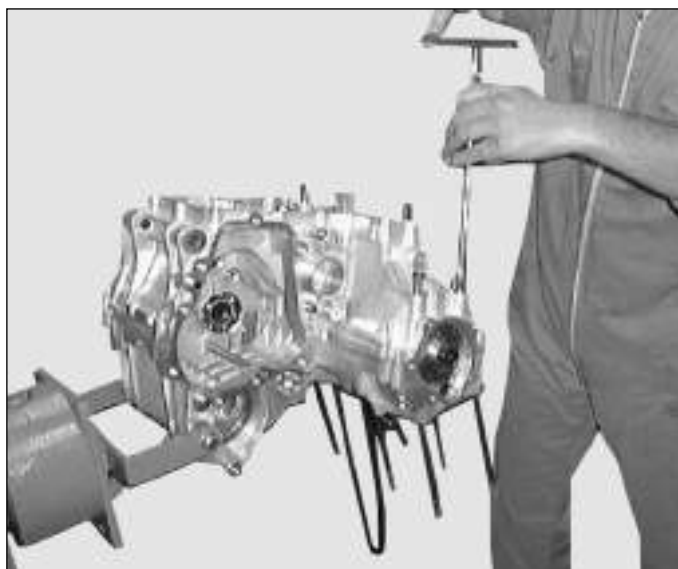
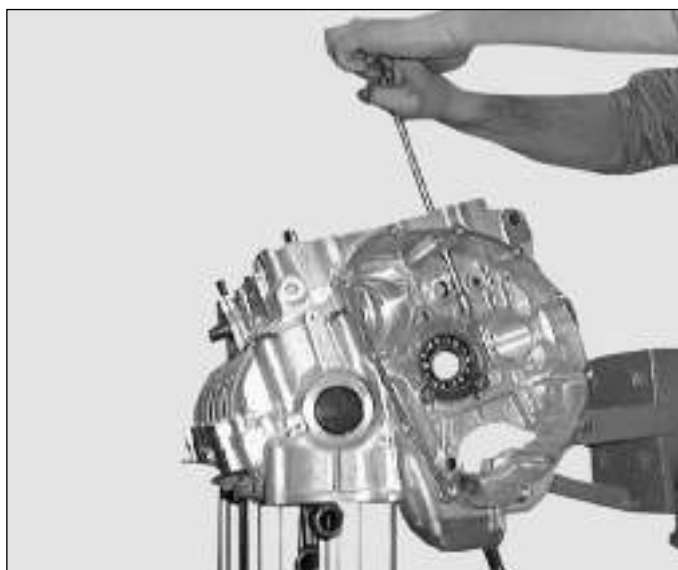
Remove:

F) The screws including the one for the blow-by cap.

NOTA Remember to unscrew the screw inside the carter indicated in the picture at the right.

G) The size 8 screws.

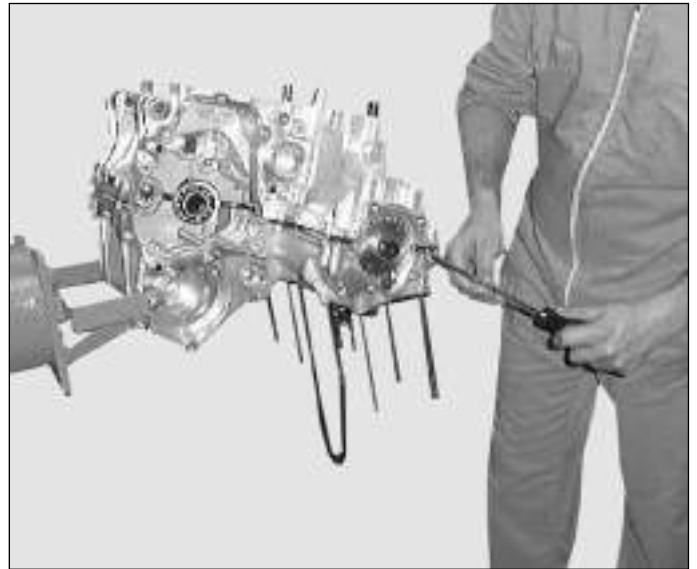
NOTA All the screws are of the same length or visually different; it is therefore impossible to confuse them during reassembly.



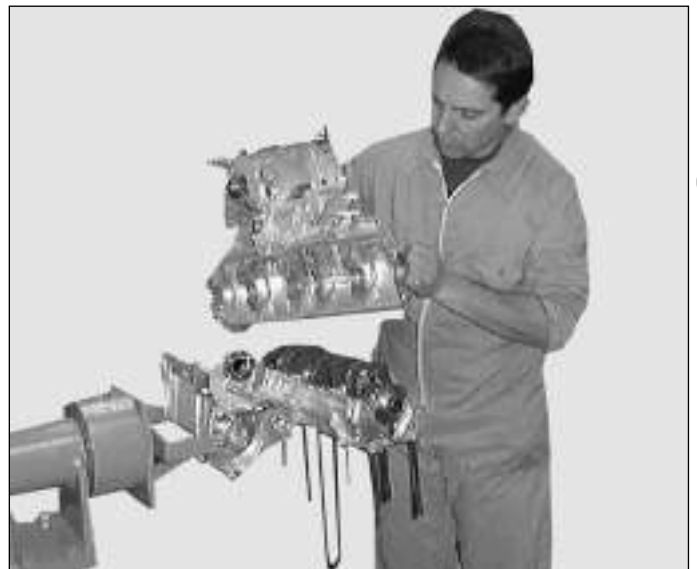


Engine F4 BRUTALE MY 2003

H) Separate the two carters (1 and 2) by manipulating the protrusions.



I) If necessary remove the bearings (3).



L) Slide the motor shaft out.

In the event that the bushings should be temporarily removed (4) it is a good idea to identify the bearing number and its carter with a number using a marker. For example the bushing removed from the n°1 bearing of the superior carter (starting from the left) will be identified by the mark S1.

For the couplings refer to the groups they belong to shown on the chart.



SELECTION TABLE FOR F4 BEARINGS						
			BEDPLATE SLOT DIAMETER			
			A	38.103 38.111	B	38.112 38.119
BENCH PIN DIAMETER	A	34.981 34.988	1.546/1551 BLUE		1.550/1.555 YELLOW	
	B	34.989 34.997	1.542/1.547 RED		1.546/1.551 BLUE	
FUNCTIONING PLAY 0.012/0.038						



Engine F4 BRUTALE MY 2003

Revision

Once you have disassembled the motor shaft and in case there should be any doubt substitute the bench bushings as well as the connecting rod.

Verify the motor shaft wear tolerance.

The function **play** of the **bench bearings** must be between **0.012 ÷ 0.038 mm**.

Service limit is **0.06 mm**.

The function play of the **connecting rod bearing** must be between **0.036 ÷ 0.061 mm**.

With a service limit of **0.08 mm**.

Reassembly

Carefully degrease and clean from any paste residues
Position the bushings into the carter without lubricating.



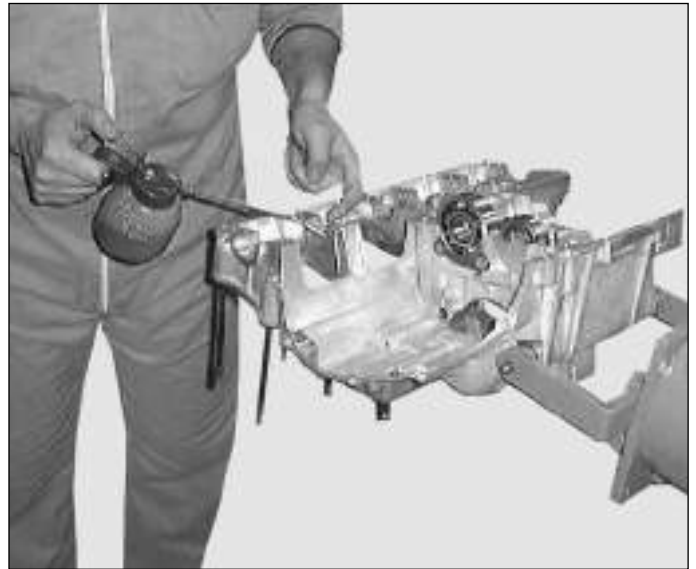
After having positioned them put oil on each bush.





Engine F4 BRUTALE MY 2003

Laterally lubricate the n° 5 support as it carries out the function of the motor shaft centering.



Put the new cap on the right side after having put the silicone type paste on the cap's surface, between cap and carter bearing.



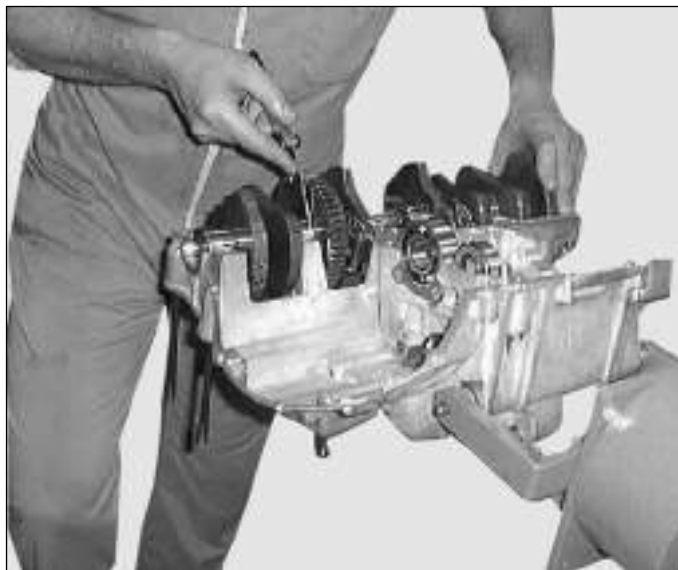
Assembly the motor shaft.



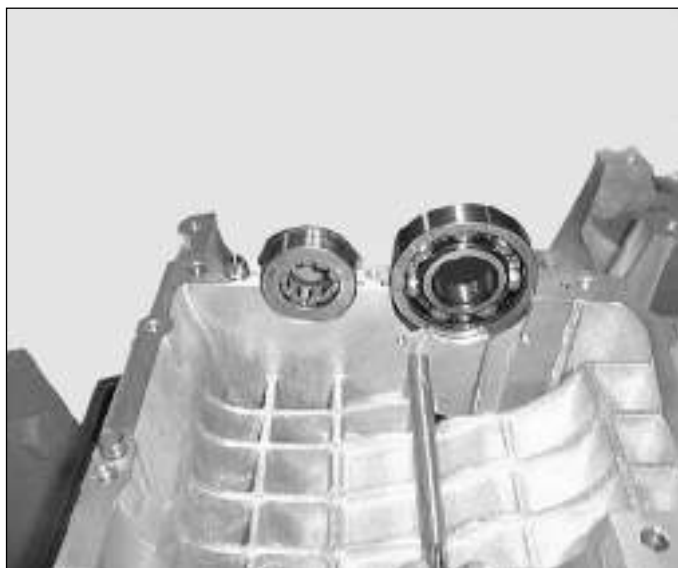


Engine F4 BRUTALE MY 2003

Verify with a thick meter that the motor shaft has an **axial play** of **0.2 mm** as regards the bench bearings. In case there should be different values contact the manufacturer.

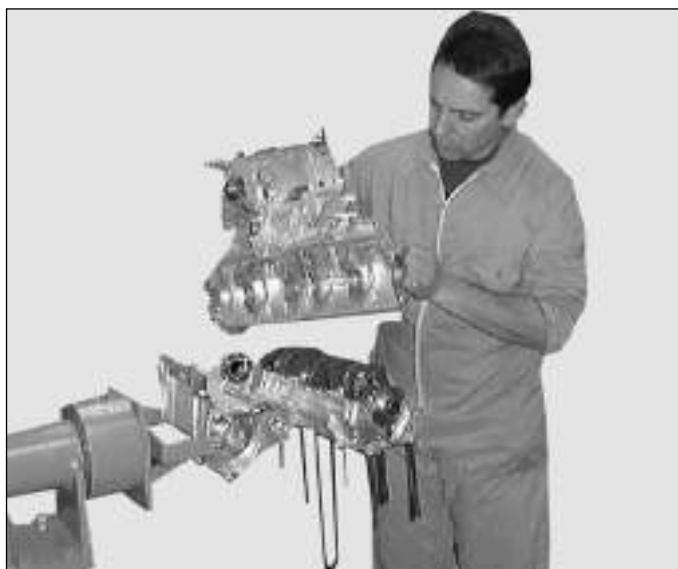


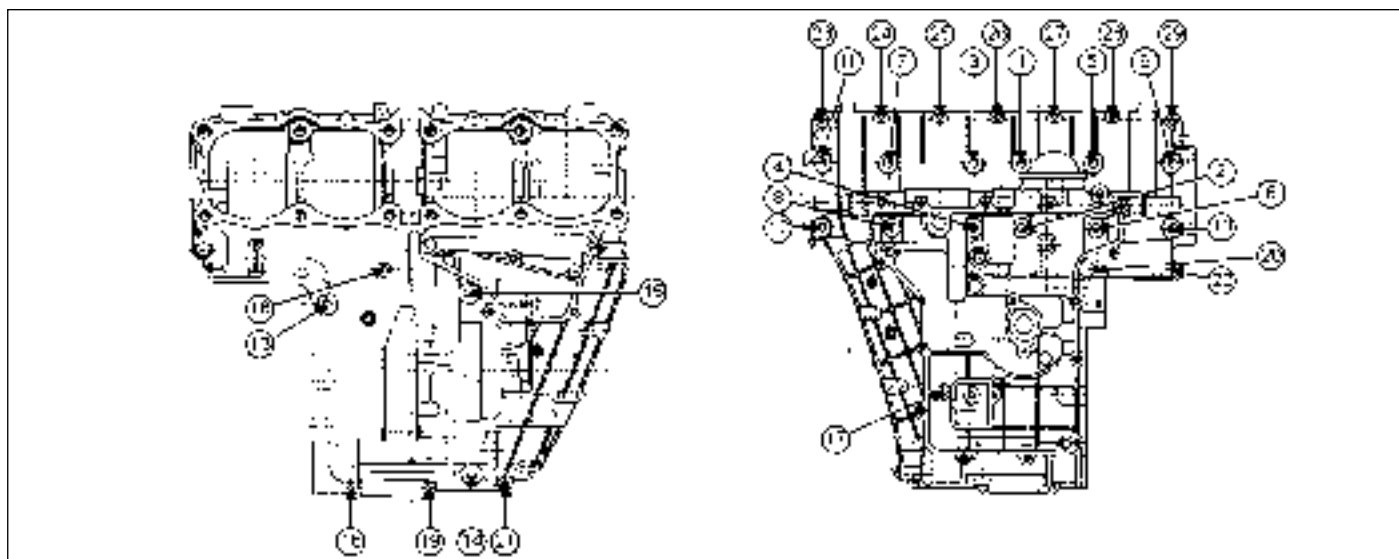
Reassemble the bearing on the inferior semi carter with the locks facing each other and turned inward the bedplate.



Be sure that the centering bushes are installed on the inferior semi carter. Spread a layer of the 1215 THREEBOND type garnish on the stroke points of the two semi carters.

Couple the two semi carters carefully beating them with a plastic hammer until completely closed.





Insert the 8-screws (12) manually and tighten them to the prescribed clamping torque.
Insert the remaining 6-screws manually and tighten them to the prescribed clamping torque.

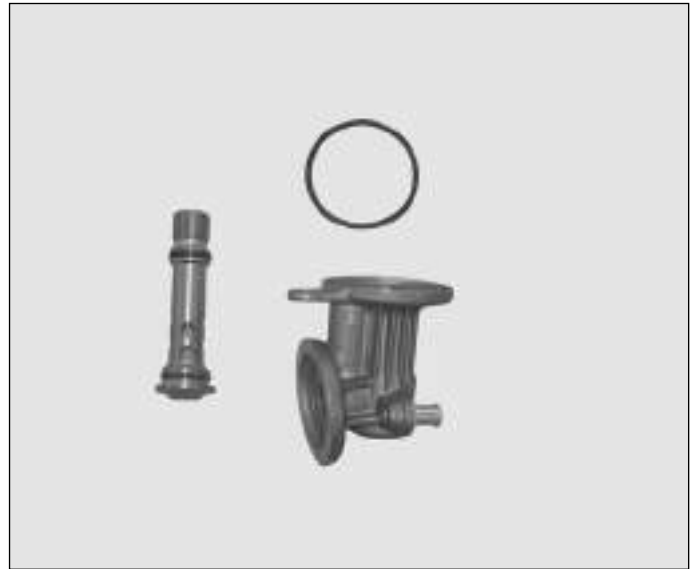


Tighten all the screws inversely to the order they were disassembled.

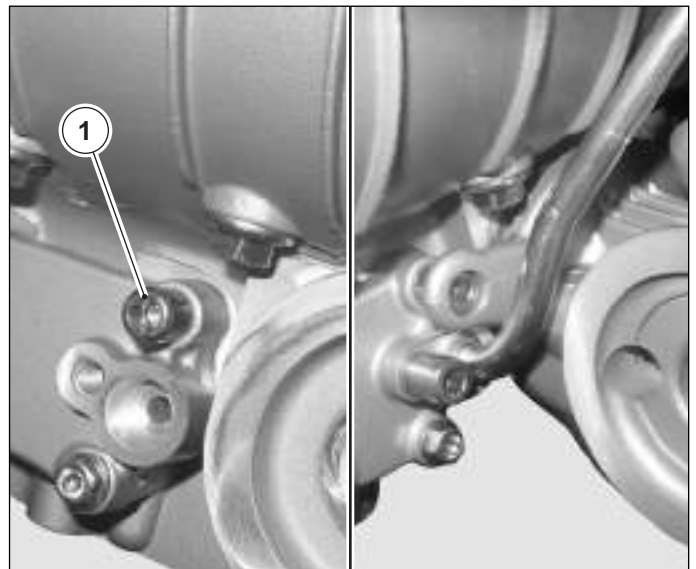
LUBRICATION COMPONENTS: OIL FILTER SUPPORT

Reassembling

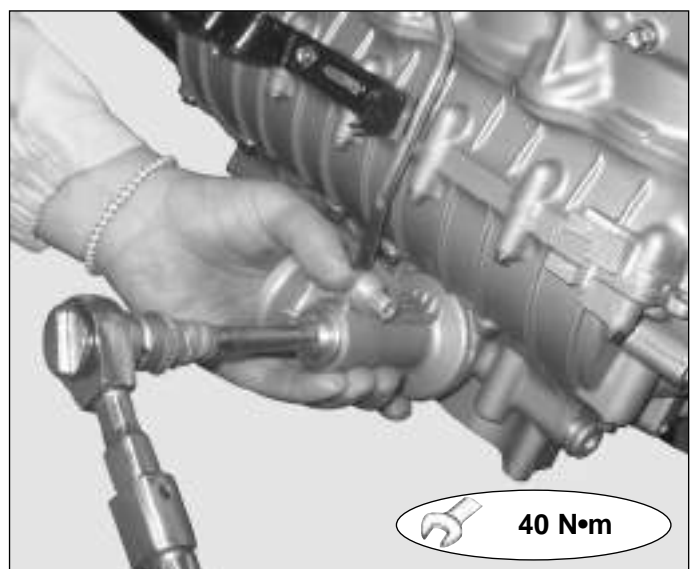
Clean all the surfaces accurately and check the seal rings on the oil filter support screw as well as the O-rings for wear; substitute them, if necessary. Grease both the seal rings and the O-ring and position them in their seats respectively, as shown in the figure.



Position the filter support on the base; as per guiding and centering it refer to the special screw (1) for fixing the oil cooler union plate placed on top left.



Once the support has been positioned, tighten the oil filter support screw to a clamping torque of 40 Nm. Assemble the short end of the oil filter union by applying medium thread blocker (Loctite 243) and tightening to a clamping torque of 30 Nm.



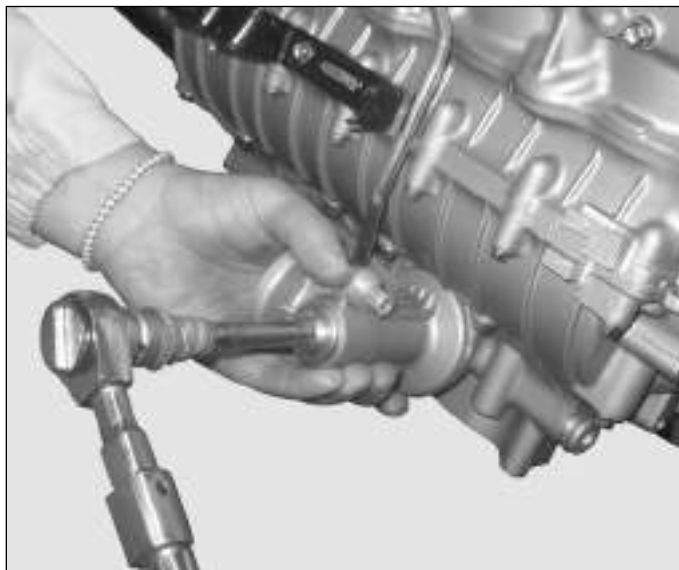


Engine F4 BRUTALE MY 2003

LUBRICATION COMPONENTS: OIL TUBING SUPPORT PLATE

Disassembling and reassembling

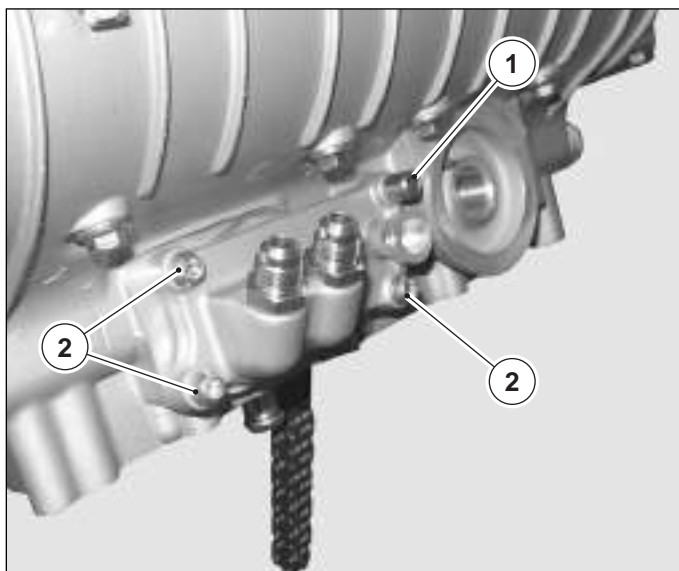
To remove the oil tubing support plate, the oil filter support should be removed first, as described in the "Oil sump" paragraph.



Then, remove the oil head delivery conduit by removing the lower and upper fixing screws respectively.



Unscrew the three screws (2) and remove them; then remove the special screw (1) placed on top left.





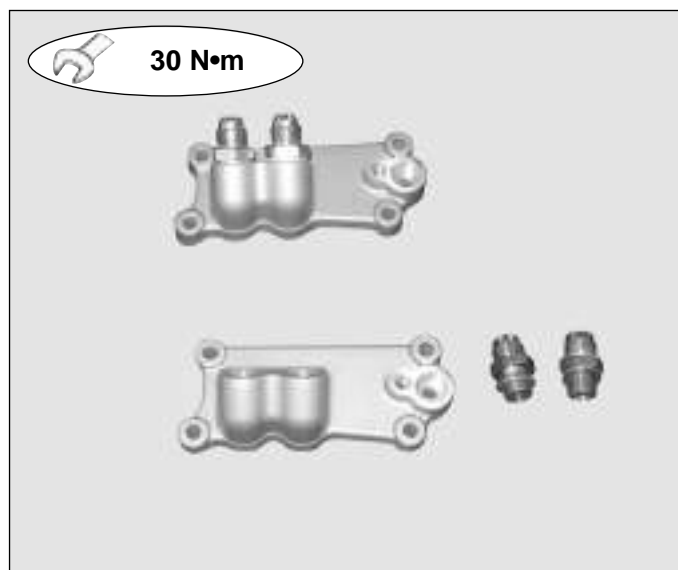
Engine F4 BRUTALE MY 2003

When reassembling, clean the surfaces accurately, and if the nipples have been removed from the oil tubing support plate, reassemble them by always inserting new copper washers between the nipple and the support plate.



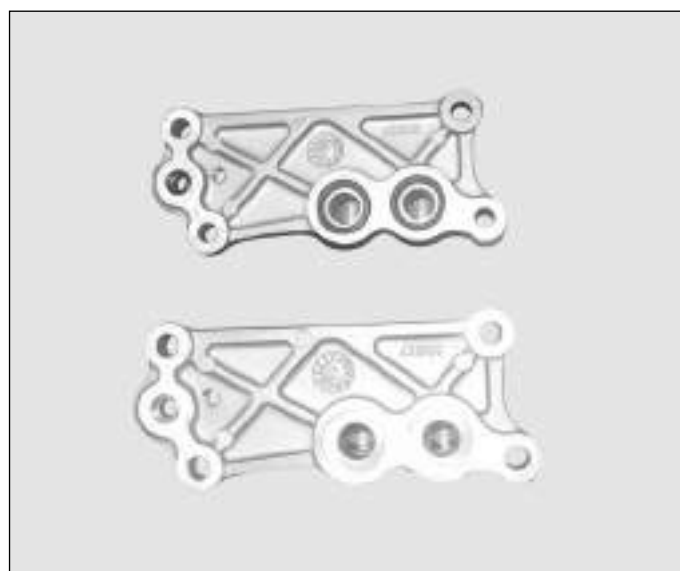
Screw the cylindrical end of the unions verifying that the conical side of each union has been left free.

Apply a medium thread blocker (Loctite 243) and tighten the nipples to a clamping torque of 30 Nm.



Verify the three O-rings placed in the back part of the oil tubing support plate for wear and substitute them, if necessary.

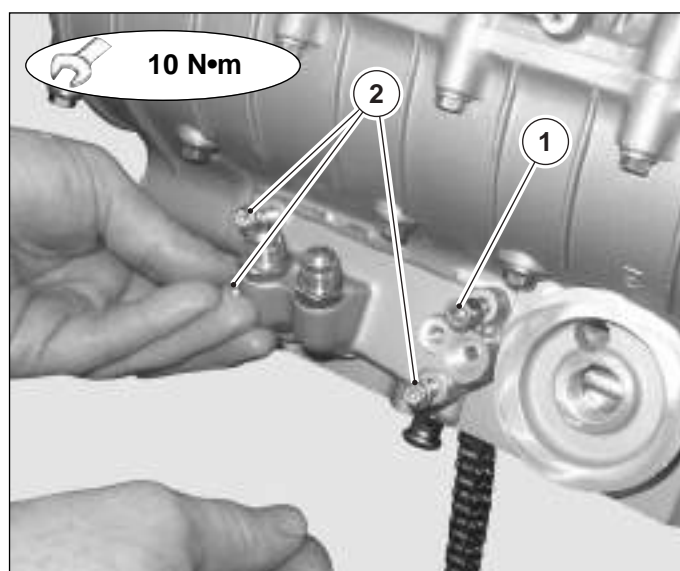
When reassembling, grease the O-rings before reassembling the plate.



Position the plate on the base and fix it by using the three screws (2) and the special screw (1), tightening them to a clamping torque of 10 Nm.



Take care that the special screw positioning (1) follows the one shown in the figure.

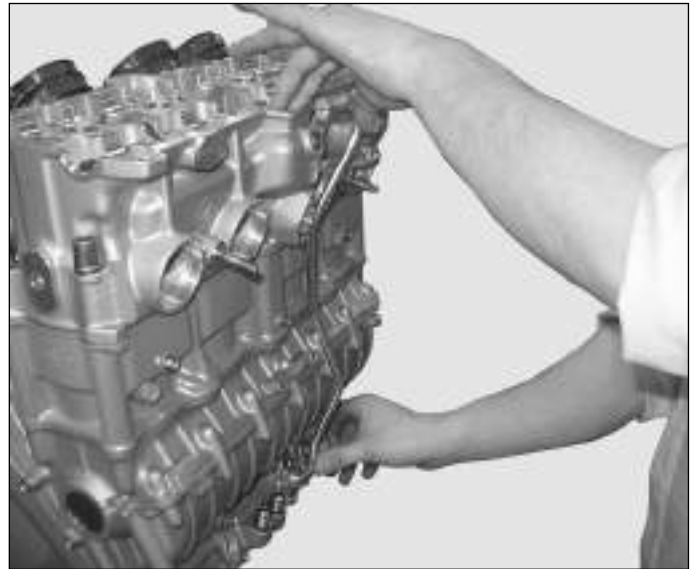




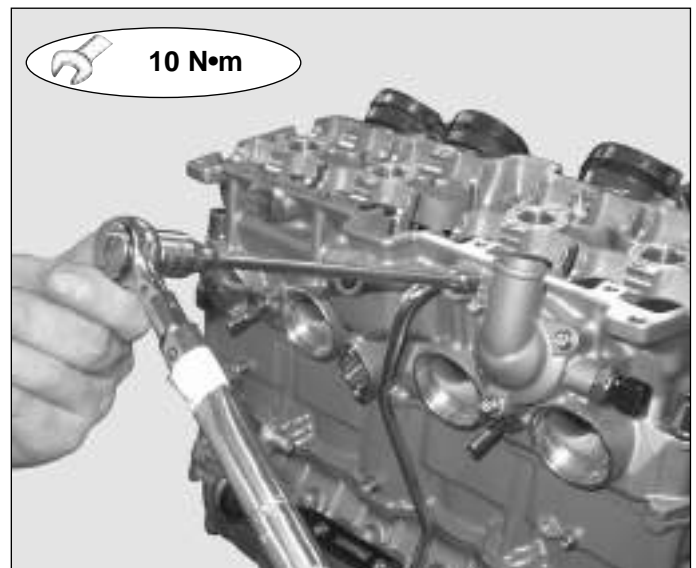
Engine F4 BRUTALE MY 2003

Verify the O-rings placed on the oil head delivery conduit for wear and substitute them, if necessary.

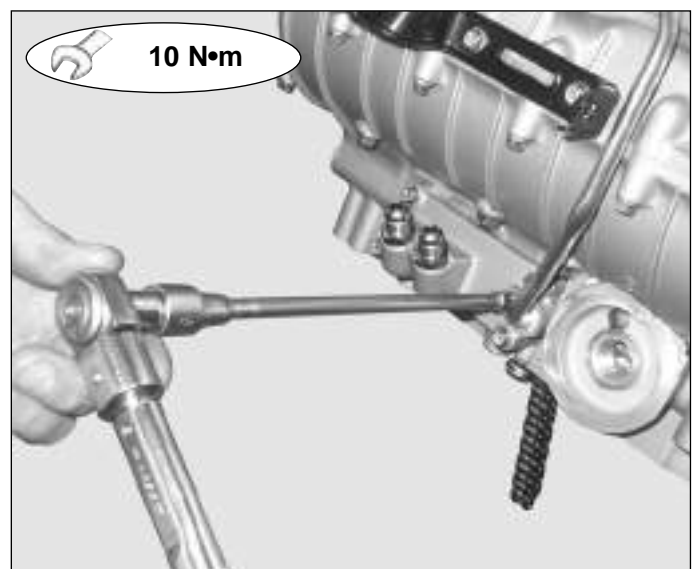
When reassembling, grease both O-rings and position the upper part of the conduit in the seat arranged within the head and the lower part of the conduit in the seat arranged in the oil tubing support plate.



Tighten the upper fixing screw of the oil head delivery conduit to a clamping torque of 10 Nm.



Carry out the same operation for the lower fixing screw by tightening it to a clamping torque of 10 Nm.





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Substitution of the oil filter

Take out the oil filter from the new engine oil filter kit.

- Toyo Roki oil filter kit: Part code 8000A3702
- Champion oil filter kit: Part code 8000A1428



Only use original components of MV Agusta.



If you use an oil filter Toyo Roki (Part code 8000A3702), you should the following preliminary operation.

G Take out the gasket from the engine oil filter kit of new equipment and insert on the filter as shown in the figure on the left.



Only use a new gasket.

Slide the gasket up to bring in contact with the oil filter back ring (see figure on the right).



Lubricate the gasket on the filter with engine oil.





Engine F4 BRUTALE MY 2003

Insert the filter in its seat.

Turn the filter manually until the gasket is into slight contact with the machined surface.



Tighten the filter using the appropriate tool and a torque wrench.

- TOYO ROKI oil filter:

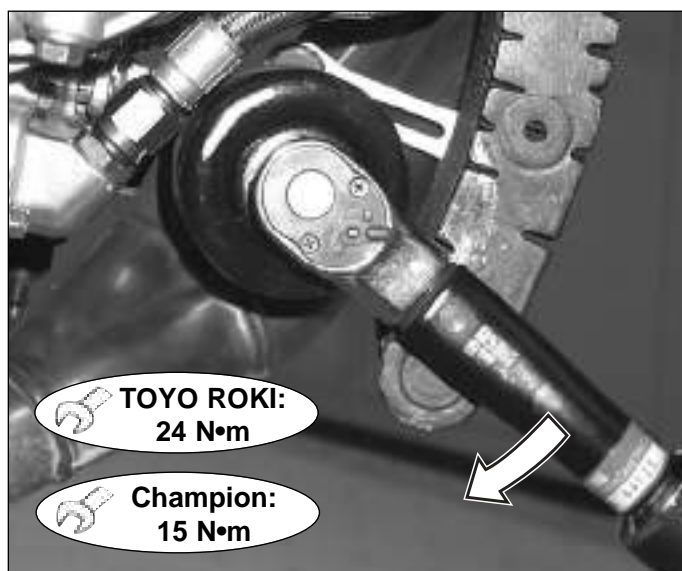
FACOM D. 139 tool
Part code 8000A4317

Oil filter torque wrench:
24 N·m

- Champion oil filter:

Tool code 800099010

Oil filter torque wrench:
15 N·m



After having tightened the filter, take out the clamp for engine oil filter and its screw from the new oil filter kit.



Only use a new clamp.

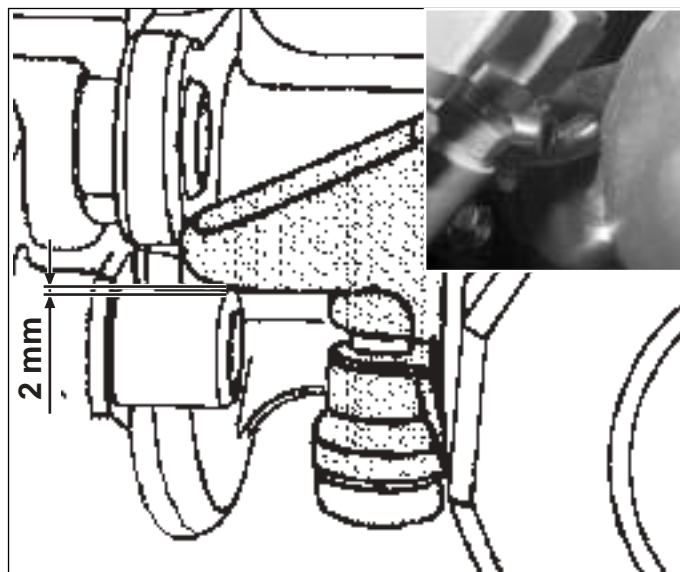
Insert the clamp and slide it until it brings in contact with the oil filter back ring.





Engine F4 BRUTALE MY 2003

Place the clamp lock at a range of **2 mm** from the screwhead on the supporting plate of oil cooler pipes.



Turn the clamp screw up to bring in contact with the filter without tightening.

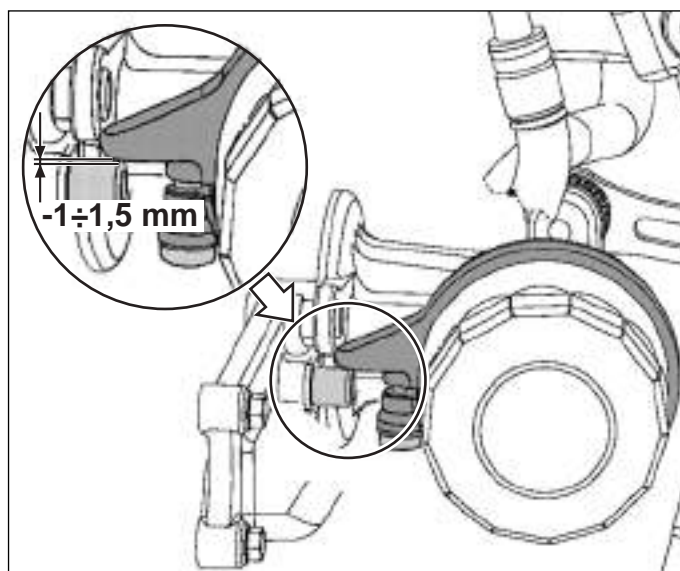
Mark the screw position drawing a line by a felt-tip both on the screw and on the clamp.

Make the last tightening of the screw getting it perform 2 turns and 1/4 further the position marked previously.



Once completed the assembly, ensure that the clamp lock of the engine oil filter is at a range between **1 and 1.5 mm** from the screwhead on the supporting plate of oil cooler pipes. Check any leakages from oil filter.

Mark the position of the definite tightening of the screw using a felt pen, both on the filter and the band fastener. Trace a reference mark also on the band fastener and the relative screw, with the object of eventually checking any slackening of the screw.



Do not use the oil filter as a point of grip or contact.

LUBRICATION COMPONENTS: OIL COOLER

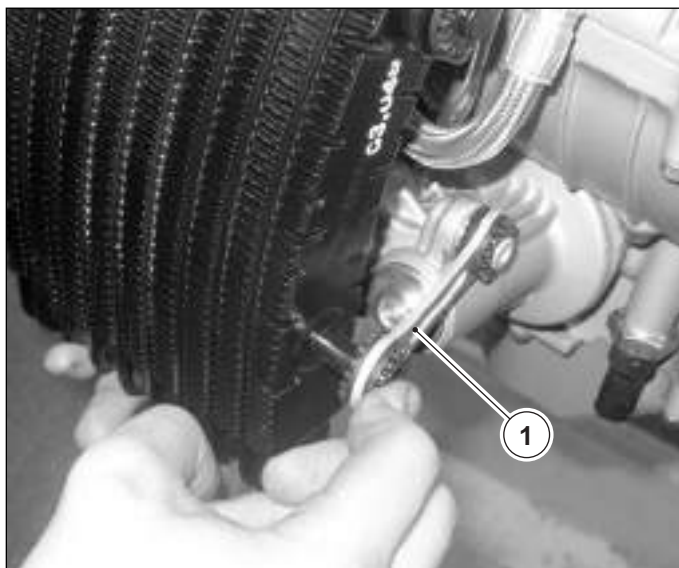
Disassembling

Remove the engine/ radiator support fixing screw placed on the left side.

NOTA This figure and the next ones show an engine assembly which the water radiator has been removed from; but the described operations can be performed also when the radiator is assembled.

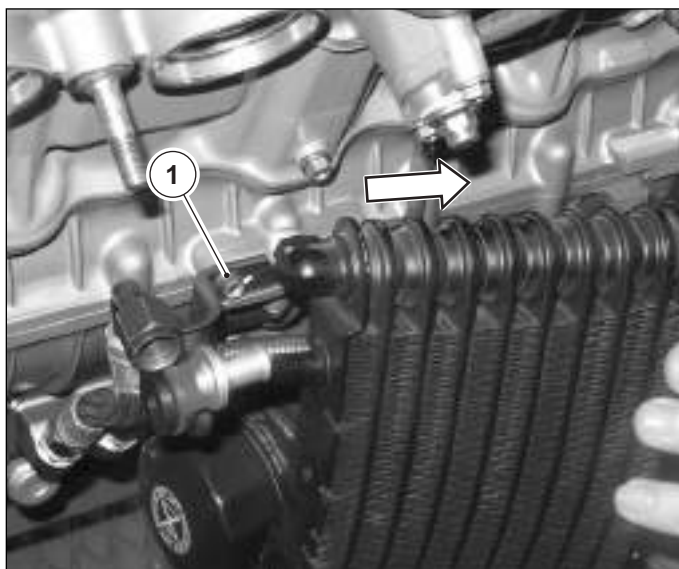


Disconnect the engine/radiator anchor rod (1) on the left side.



Remove the oil radiator moving it from right to left in order to release the support peg inserted in the rubber bulb support (1) on the right side.

! If not necessary, do not remove tubings and unions from the radiator.



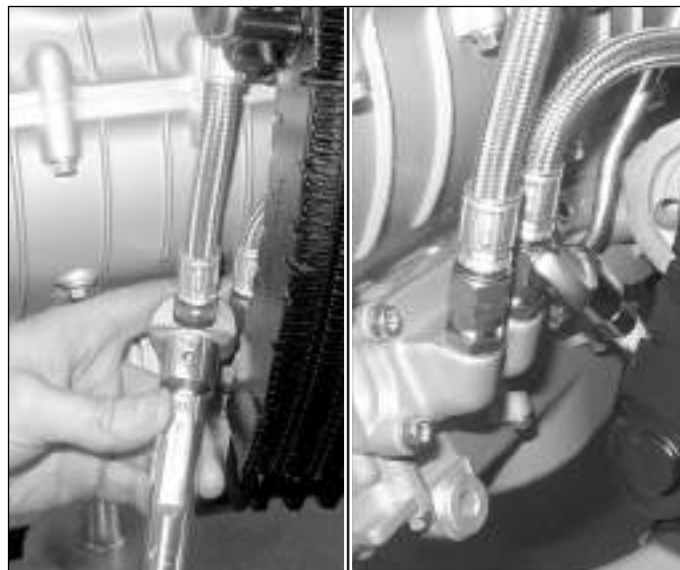


Engine F4 BRUTALE MY 2003

Remove the oil delivery and return pipings connected with the nipples of the oil piping support unscrewing the fixing nuts.



If the oil radiator should be only removed from its position instead of being replaced, don't intervene either on pipings or on unions.



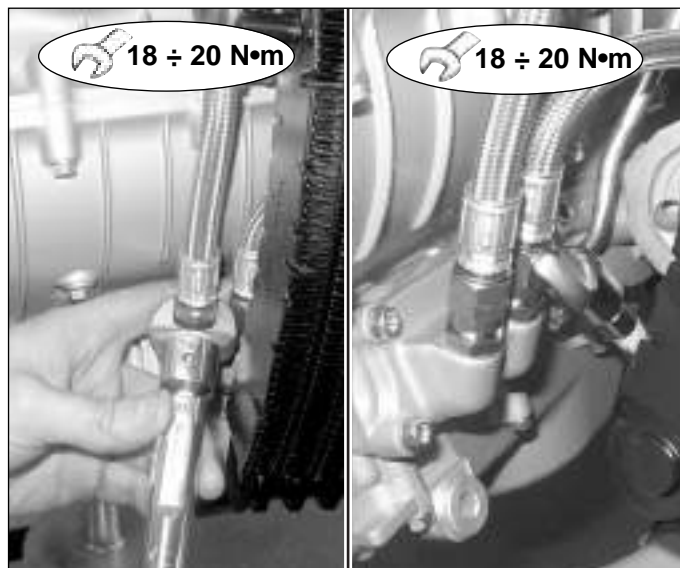
Reassembling



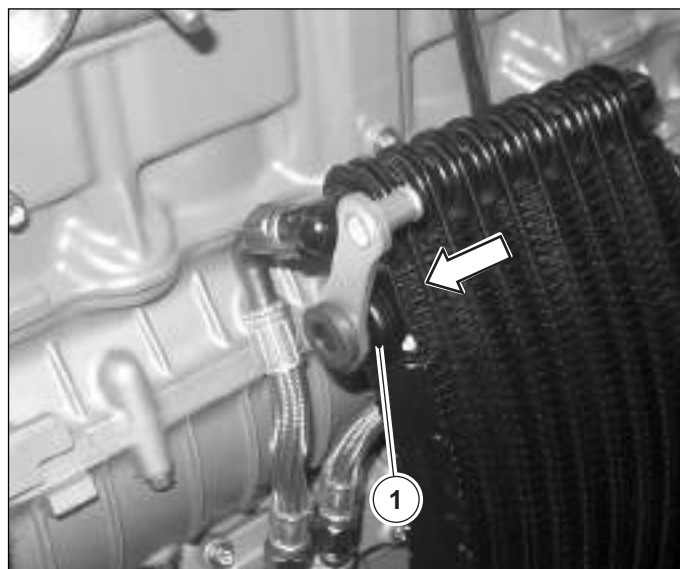
If pipings and unions had been removed from the radiator, reassemble carefully. Lubricate the union threads using engine oil. Tighten pipings and unions to the prescribed torque wrench.

Reconnect the oil delivery and return pipings with the nipples of the oil pipings support flange lubricating previously the nipple threads placed on it by using engine oil.

Tighten the pipe fixing nuts to the radiator to the prescribed torque wrench ($18 \div 20 \text{ Nm}$).



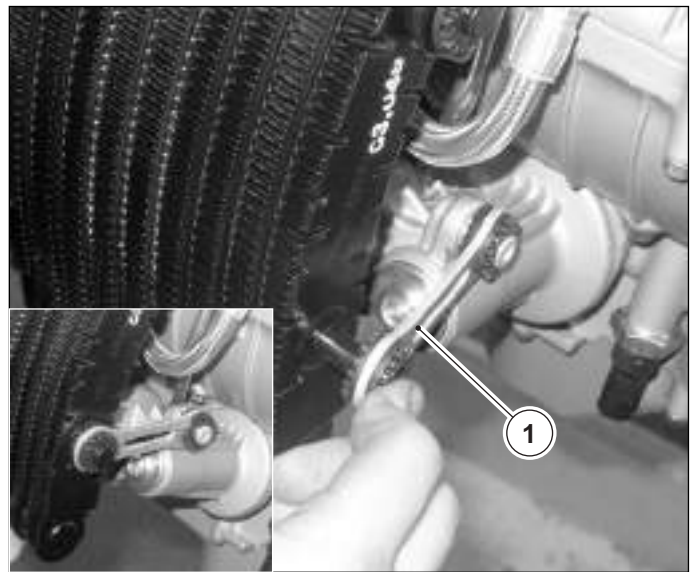
Insert the exhaust manifolds first on their seat on the compensator and then secure them by the flange (1) to the cylinders tightening the nut.





Engine F4 BRUTALE MY 2003

Connect the engine/radiator anchor rod (1) on the left side.



Put the radiator/engine support on the left side again and secure it tightening the screw.
Apply a medium thread-locking fluid (Loctite 243) and fix the engine support by tightening the screw to a clamping torque of 10 Nm.



G



Engine F4 BRUTALE MY 2003

Disassembling connecting rod

Remove the driveshaft following the suggested procedure.

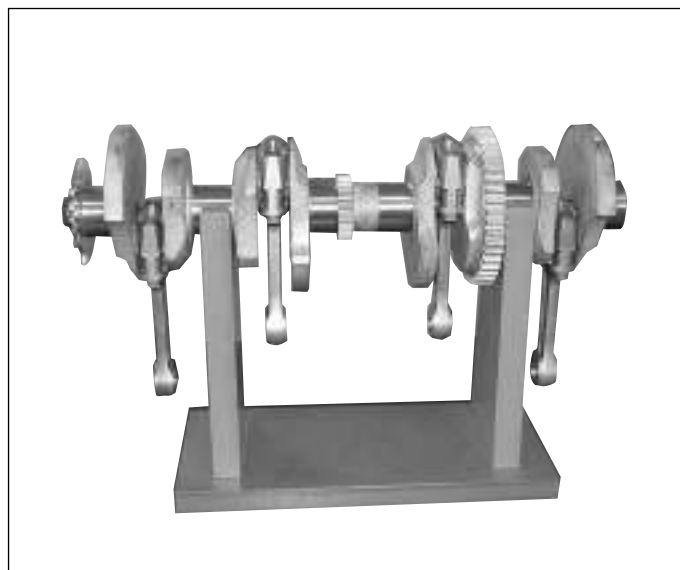
Position the shaft with the connecting rod downwards. Work on each connecting rod separately.

Loosen the two screws that tighten the foot of the connecting rod and the head of the rod.

Remove the two screws that sustain the connecting rod stem.

Move the two motor drive shaft parts away.

NOTA Reassemble every connecting rod before working on the next one.
Lubricate the thread with a **MINIMUM QUANTITY** of Molikote HSC Plus. Do not use too much of this product.



Removing semi bearings

Disassemble the connecting rod following the suggested procedure.

Unscrew the screws and remove the semi bearings from the foot and head of the connecting rod.

G Coupling semi bearings-connecting rod pin

If no substitutions have been made it is sufficient to verify the connecting rod measurement and its pins and refer to the chart included, choose the semi bearings according to the colour.

The measurement has to be carried out on the principal axle of the stem, after having tightened at 35 Nm.

If substitution of one or more parts is necessary, it is sufficient to follow the indications of the letter indicating the class that the connecting rod and bushing belong to, indicated on them.

Assembling semi bearings

Screw the semi bearing to the foot of the connecting rod and to the head.

Tighten at a couple equal to 25 Nm + 55°.

Always use new screws, even with the used connecting rod.

SELECTION TABLE FOR F4 CONNECTIN ROD						
			CONNECTING ROD HEAD DIAMETER			
			A	38.114 38.122	B	38.123 38.130
CONNECTING ROD PIN DIAMETER	A	34.981 34.988	1.540/1.545 BLUE		1.544/1.549 YELLOW	
	B	34.989 34.997	1.536/1.541 RED		1.540/1.545 BLUE	
FUNCTIONING PLAY 0.035/0.061						

Check and placement of distribution chain

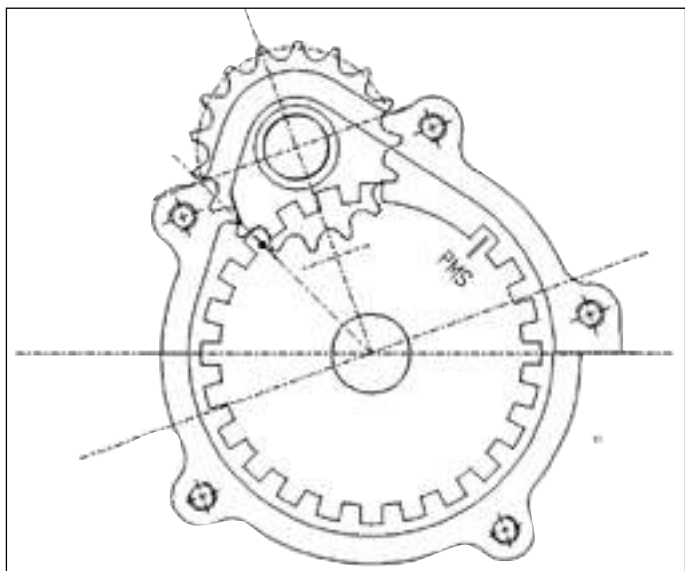
At each motor revision verify the wear state of each transmission distribution component. If the gear teeth appear to be very worn substitute each piece. Substitute the chain at the foreseen mileage (see section 5).



In case wear should result beyond the permitted allowance even of just one of the distribution components, check them all and if necessary substitute them.

Rotate the drive shaft until the pellet on the phonic wheel tooth coincides with the notch on the bedplate, as shown in the following picture.

Attention: the drive shaft in this position is NOT in the MSP position.



Fit the distribution chain on the intermediate gear. Position the intermediate gear being careful that the pellet on the gear corresponds with the pellet on the bedplate, being careful that the drive shaft has not moved from the position priorly described. Insert the intermediate gear rotation pin and tighten it with the relative seeger. Without rotating the drive shaft check again to be sure that the pellet on the phonic wheel corresponds to the notch on the bedplate. At this point, rotate the drive shaft and verify the correct teeth gripping.

Attention: The relative pellet position will repeat itself only after a few rotations of the drive shaft.



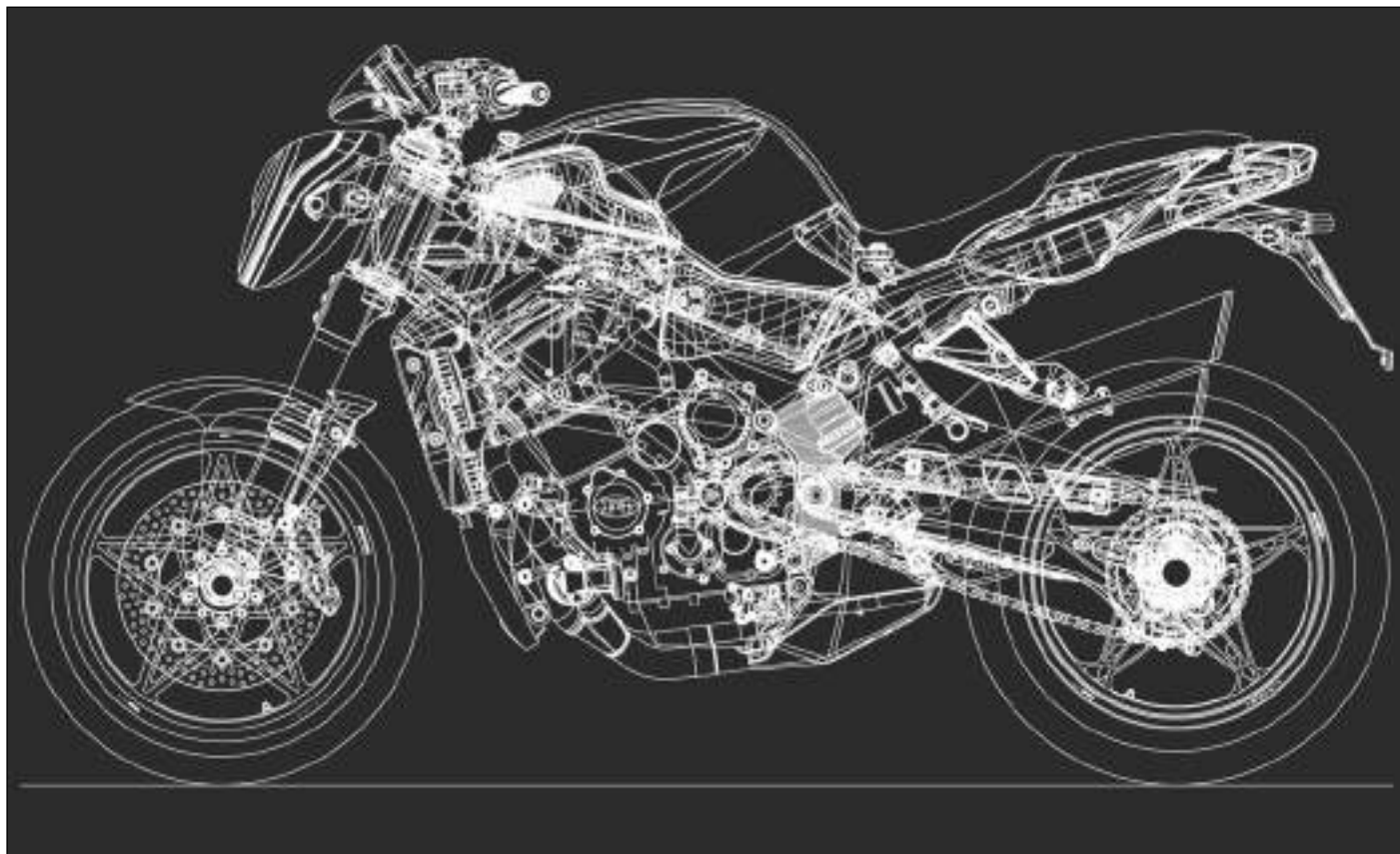


Engine F4 BRUTALE MY 2003

G



Engine F4 BRUTALE MY 2004



H

SECTION H

Revision 0



SUMMARY

CLAMPING TORQUES TABLE	PAGE 3
MAINTENANCE TABLE	PAGE 5
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DISTRIBUTION CONTROL UNITS	PAGE 17
GEAR AND GEAR CONTROL	PAGE 37
ELECTRICAL COMPONENTS	PAGE 44
BEDPLATE	PAGE 46
CAPS	PAGE 47
LUBRICATION COMPONENTS: OIL FILTER SUPPORT	PAGE 56
LUBRICATION COMPONENTS: OIL TUBING SUPPORT PLATE	PAGE 57
LUBRICATION COMPONENTS: OIL COOLER	PAGE 63

NOTE For sub-assemblies that are not listed, refer to the “F4 S MY 2002” model.



Engine F4 BRUTALE MY 2004

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
HEAD			
Camshaft and gear screws	12	1.2	Strong
Sliding block distribution screws	8	0.8	Medium
Stand screws	12	1.2	
Valve cap screws	8	0.8	
Chain tightening screws	8	0.8	
Chain tightening cap	8	0.8	
CLUTCH			
Clutch nut	150	14.25	Medium
Disk thrust plate screws	10	1	
GEAR SHIFT			
Pinion nut	150	14.25	Medium
Gear selection drum tightening screws	12 If M6 thread 25 If M8 thread	1.2 2.5	Medium
M6 gear control screws	8	0.8	Medium
BEDPLATE ACCESSORIES			
Alternator tightening screws	25	2.5	
Motor starter tightening screws	8	0.8	
Water pump tightening screws	10	1	
Neutral switch screws	10	1	
FREE WHEEL STRATING			
Flexible coupling generator control screws	25	2.5	Medium
Flexible coupling nut	25	2.5	
Flange tightening screws together with free wheel	8	0.8	Medium
OIL CUP			
Oil cup tightening screws	10	1	



Engine F4 BRUTALE MY 2004

CLAMPING TORQUES TABLE

DESCRIPTION	Nm	Kgm	Thread blockers
BEDPLATE			
Clutch cap M6 screws	8	0.8	
Extractable gear change cap M8 screws	25	2.5	
M6 torque screws	10	1	
M8 torque screws (mat n° from 546)	10+60°	1.0+60°	
Plate screws	10	1	
Oil filter support screw	40	4	
Cooler oil inlet/outlet unions	30	3.0	medium
CONNECTING ROD			
Cap screws	(*) 25+55°	2.5+55°	

(*) Lubricate the thread with a minimu quantity of Molikote HSC Plus.
Do not use too much of this product.



Engine F4 BRUTALE MY 2004

MAINTENANCE TABLE

Slip		Pre-delivery	A		B		C	
Frequency	km	0	1000	6000	12000	18000	24000	30000
Procedure								
Cooling liquid level	C	•	•	•	•	•	•	•
Cooling liquid substitution	S		Substitute every 2 years				•	
Motor oil level	C	•	Check every 1000 km					
Motor oil	S	6000 km or 12 months	•	•	•	•	•	•
Motor oil filter	S		•	•	•	•	•	•
Valve play	C		•	Check every 12000 km				
Distribution chain	S							•
Mobile distribution block	C/S				•		•	
Chain tightening block	C/S				•		•	
Spark plugs			Substitute every 12000 km					
	S				•			
Minimum synchronizing regime	C		•	•		•		•
Fluttering body: synchronization, minimum, CO control	C/P		•	•		•		•

C: Check and/or regulation

L: Lubrification and / or grease

P: Clean

S: Substitution

V: Verify with motor running

•: Follow the indicated instructions

H



Engine F4 BRUTALE MY 2004

ITEM	STANDARD	WEAR LIMIT
VALVES		
Ø Sealing external diameter Exhaust.....	24.6 $^{+0.3}_0$ mm	
Inlet.....	28.6 $^{+0.3}_0$ mm	
Sealing face thickness..... Inlet.....	0.9 $^{+0}_{+0.3}$ mm	limit 1.5 mm
Sealing face thickness.....	0.7 $^{+0}_{+0.3}$ mm	limit 1.3 mm
Stem-guide clearance Exhaust.....	0.02 ÷ 0.04 mm.....	Coupling: 0.10 mm
Inlet.....	0.01 ÷ 0.03 mm.....	0.08 mm
Ø Guide internal diameter.....	4.5 $^{+0}_{+0.012}$ mm.....	4.55 mm
Valve stem Exhaust.....	4.5 $^{-0.02}_{-0.035}$ mm.....	4.460 mm
Inlet.....	4.5 $^{-0.01}_{-0.025}$ mm.....	4.470 mm
Valve spring Internal.....	33.8 mm.....	33.5 mm
External.....	37.9 mm.....	37.5 mm
Valve-cam clearance Exhaust.....	0.20 ÷ 0.25	
Inlet.....	0.15 ÷ 0.20	



Engine F4 BRUTALE MY 2004

ITEM	STANDARD	WEAR LIMIT
CYLINDER AND PISTON		
Piston ovalization.....	.....	0.015 mm
Piston-cylinder play.....	0.014 ÷ 0.046 mm	0.10 mm
Piston-pin play.....	0.002 ÷ 0.010 mm	0.03 mm
Pin-foot connecting rod play.....	0.015 ÷ 0.032 mm	0.04 mm
Segment thickness		
1 st	1 ^{-0.01 -0.03} mm.....	0.96 mm
2 nd	1 ^{-0.01 -0.030} mm.....	0.96 mm
Oil scraper.....	2 ^{-0.010 -0.025} mm.....	1.95 mm
Maximum segment-cylinder play		
1 st	0.2 ÷ 0.4 mm.....	0.6 mm
2 nd	0.2 ÷ 0.4 mm.....	0.6 mm
Scraper.....	0.2 ÷ 0.7 mm.....	1 mm
CLUTCH		
Disk thickness.....	3 mm.....	2.8 mm
Springs.....	.....	38.8 mm



Engine F4 BRUTALE MY 2004

ITEM	STANDARD	WEAR LIMIT
GEAR SHIFT		
Gear fork-groove pivot play.....	0.35 ÷ 0.15 mm.....	0.65 mm
Drum pit width.....	7.05 ÷ 7.15 mm.....	7.35 mm
Ø fork pivot.....	6.8 ÷ 6.9 mm.....	6.7 mm
Minimum idle gear axial play.....	0.10 mm	
Maximum gear fork play.....	.....	0.7 mm
Gear limit		
Primary.....	.....	5.6 mm
Secondary.....	.....	4.6 mm
Fork selection gear limit		
Primary (5a - 6a).....	.....	4.65 mm
Secondary (1a-2a, 3a-4a).....	.....	3.65 mm
Fork – pit play.....	0.2 ÷ 0.3 mm	0.7
BEDPLATE – DRIVE SHAFT		
Bed bearing functioning play.....	0.012 ÷ 0.038 mm.....	0.06 mm
Connecting rod bearing Functioning play.....	0.036 ÷ 0.061 mm.....	0.08 mm
Drive shaft axial play.....	0.2 mm	



Measuring compression in the cylinder

The following tools are necessary in order to carry out this procedure:

Spark plug key: n° 89013

Compression measurer

Adapter for the compression measurer.

- Heat the motor to the usual functioning temperature (of regime);
- Turn the motor off, remove covering structure, tank, air box and remove the spark plugs;
- Measure cylinder compression.

Drag the motor into rotation by means of the starting motor with the butterfly valve completely open until the compression measurer indicator (compressionmeter) no longer rises; the compression measurement obtained is the maximum.

NOTE Be sure the battery is completely charged.

<i>Cylinder compression control (280 rpm-min)</i>		
Motor type	Min Press.	Max Press.
ORO	7.5	12
S2000	7.5	12
S2002	7.5	13
SENNA	7.5	13
SPR	7.5	14
Brutale	7.5	13

- Repeat the procedure for the other cylinders.

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- carbon deposits on the walls of the combustion chamber and on the piston ceiling;
- the head gasket is not of the correct measurements;

N.B.: If the compression in the cylinder is lower than the minimum value of the reported range, check the following points:

- The seat of one or more valves is damaged and the valves do not maintain the compression pressure;
- One or more valves have null functioning play;
- The piston, cylinder play is excessive;
- The cylinder head is twisted and/or the head gasket is damaged;
- Excessive play between ring and cable.



NOTE Before carrying out the compression trial, accurately check the battery tension since the compression value which appears is quite influenced by the rotation velocity of the motor, and consequently by the battery tension.



Engine F4 BRUTALE MY 2004

THROTTLE BODY ADJUSTMENT AND TUNING (Tickover check, CO synchronisation and check)

Check and adjust → First 1000 kilometres and then every 6000 kilometres

The throttle body adjusting should be performed starting the engine of the motorcycle, therefore you should use a flue gas exhauster in order to not saturate the environment with burnt gas.

The following described operations are fundamental for the correct functioning and the maximum performance of the engine.

When carrying out operations on throttle bodies, it is advisable to remove certain parts of the bodywork such as:

- Passenger seat
- Rider seat
- Tank side panels
- Ignition switch cover
- Fuel tank

Attention: before adjusting the throttle body verify accurately:

- the absence of any cracks or damages on the pipes to check the depression;
- the absence of gas leakages from drain pipes joint;
- that the fuel pipe unions are not buckled and crushed.



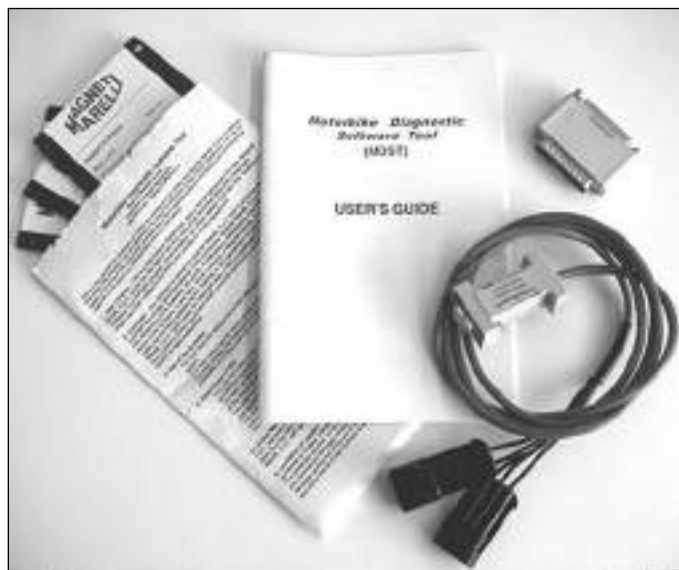
You should provide the motorcycle with tank placed on an auxiliary support. Therefore you should connect the hydraulic extensions of the fuel pipes and the electrical extension for feeding fuel pump.





Engine F4 BRUTALE MY 2004

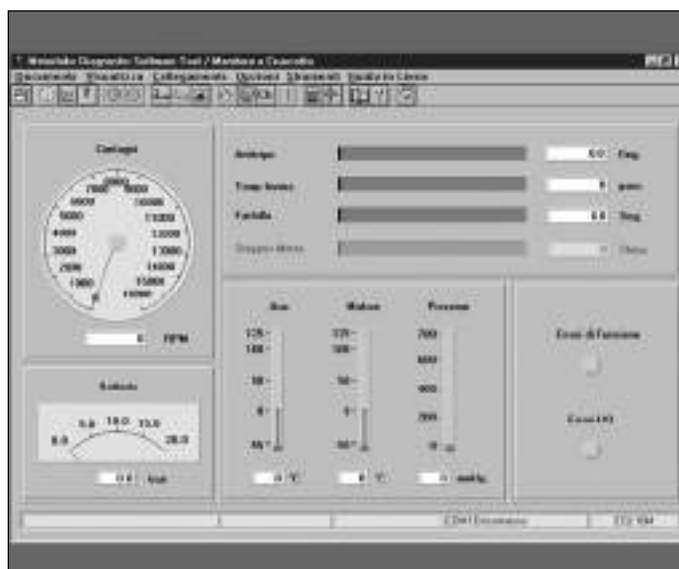
Verify the parameters of the injection-ignition system by the MDST diagnosis software.



Connect the tool cable of the MDST diagnosis with the "Diagnostics" tap on the right side of the motorcycle near the expansion tank of the coolant.



Start the MDST diagnosis software and go to the "Display instrument panel" screen.
Set the ignition switch to ON.
Select the "Connect" option from the toolbar. Now the software displays the main operating parameters of the injection-ignition system: verify that the temperature and pressure sensors have coherent readings.





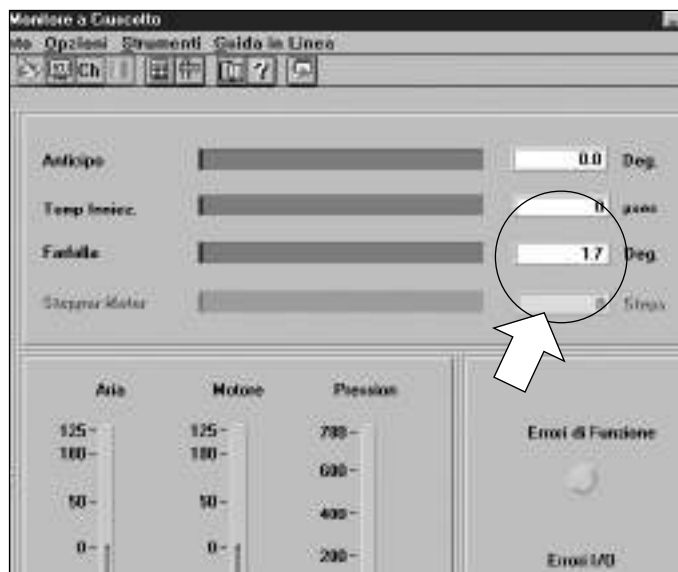
Engine F4 BRUTALE MY 2004

Check the throttle angle when the throttle is completely closed.

The nominal throttle opening angle is **1.7°**.

Huntings between **1.5°** and **1.7°** are allowed only if the engine is started.

Huntings between **1.7°** and **1.9°** and between **1.3°** and **1.5°** are not allowed.



If necessary adjust the throttle opening using only the appropriate screw on the throttle opening pulley.

It is recommended not modify the throttle potentiometer position because the throttle has been set during the production to the optimal value.



Remove the sealing caps of the small tubes to check the vacuum pressure.

The number of the cylinder to which the caps are connected is written on the caps.

The small tubes for checking the vacuum pressure are situated on the left and right side of the motorcycle.





Engine F4 BRUTALE MY 2004

Connect the depression pipes with the vacuum meter complying with the match between the pipe and the cylinder which is connected to.



In order to perform the following operations, you should provide with the specific tool kit for setting CO.

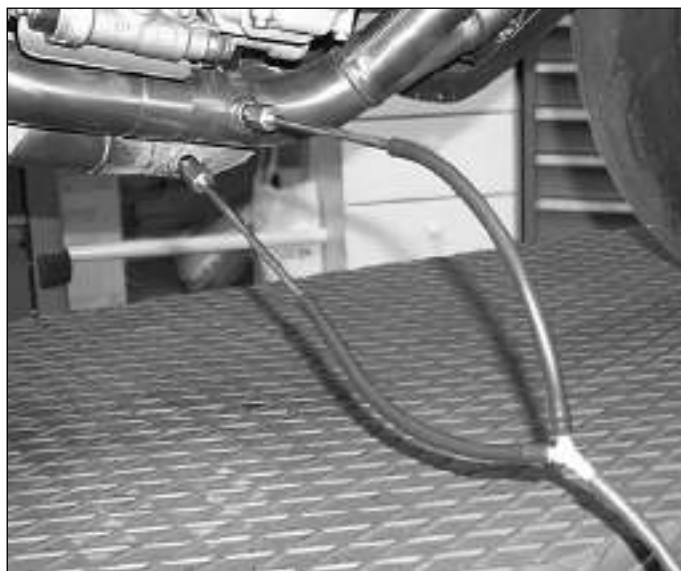
Specific tool: Part code 8000A4686

Remove the sealing caps of the CO drives placed on the exhausts.

Insert and screw the 2 probes registering CO inside the specific tool kit (code 8000A4686).

Assemble the 2 pipes with their Y union, also supplied with tool kit, code 8000A4686, on the probes registering CO.

Connect the Y union with a rubber pipe to the exhaust gas analyser.



Verify that the ignition switch is set to OFF.

Disassemble the injection-ignition gearcase placed on the air filter compartment unscrewing the four fixing nuts.

Reset the earth bonding on the gearcase by using a nut and a M6 screw (for the correct performance of the adjusting operations, it is important the gearcase is earthed).





Engine F4 BRUTALE MY 2004

Remove the seal plate and then the gearcase sealing cap.



Operate the by-pass screws in order to return to a known condition.
Close completely the screws and then open them for 1 turn again.



Start the engine and warm it up. During this phase you should not accelerate because the high depression created in the induction lines could pipe the mercury from vacuumeter.

The engine rotation can be supported by using the starter.

The attainment of the correct thermal speed is given by the intervention of the cooling fan.





Engine F4 BRUTALE MY 2004

Balance the depressions in the cylinders: the thermometers should get to the same height (reference level = 2).

Se all engine parameters are correctly set, the position of the adjusting screws should be between 1 and 1.5 rpms from the fully closed position.

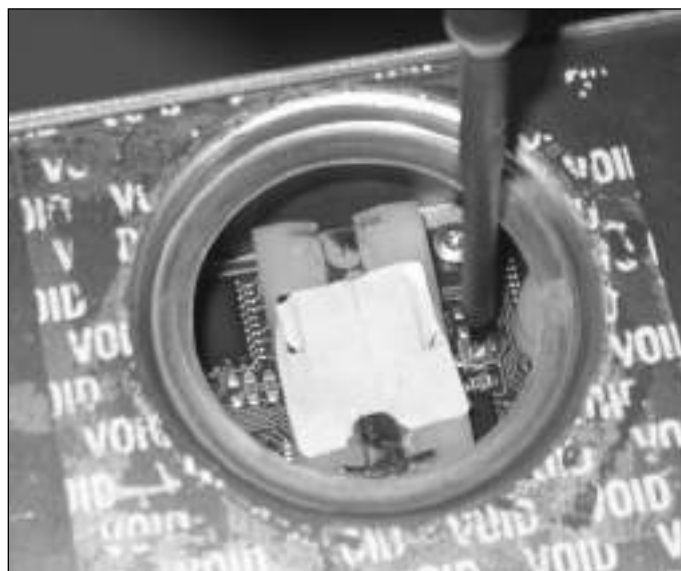
Keeping the depressions aligned, adjust the engine speed (with fan connected and light on) so it is between 1100 and 1200 rpms.



Check the CO value using the exhaust gas analyser. This value must be between 3% and 4%.



If the CO value does not fall into the established values, operate the trimmer inside the gearcase until the values fall into the tolerance range.





Engine F4 BRUTALE MY 2004

The attainment of the correct CO value could involve a variation of the engine speed at minimum.

In this case you should operate the by-pass screws again to return the speed to the desired value and then repeat the trimmer adjustment.



After having finished the adjustment operations, perform in the order as follows:

- assemble the rubber plug on the gearcase lower side;
- apply a new seal plate;
- assemble the gearcase on the air filter compartment restoring the earth bonding;
- disassemble the exhaust gas probes and tighten the fixing screws;
- restore the sealing caps of drives for checking depression;
- reassemble tank, tank side panels, ignition switch cover, rider seat and passenger seat.

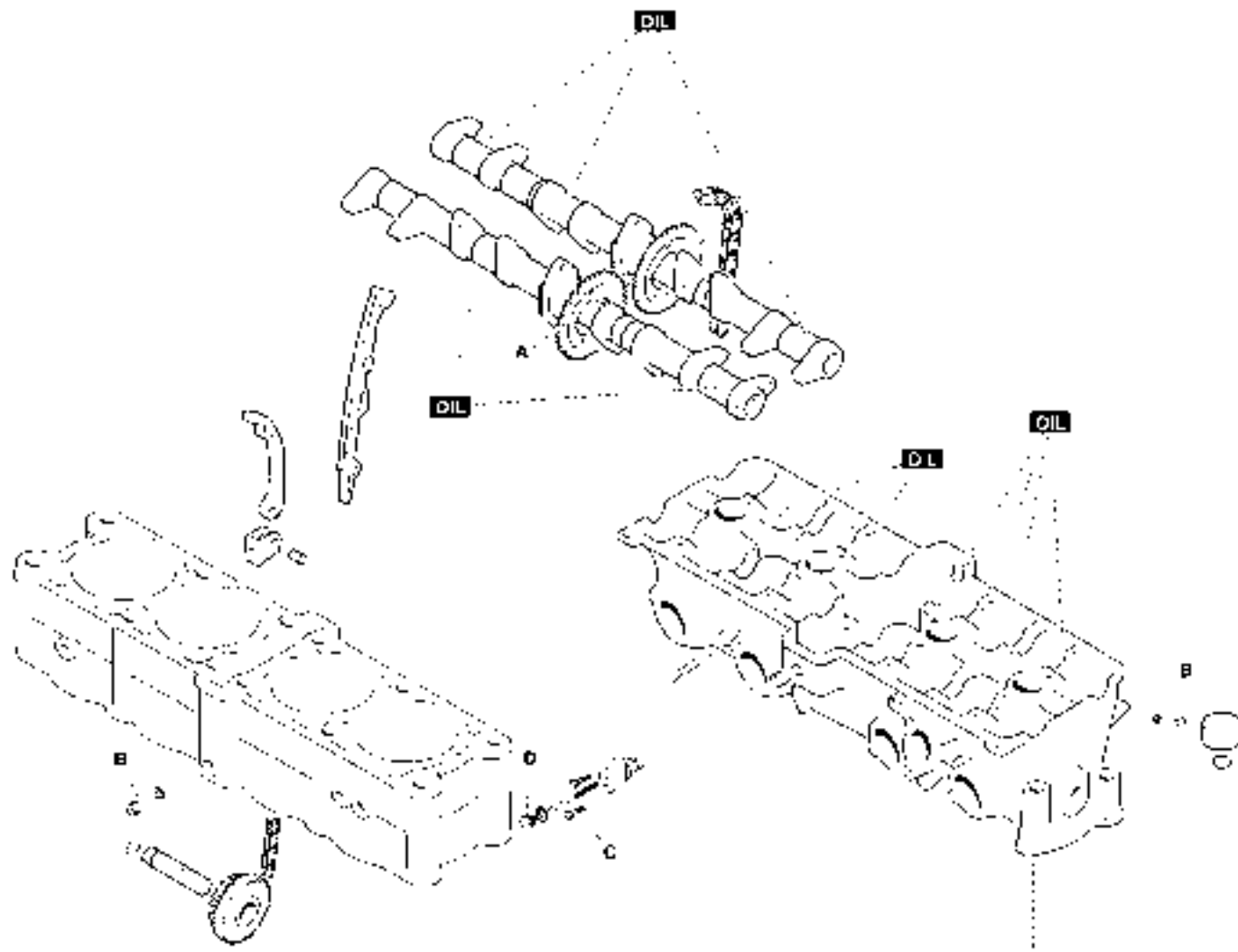


After reassembling all parts, carry out a final check to ensure that everything has been correctly replaced.





DISTRIBUTION CONTROL UNITS



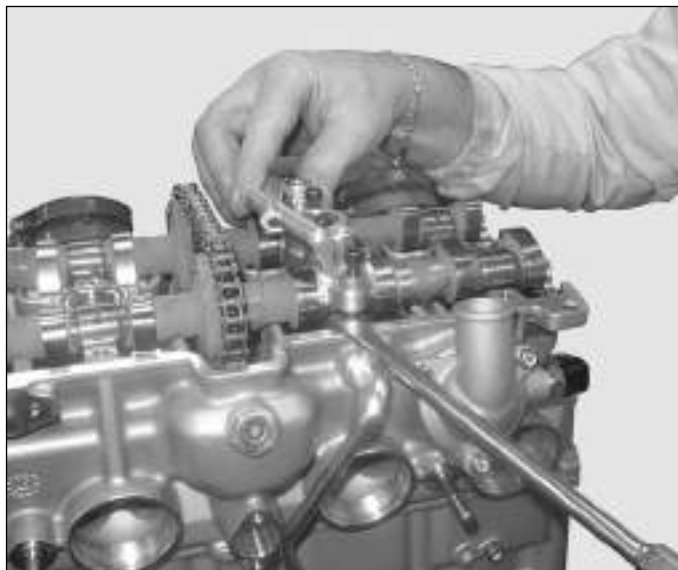
		A	B	C	D	E	F	G	H	I	L
Tightening torque	N-m	21	8	8	12						
	Kg-m										
	ft-lb										
Thread blockers		Strong	Medium								

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

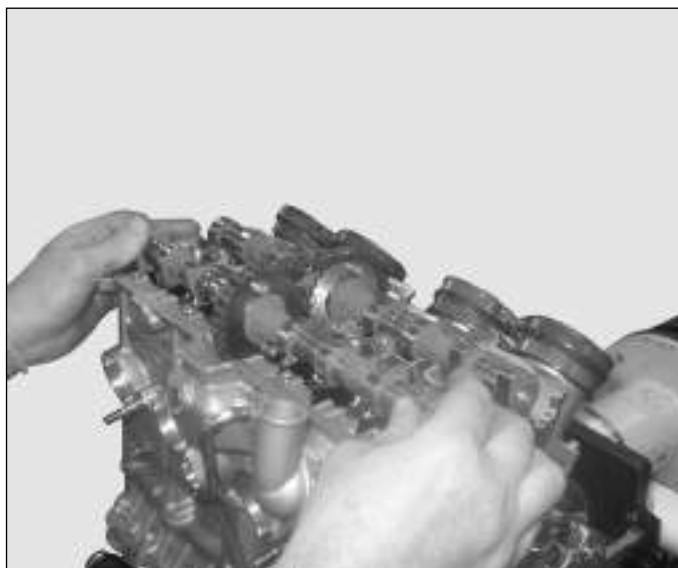


Engine F4 BRUTALE MY 2004

In order to facilitate the detachment of the stands use a rubber hammer or delicately the end part of a flat screwdriver.



Slightly rotate without force the unloaded end of the gearshaft shifting it from its slot; by doing so, the tension on the distribution chain will loosen.



H Release the distribution chain. First remove the unloaded end of the gearshaft. Fasten the distribution chain with copper thread in order to retrieve it during the following procedure.

Remove the inlet end of the camshaft.

Remove the first link block for the distribution chain by using the tightening screws.





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When reassembling, clean all the surfaces accurately. Position the timing gear so that the side that is not heat treated (recognizable for the presence of stroke marks) is in contact with the NORDLOCK washers - NL6SS TYPE No. A3486.

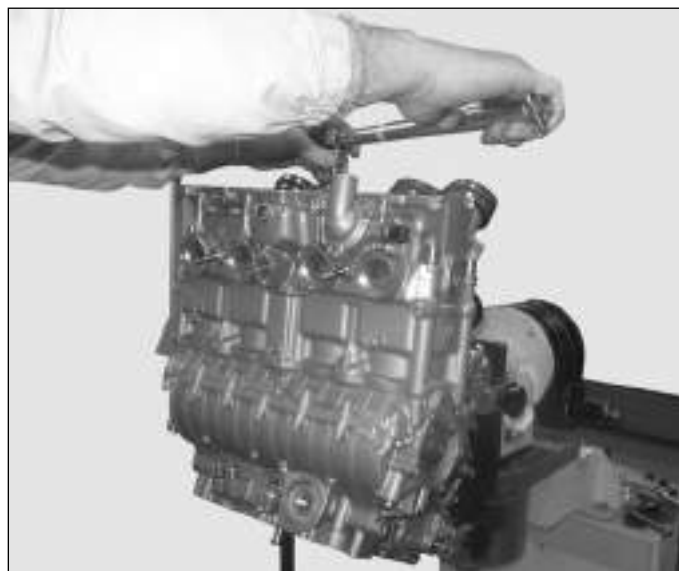
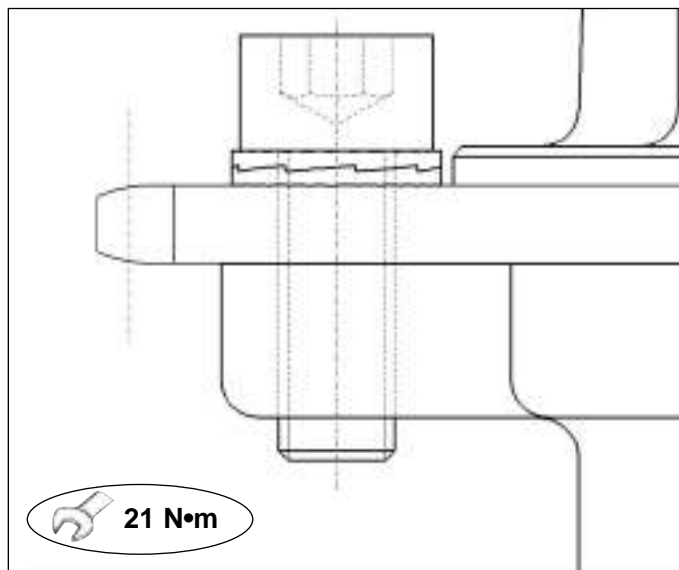
Substitute the washers at every reassembling operation and position them as shown in the figure.

Apply LOCTITE 648 on new screws No. 800085071 and tighten them to 21 Nm.

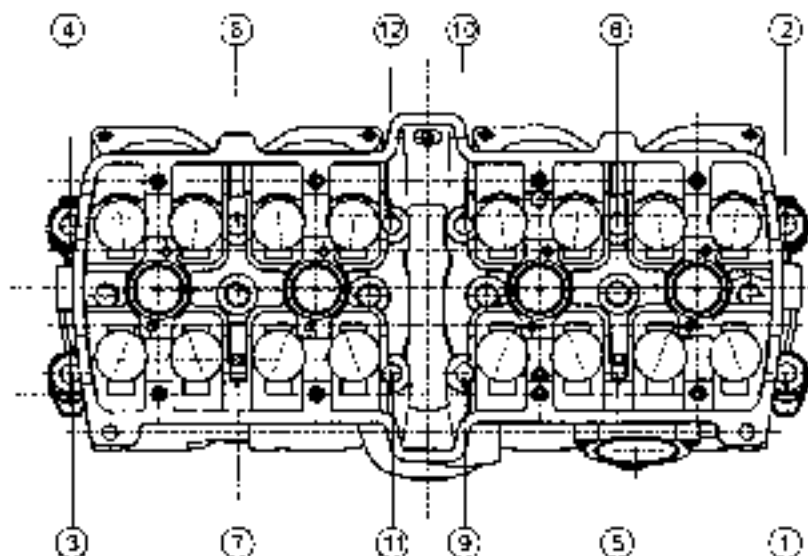
Remove the 12 tightening nuts from the head beginning from the external ones proceeding towards the internal ones, following the sequence indicated in the figure.



On each encarcement there is a washer. Be carefully no to let it fall into the motor, you may block the holes with clean rags.



H





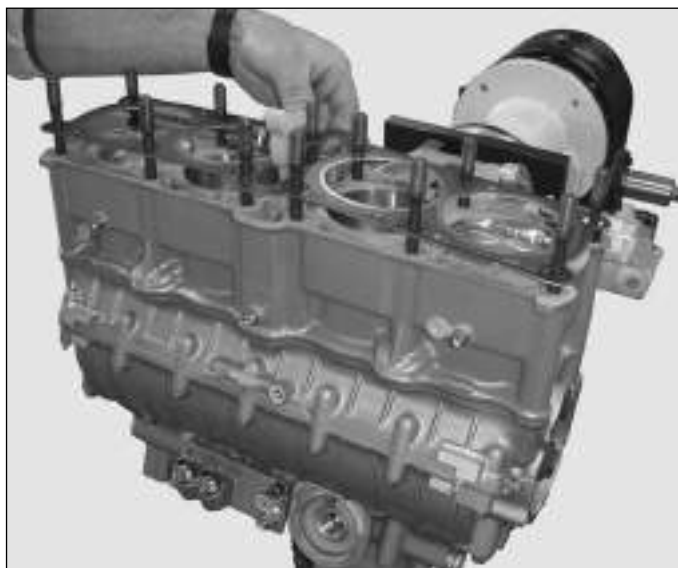
Engine F4 BRUTALE MY 2004

Remove the head and place it onto a clear place



Remove the gasket which will be substituted during reassembly.

Avoid placing the head upside down.



Inspection of the head group

Remove carbon deposits from the combustion chambers. Clean away eventual encrustments from the canalizations of the cooling liquid. Check to be sure that there are no cracks and that the holding surfaces are free of crevices, runs or any other kind of damage.

Verify the planarity of the stroke surfaces.

Verify the perfect state of the spark plug threads



Engine F4 BRUTALE MY 2004

Head assy assembly

To execute this operation you need the following special tool:

- A) n° 94793 piston / cylinder plane distance measuring tool

Place the new gasket on the cylinder plane.

The gasket is of the same thickness of the one installed before if no parts replacement occurred.

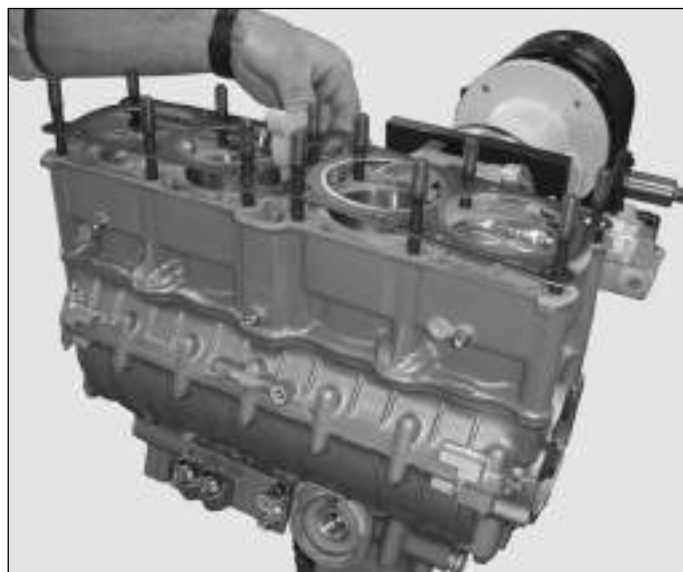
If replacement is necessary you'll need to measure the piston / cylinder plane distance with the n° 94793 tool, tightening the head nuts at 12 Nm. The choice is made following table below:

Piston/cylinder plane projection	Type of gasket
0.55-0.7 mm	Thick= >1.45 mm
0.39-0.54 mm	Medium= >1.30 mm
0.23-0.38 mm	Thin= >1.20 mm

The gaskets are different for the presence of the holes (1) shown in picture.

The presence of the holes identifies the thicker gasket as shown on the chart.

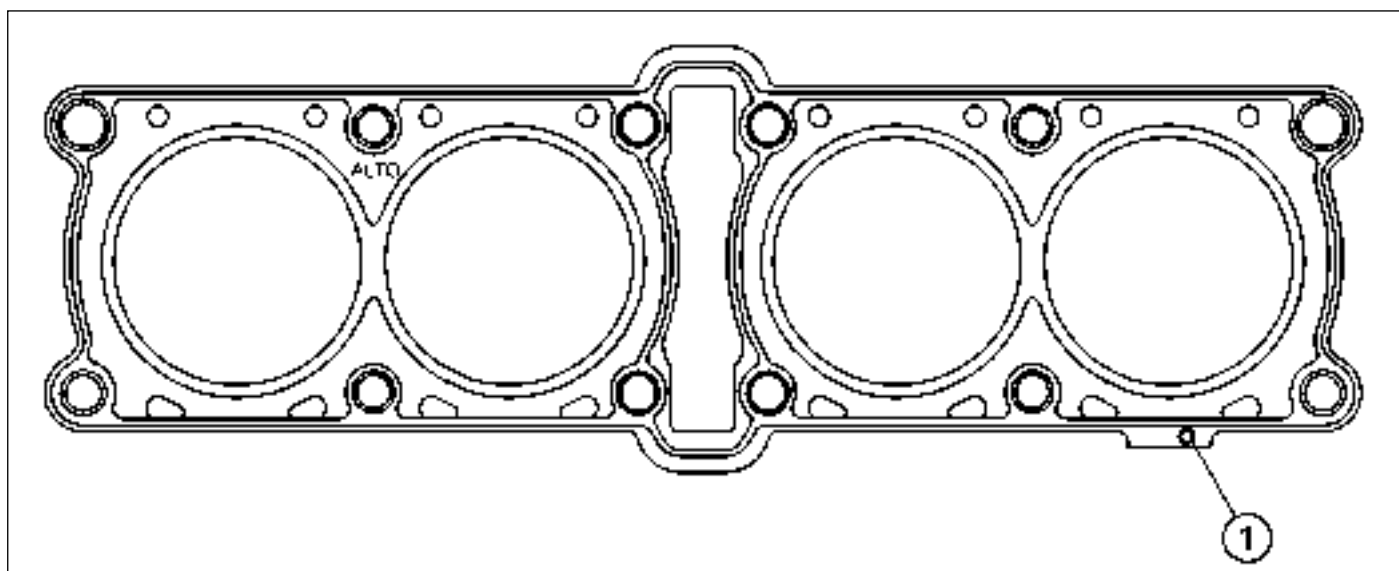
Holes numers	Compressed thickness	Part N°
2	1.20 ± 0.05 mm	8B0098679
NONE	1.30 ± 0.05 mm	8A0098679
1	1.45 ± 0.05 mm	800098679



K
12 Nm clamping



H





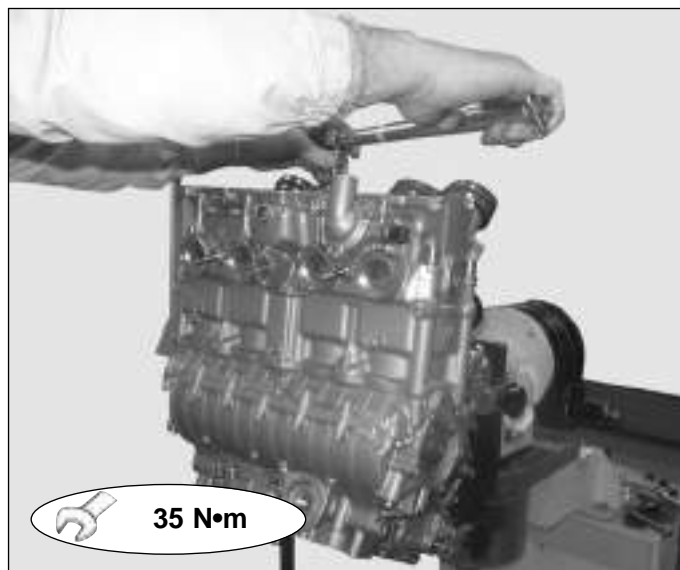
Engine F4 BRUTALE MY 2004

The gasket must be assembled with the letters ALTO on the superior facade and the protrusion towards the march gear.

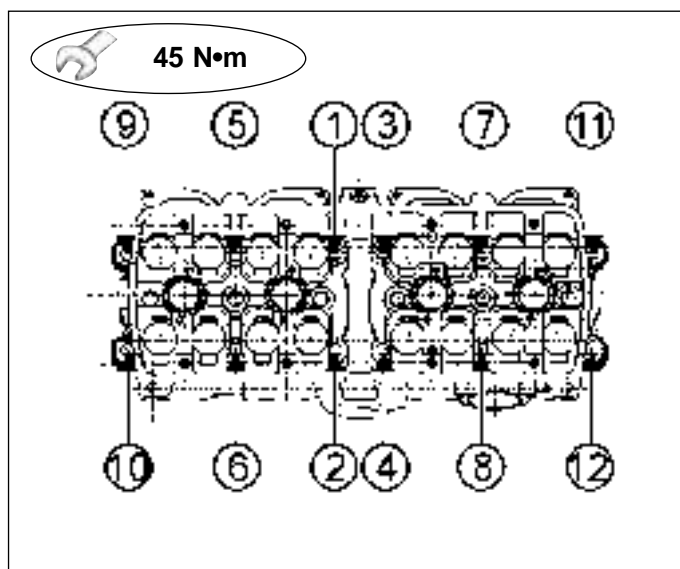
Insert the centering bushes between the head and the cylinder. Insert the washers on the encarcement if necessary with the help of a screw driver to guide them onto the internal encarcements.

Apply engine oil on stud bolt threading.

Screw the bolts with a brugle key and press them at a 35 Nm.

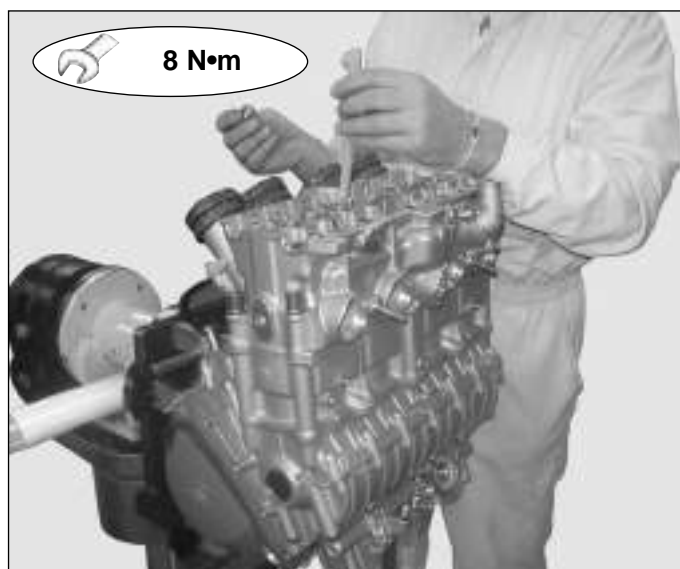


Tighten the bolts beginning with the internal ones towards the external ones following the outline indicated in the figure at 45 Nm.



Retrieve the distribution chain.

Insert the fixed sliding block with its screws and, after having carefully degreased it, tighten it at a torque of 8 Nm. with 243 LOCTITE





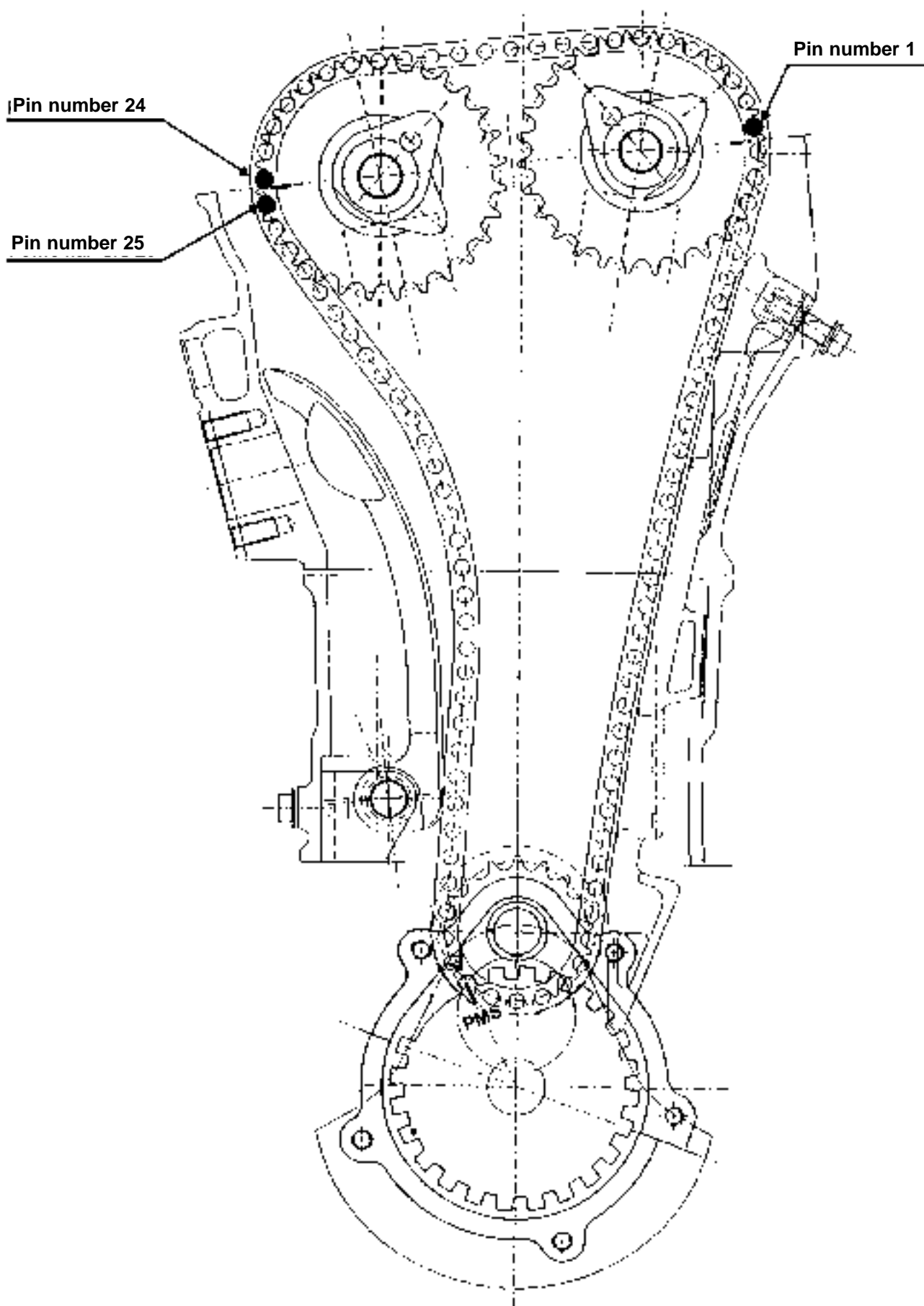
Engine F4 BRUTALE MY 2004

Continue with the setting as follows:

be sure that piston n° 1 is the MSP in burst phase; in this position "T" notch on the phonic wheel is in line with the reference notch on the bedplate.

Remove the copper thread from distribution chain, keep the chain tightened.





Insert the inlet camshaft so that the phase notch on the conveyor wheel is parallel to the head plane and facing the outside.

Insert the exhaust camshaft with the notch placed between the 24th and 25th chain distribution gudgeon, beginning to count from gudgeon after the inlet camshaft notch.

Check the correct position of all the O Rings under the head stands.



Position the n°2 and n°3 stands, referring to the numbers towards the inlet end;

Position the n°1 and n°4 stands,

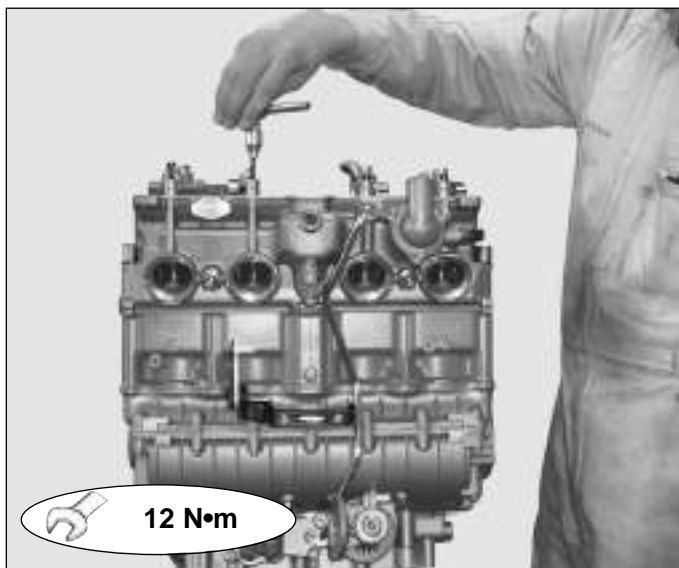
Bring the screws together manually hexagonally embedded.



Before tightening stand screws be sure that the chain tensioner is assembled.



Do not tighten the stand screws if the reaction springs are charged. Appropriately turn the camshaft so that the stand springs of which are to be tightened are uncharged and that the cams are positioned on the base radius.



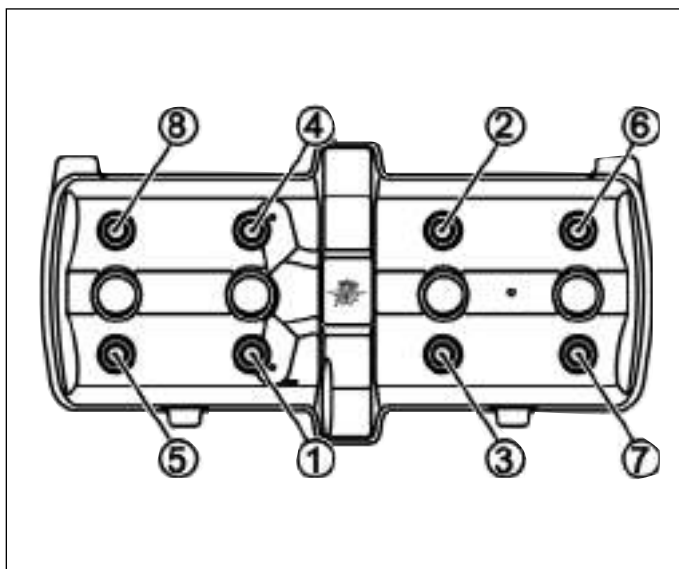
Progressively move the internal hexagonal screws close. Tighten the screws at a torque of 12 Nm., always beginning from n°2 and n°3 stands.

Check to be sure that the valve cap gaskets are in good condition.

Apply a layer of gasket 5552 silicone on the semi moons on the head in correspondence with the camshaft.

Position the valve cap.

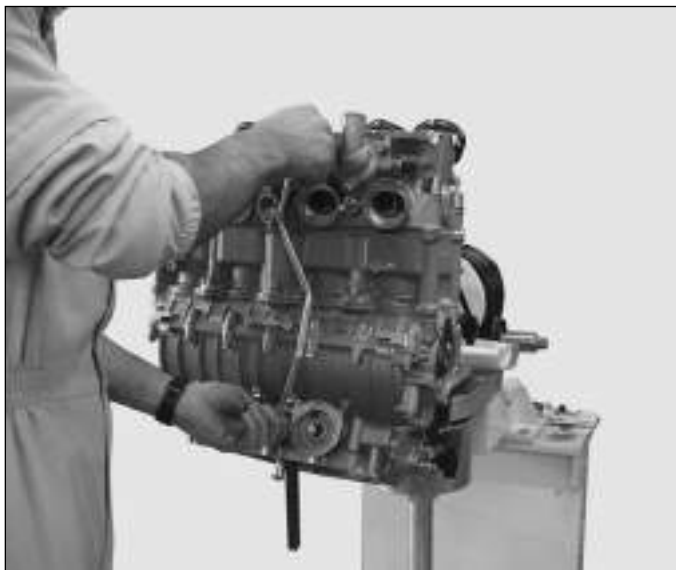
Manually position the screws, thus tighten at 8 Nm.





Engine F4 BRUTALE MY 2004

Place the adduction oil tube at the head greasing the O-Rings.



H

Dismounting cylinder head pieces

In order to carry out this procedure the following tools are necessary:

tool n° 94796 to disassemble valves

tool n° 95179 to remove semi cones



Each piece relative to the same valve (cup, spring, semi cone, etc.) must be reassembled onto the same valve from which it came off.

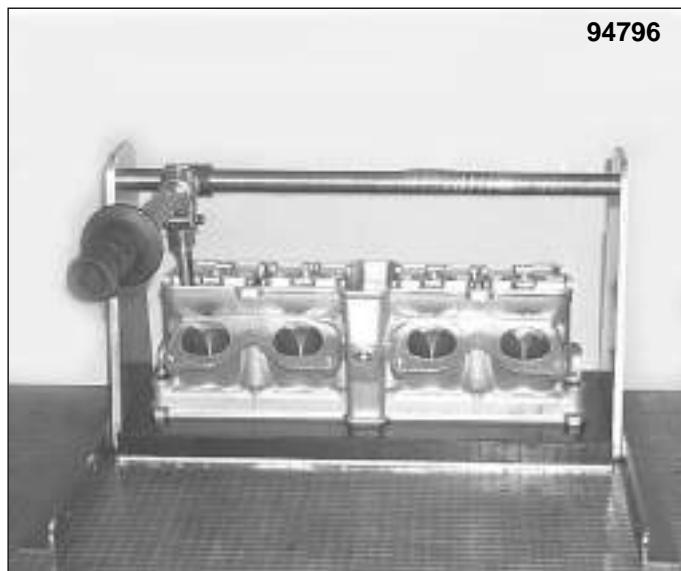
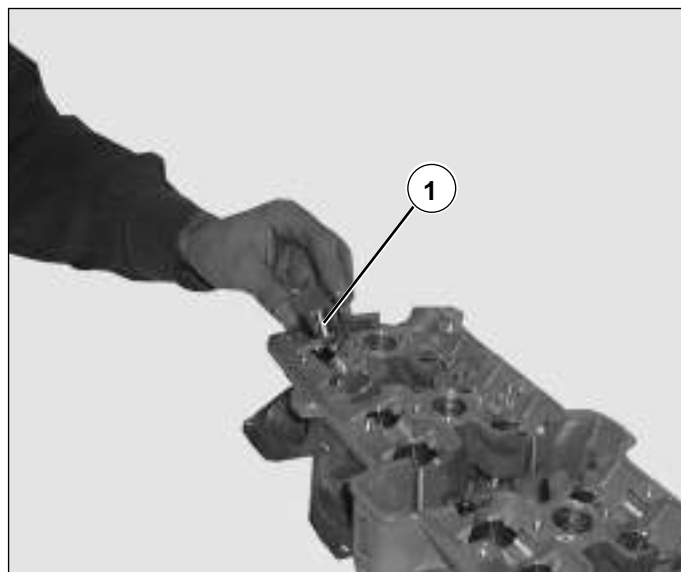
Remove the cylinder head as indicated the paragraph "cylinder assay removal".

95179



Valve removal

- A) Take out the cups (1) with the help of a magnet and number them with a marker so as to reassemble them in the same position.
- B) Remove the tablets (2) of play adjustment with a magnet and place them inside the relative cup so as to reassemble them in the same position. To remove the semi cones (3) exclusively use tool n° 95179 so as to avoid bending the valves:
- C) Assemble the head on tool n° 94796
- D) Hammer on the superior disk with a rubber hammer to unblock the semi cones
- E) Press the springs on the superior disk
- F) Take out the semi cones with a magnet
- G) Slowly release the disk pusher.





Engine F4 BRUTALE MY 2004

Then remove in the following order:

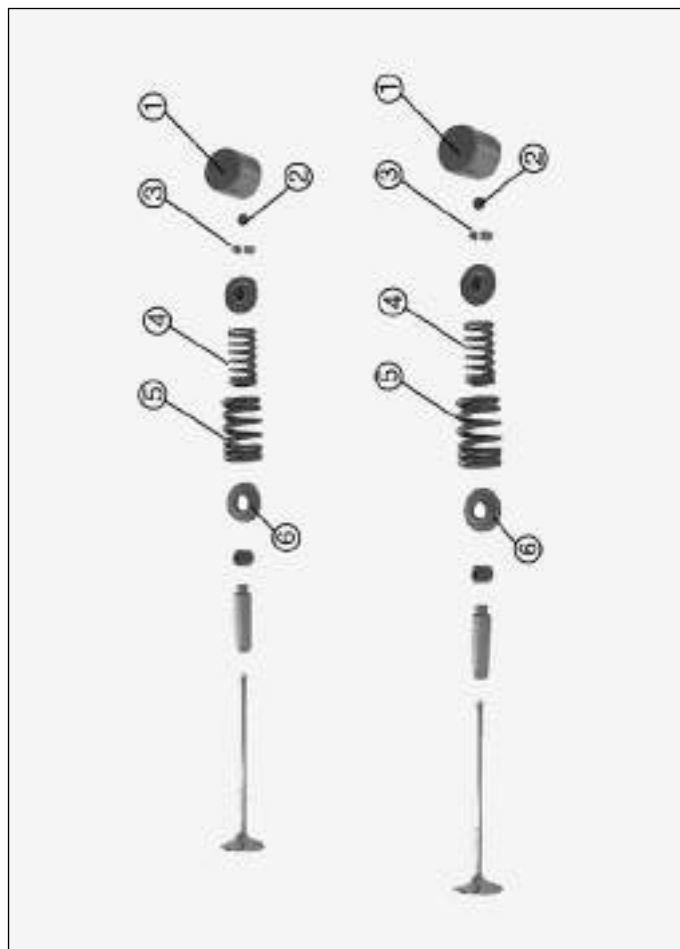
A) Semicones

B) The 2 coaxial springs (4 and 5);

C) If necessary remove the rubber holdings using tool n°94798

D) Remove the inferior disk more grazingly (6)

E) Slide the valve out of the combustion chamber



Maintenance of the valve slot

Check the stroke surface [A] between the valve [B] and the slot [C] : no traces of pitting or cracks must appear. Measure the external diameter [D] of the stroke surface on the valve slot.

If this should appear to be too elevated it is possible to repair the slot.

External diameter of the stroke surface of the valve slot

Standard : exhaust $24.6^{+0}_{+0.3}$ mm
inlet $28.6^{+0}_{+0.3}$ mm

Measure the width of the stroke [E] with a varnished gauge or with Prussian blue.

If it should turn out to be too wide, too thin or irregular it will be necessary to repair it.

Area thickness of the stroke STD

standard : exhaust $0.9^{+0}_{+0.3}$ mm [E]
inlet $0.7^{+0}_{+0.3}$ mm [E]

Limit value mm [E] exhaust 1.3 max
inlet 1.7 max

The repair must be carried out by milling the slots using the appropriate monocutting milling machines at 78° (1), 45° (2) and 25° (3).

Ten proceed with the grinding of the valves and verification of the holding.



Remove the minimum quantity of material from the slot.

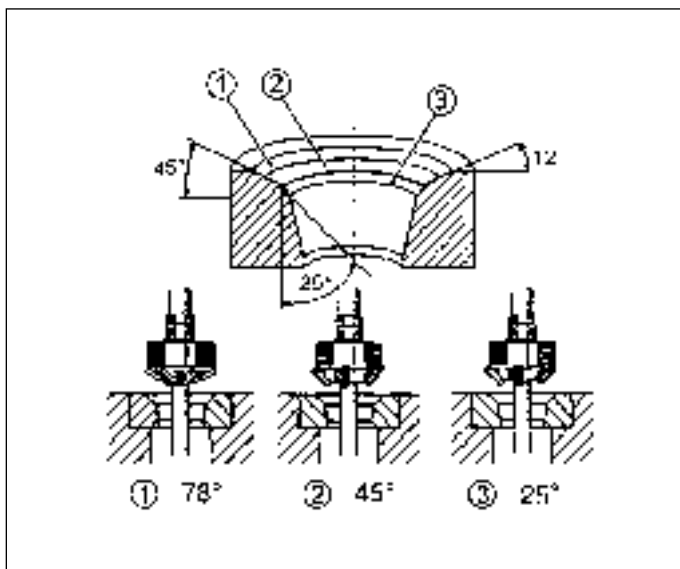
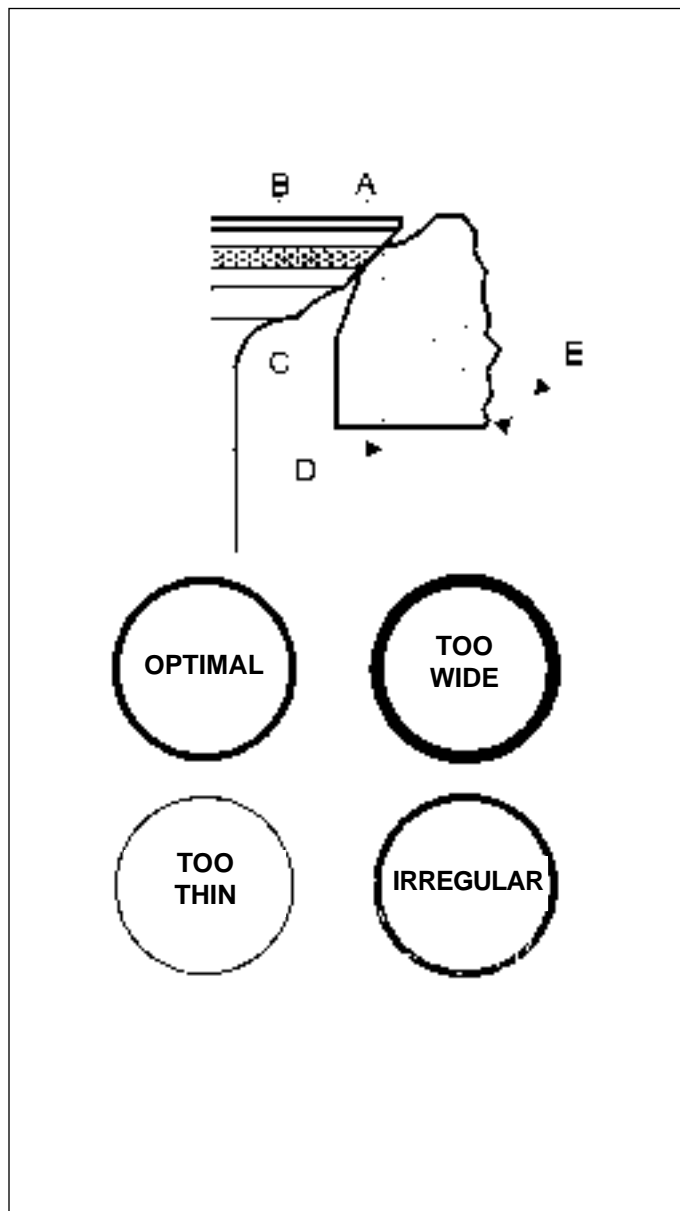
Inlet max 0.5 mm (vertical)
Exhaust max 0.5 mm (vertical)

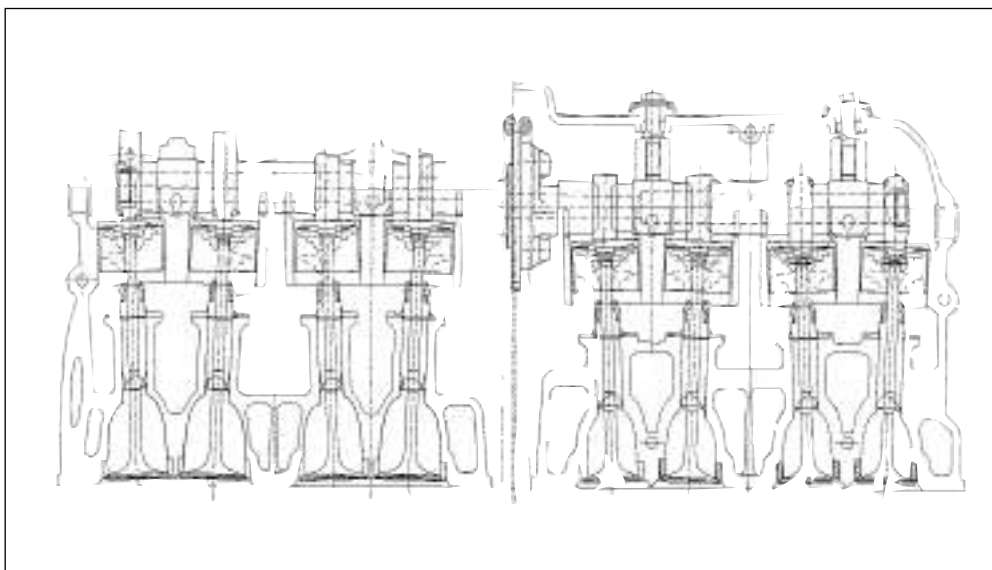
Verify that there is no leakage filling the inlet and exhaust of the gas canalization.

If so, check the quality of repair with Prussian blue.



When reassembling never use calibrated tablets of a thickness inferior to 1.6 mm.





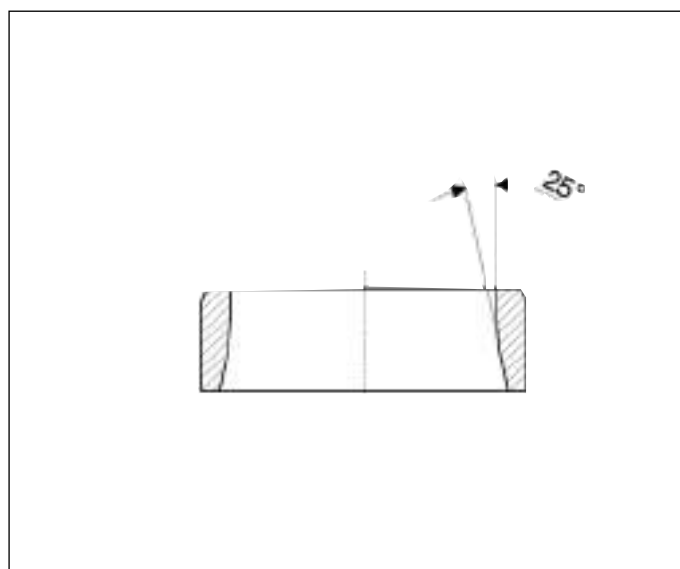
Substitution of the valve slot

The following tools are necessary for this procedure:
prick-puncher n°95319 for inlet slot
prick-puncher n°95318 for exhaust slot

Proceed as follows:

- Remove the worn slots carefully milling them so as not to damage the head lodging
- Check the lodging diameter on the head and choose the oversized valve slot considering that the **assembling interference should be 0.10÷0.15 mm.**
- Valve slots are furnished with an increased replacement part of 0.03 mm on the external diameter.
- Slowly and evenly heat the head at a max temperature of 180°C and cool the new slots with dry ice.
- Place the slots perfectly in frame into its lodging, using the special n°95319 prick-puncher (INLET) and n°95318 (EXHAUST)
- Let cool and proceed with the milling of the slots and grinding the valves referring to the following quotients:

Ø A	28,60 $\begin{smallmatrix} +0.3 \\ -0 \end{smallmatrix}$
Ø S	24,6 $\begin{smallmatrix} +0.3 \\ -0 \end{smallmatrix}$
[E]	ASP. 0.7 $\begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$ SCAR. 0.9 $\begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$





Engine F4 BRUTALE MY 2004

Valve guide check and maintenance

In order to carry out this procedure the following tools are necessary:

Control tampon n°95429

Tampon n°95320

valve stem-valve guide play: **0.01÷0.037 mm inlet**

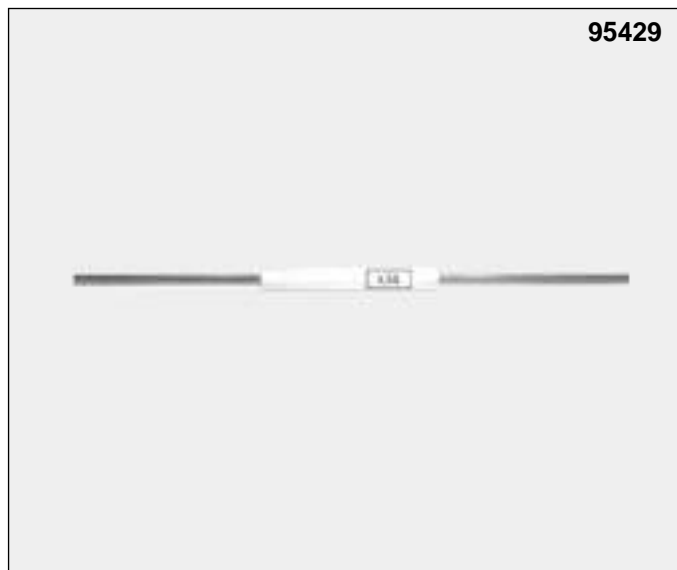
0.02÷0.047 mm exhaust

coupling limit: **0.08 mm inlet**

0.09 mm exhaust

internal guide Ø limit: **4.55 mm**

95429



Proceed with an accurate visual check of the valve guide.

In order to determine the coupling wear between guide and valve stem it is necessary to measure the play using a control tampon and micrometer.

NOTA The control tampon 95429 (Ø 4.55) must not pass.

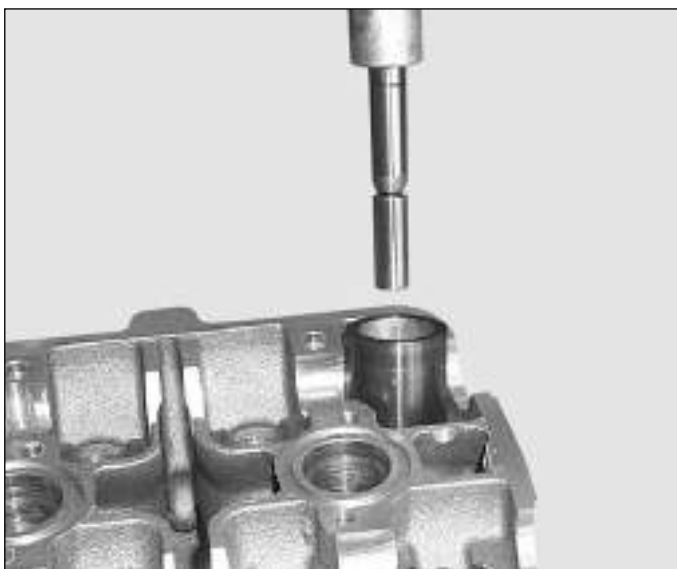
NOTA In the case of substituting the guide valve it is necessary to check and if necessary also substitute the valve.



Removal of the valve guide

After having removed the valves and rubber holdings as described in the relative paragraph, continue as follows: Slowly and evenly heat the cylinder head up to 100°. Using the pad No. - see note at the bottom of the page remove the valve guide. Continue with a visual check of the slot to verify its State.

For engines with numbers from 4911 to 5951, use the A2383 tool for removing the valve guides, and the A2385 tool for mounting the spare part. For engines with numbers higher than 5952, use the A2385 tool, both for removing the valve guides and for mounting the spare part.





Engine F4 BRUTALE MY 2004

Guide valve installation

Assemble an oversized valve guide as follows:

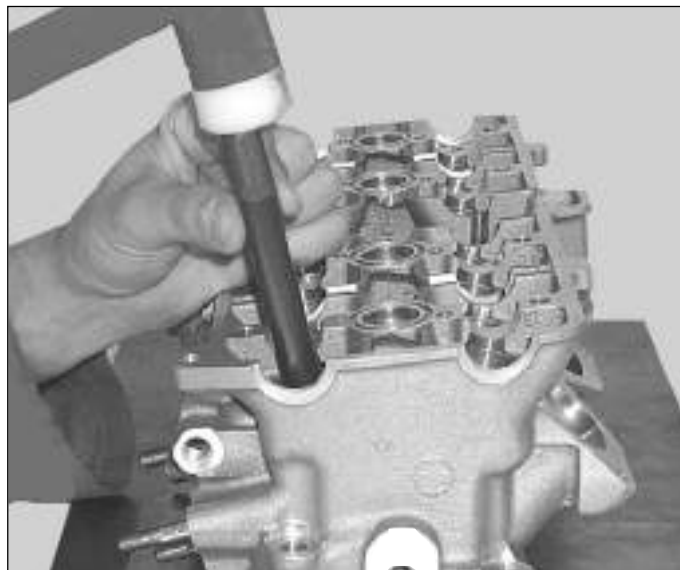
Oil the external valve guide surface.

Slowly and evenly heat the cylinder head up to 150°.

If necessary cool the valve guides with (N2) nitrogen liquid; or dry ice.

Insert the valve guide using the special tampon up to the stroke and let rest until the temperature has stabilized.

Check to be sure the valve slides freely in the valve guide otherwise coat it with a 4.5 H7 reamer or broach N°8000 A2625.



Valve

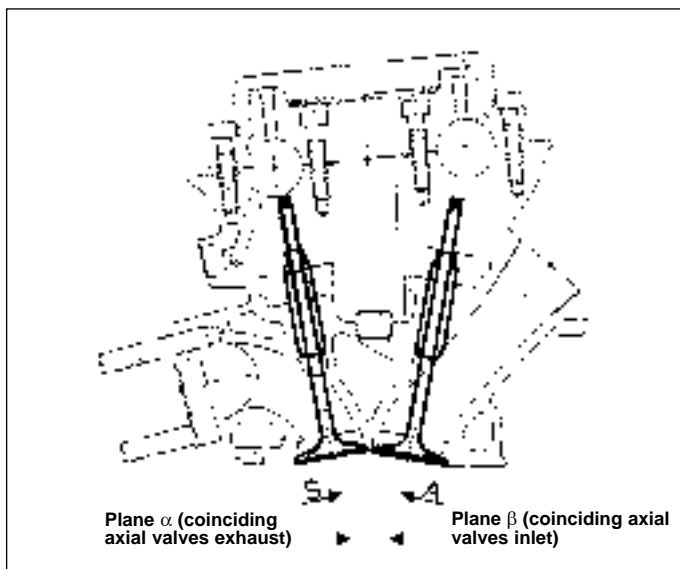
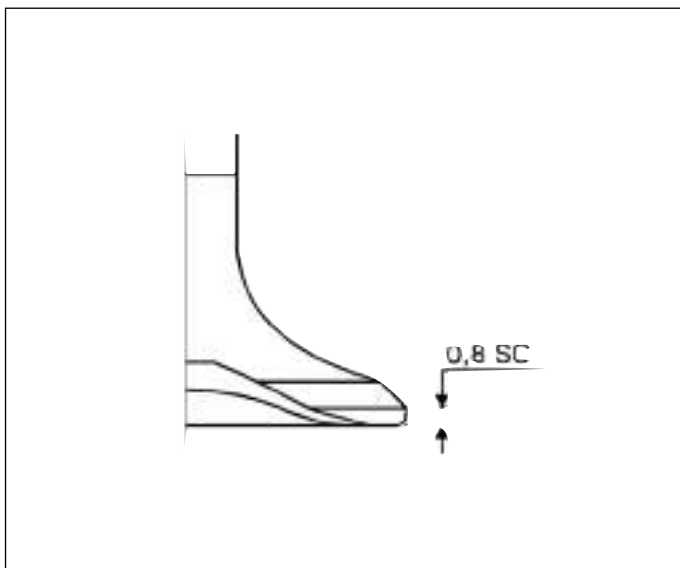
The stem diameters must not fall below:

4.470 mm inlet

4.460 mm exhaust

The minimum distance of the holding position at 45° on the valve plane must not be lower than 0.7 mm ASP.- 0.8 mm SCAR (see figure).

Check to be sure that the stem and the surface in contact with the valve slots are in good condition. No traces of pitting, cracking, deformations or traces of wear should appear. Verify that the stem is perfectly rectilinear.



Valve-guide valve coupling

Coupling play at assembly must be:

0.01 ÷ 0.037 mm inlet.

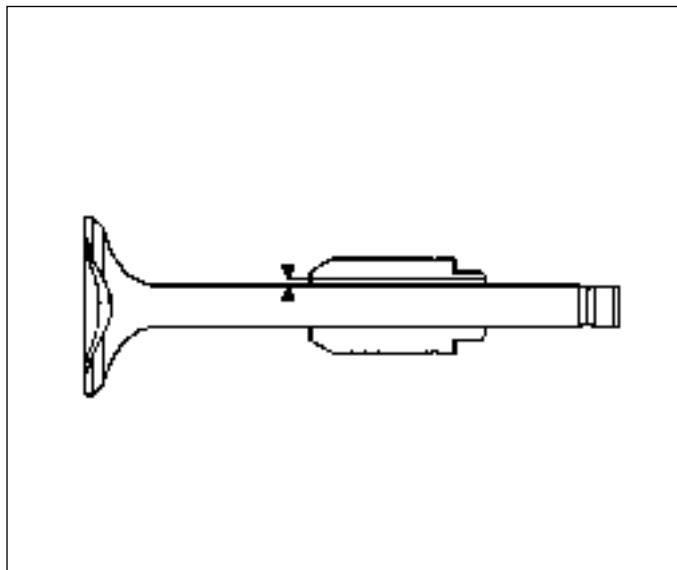
0.02 ÷ 0.047 mm exhaust

The maximum coupling limit permitted is even to

0.09 mm inlet

0.10 mm exhaust

If a major play should result, substitute valve and valve guide.



Springs

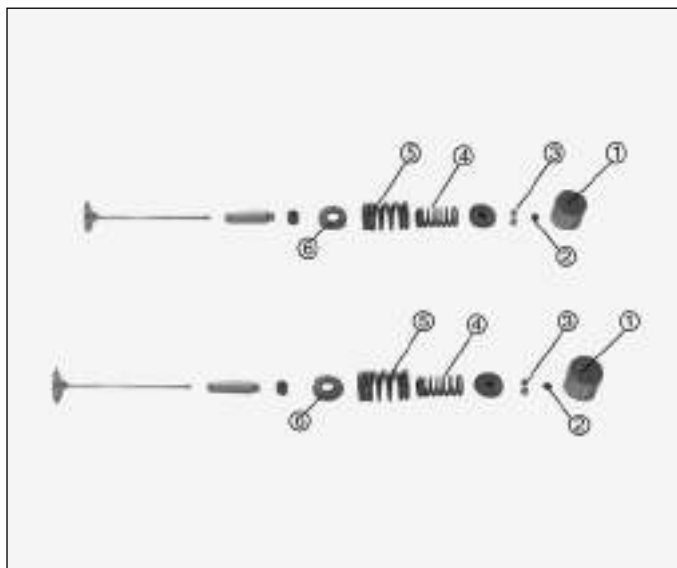
Check to be sure that the free value of length is not inferior to the suggested limit and in such case substitute the springs:

Internal spring l = 33.8 mm.

Service limit: 33.5 mm

External spring l = 37.9 mm.

Service limit: 37.5 mm



Valve reassembly

A) Carefully degrease the guide

B) Insert the inferior basement disk (6) and be sure that it is in beat.

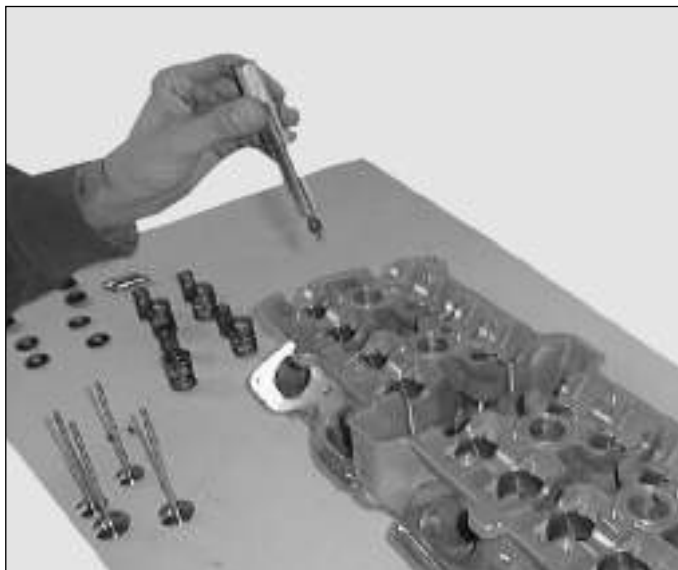
C) Assemble the rubber holdings, always new, on the valve guide using tool n°95581;

D) Sprinkle the valve stem with oil.

E) Assembling the valve.

95581

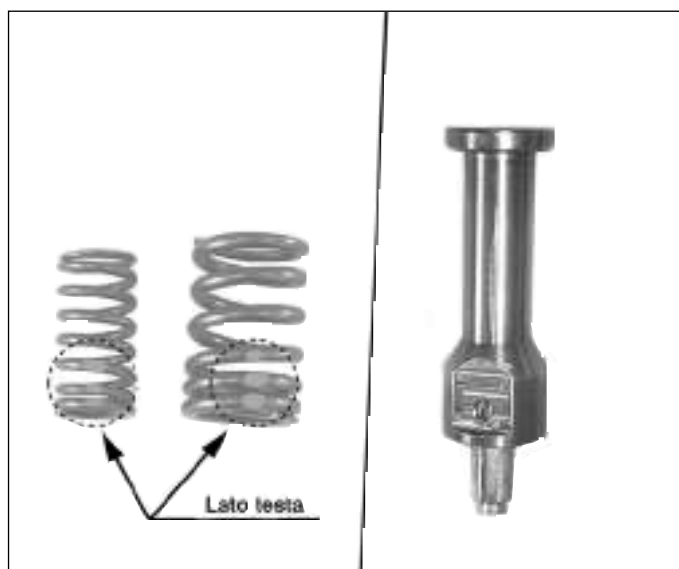




Insert in the order of:

- A) Insert the two coaxial springs
- B) Slide the semi cones into the superior disk slot and thus place the disk on the springs
- C) Assemble the head on the disassembling valve tool n°94796 and compress the spring with tool n° 95180 until the semi cones are inserted
- D) Using a rubber hammer strike a slight blow on the valve so as to place the semi cones.

NOTA Before placing the semi cones be sure that the head is not resting on a plane in order to avoid distorting the valve. Place it onto two bases which allow the valve to move.



- E) Insert the tablet of the correct thickness and lubricate its surface
- F) Make sure it easily turns in its slot
- G) Insert the cup after lubricating the slot

Insert the cylinder head as described in the paragraph "Head assay assembly".



Regulating valve play

Verify that the spark plugs have been disassembled.



Should this procedure be carried out with the head assembled on the motor, block the spark plug holes with clean rags and assemble plate n°95191 to avoid the pieces accidentally falling into the chain distribution opening.

A) Rotate the drive shaft until completely unwinding the springs relative to the valves on which intervening (MSP in burst phase).

B) Measure valve play with a thickometer.

Inlet valve play	Exhaust valve play
0.15 ÷ 0.24 mm	0.20 ÷ 0.29 mm

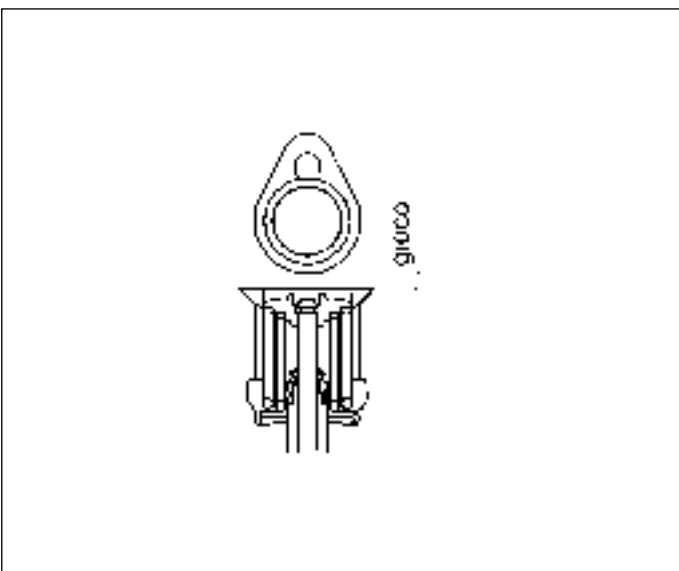
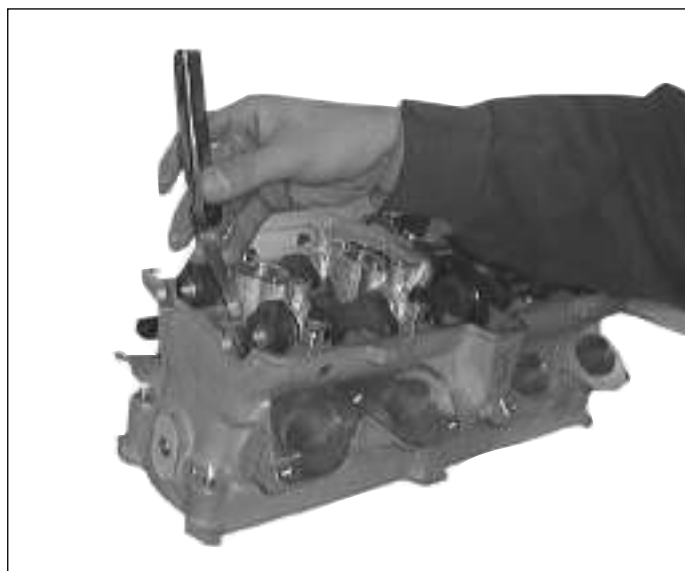
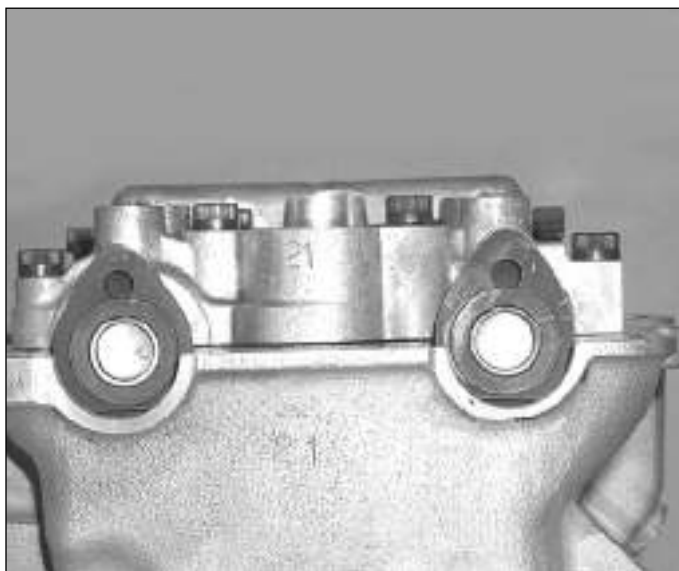
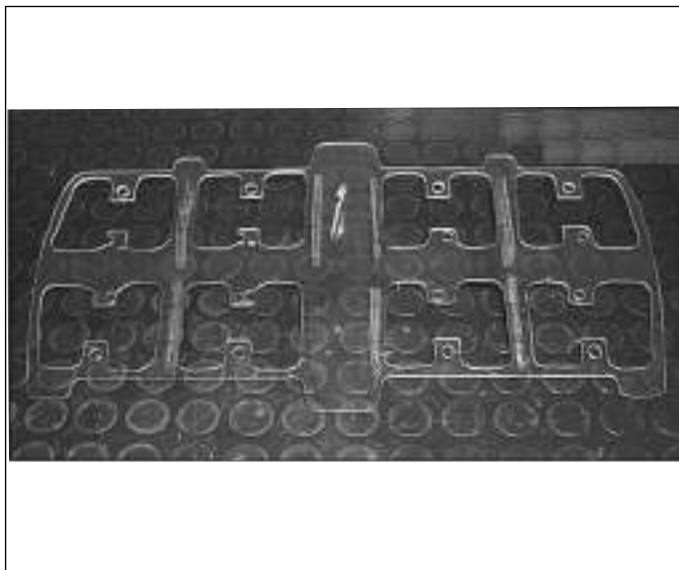
C) Calculate the D difference between the compared play and optimal play shown on the chart

D) Read the value of S thickness on the tablet;

E) Choose a new tablet with an S+D thickness.



During reassembly never use a tablet with a thickness less than 1.6 mm.



Chain tensioner

Remove the central screw-cap and withdraw the spring and the pin.

Remove the screws fixing the chain tensioner to the head.

Remove the chain tensioner.

Disassembly the chain tensioner and check the correct working of each part.

The internal pin must run clearly and the inner spring must give a quick response.

Replace the assembly in case of malfunction.

If everything works properly lubricate the parts and install the assembly with the chain tensioner in the minimum extension position (all in the main body)

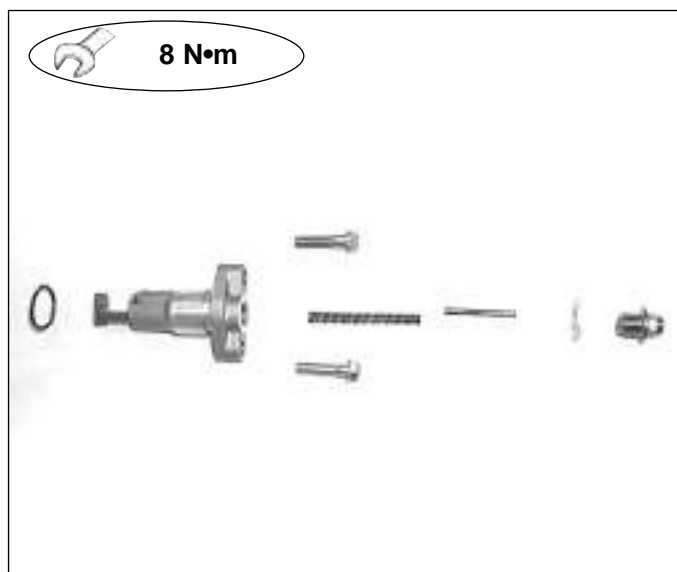
Install the chain tensioner body locking the 2 socket

head screws using a T wrench with a 8 Nm torque

Install in this order: the pin in the spring, the spacer and the screw cap.

Lock the screw cap by hand till you feel the tensioner extend, then lock it with a 8 Nm torque

Acting this way the chain tensioner is adjusted.





Engine F4 BRUTALE MY 2004

GEAR AND GEAR CONTROL



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	150	8	8	6	25 (M8)	25				
	Kg·m										
	ft·lb										
Thread blockers		Medium	Medium			Medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Disassembling gear group

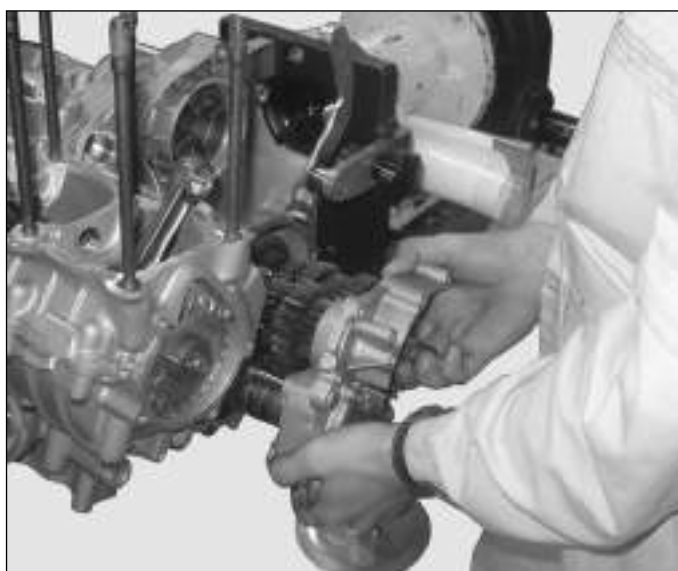
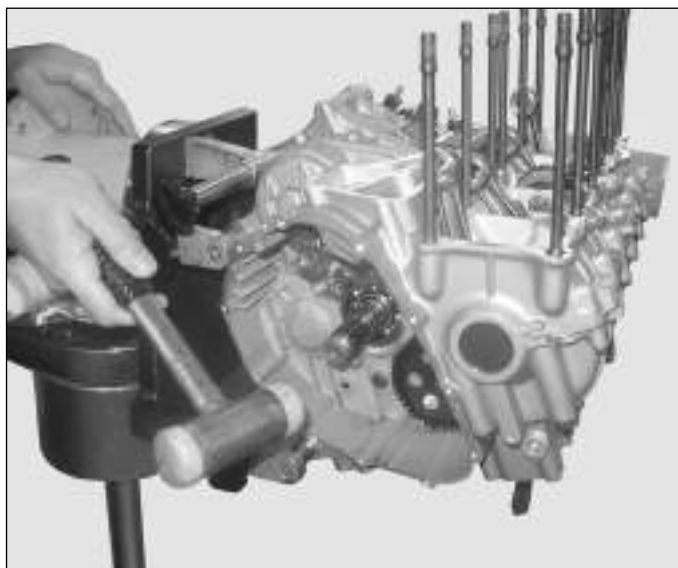
Remove the clutch following the instructions in the relative paragraph.

Remove the clutch rod from the clutch end.

Remove the 6 tightening screws from the gear cap.

Using a rubber hammer, delicately beat on the primary shaft from the clutch end holding a hand on the gear cap until it moves from the bedplate.

Slide the gear group out.

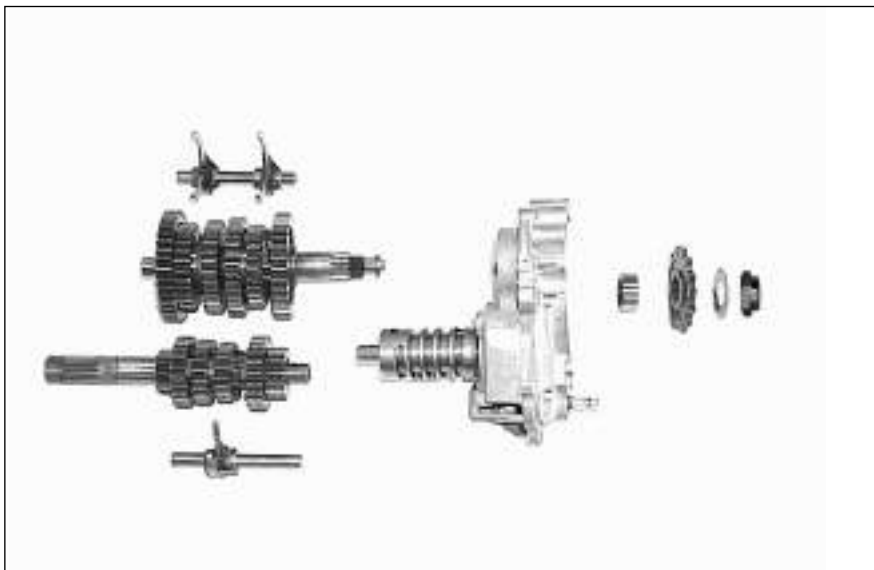


Gear command

Disassemble the gear command group following the order shown in the figure. Place the various components in an orderly way so as to facilitate reassembling.

Check each component for wear of irregular traces on its surface.

Carefully check the following components.



Shift drum

Check the shift drum: no signs of wear on the grooves are allowed.

Fork pin - groove clearance for new parts: $0.15 \div 0.35$ mm

Wear limit: **0.65 mm**

Groove width of a new drum: **$7.05 \div 7.15$ mm**

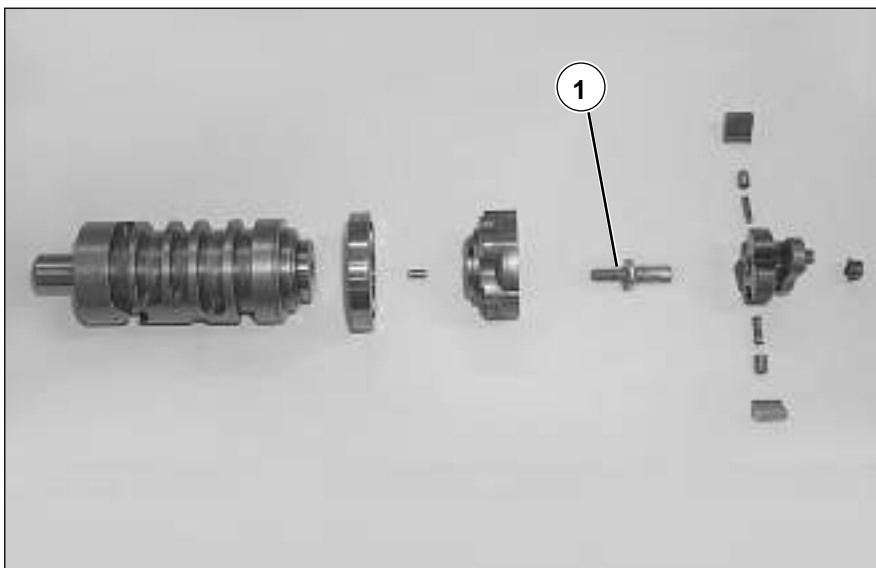
Wear limit: **7.35 mm**

The **new fork pin diameter is equal to $6.8 \div 6.9$ mm.**

Wear limit: **6.7 mm**

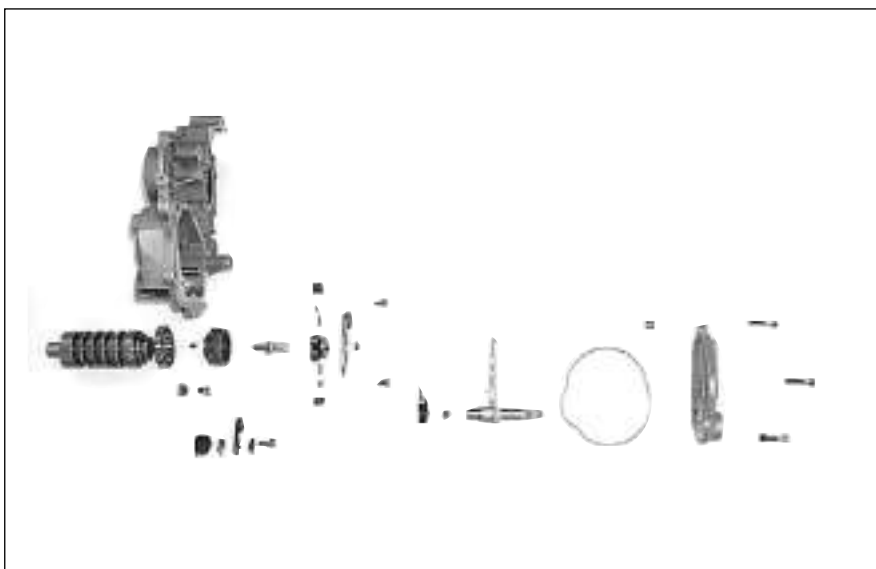
Verify the working clearance between the fork pin and the shift drum groove, measuring the dimensions with a gauge.

If the value exceeds the service limits, compare the standard value to choose the parts to be replaced.



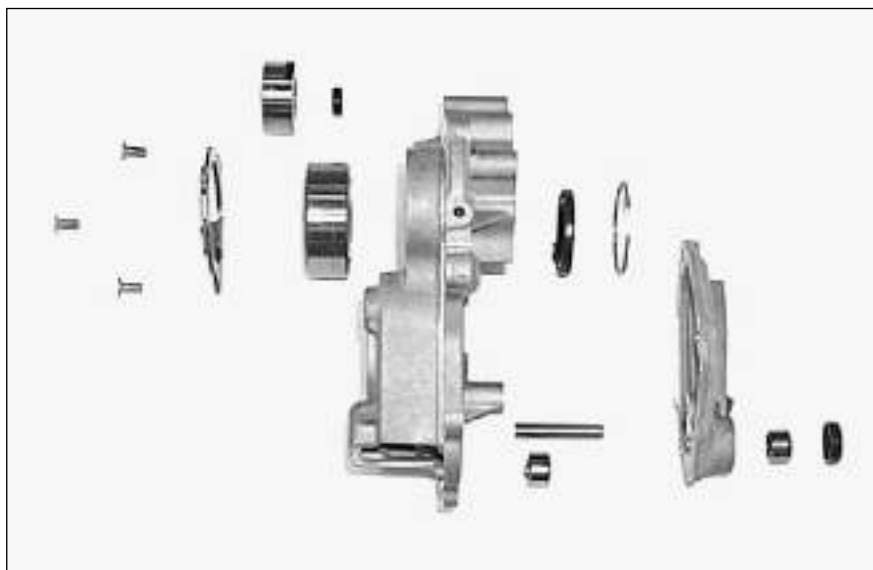
Verify the gear locker pawl free movement.

Reassemble the various parts by acting in the opposite way.



Degrease accurately and apply LOCTITE 243 to all the screws, before reassembly.

Lock all the screws at a 10 Nm torque but the screw 1, needing a 25 Nm torque.

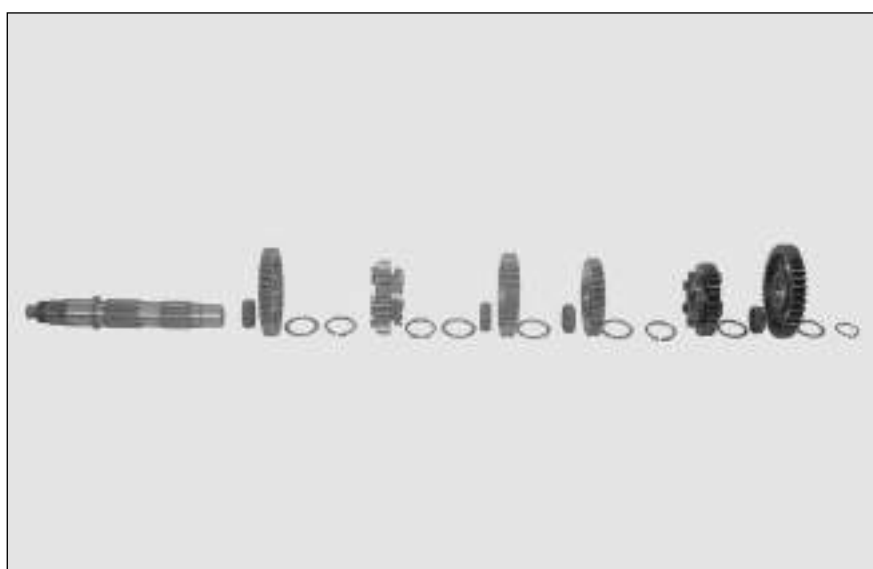
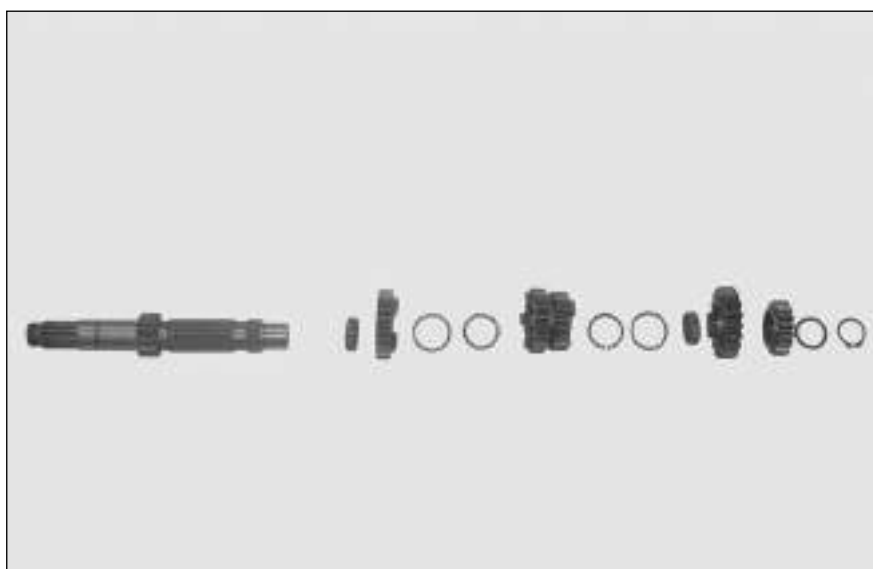


Primary and secondary shaft



Check the two shafts separately so as to avoid confusion of similar components.

Place the components in such a way as to facilitate the correct positioning during reassembly.





Engine F4 BRUTALE MY 2004

Gear group revision

In order to carry out the following procedure the following special tool is necessary:

Motor simulation utensil n° 94792 (for $\varnothing 25$ bearings) No. 8000-94792 (engines with registration numbers from F4A206446 to F4A309191 and from F4A410410 to F4A410760) engine simulation tool (for $\varnothing 27$ bearings) No 8A00-94792 (engines with registration numbers from F4A309192 to F4A30410409)

Disassemble the gear group from the motor and reassemble it on the special utensil n° 8000-94792 o n° 8A00-94792 motor simulator being careful to tighten the pinion fixing nuts with the separator that simulates the clutch hub.

Check the condition of the front clutching teeth of the gears which must be in perfect shape and sharp edged. The neutral gears must rotate freely on their shafts.

All of the neutral gears must present a minimum axial play of 0.10 mm.

Verify the wear on the bearings present on the inside of the gear box. Verify the control quotas indicated on the sketch in the figure.

Gear selection forks

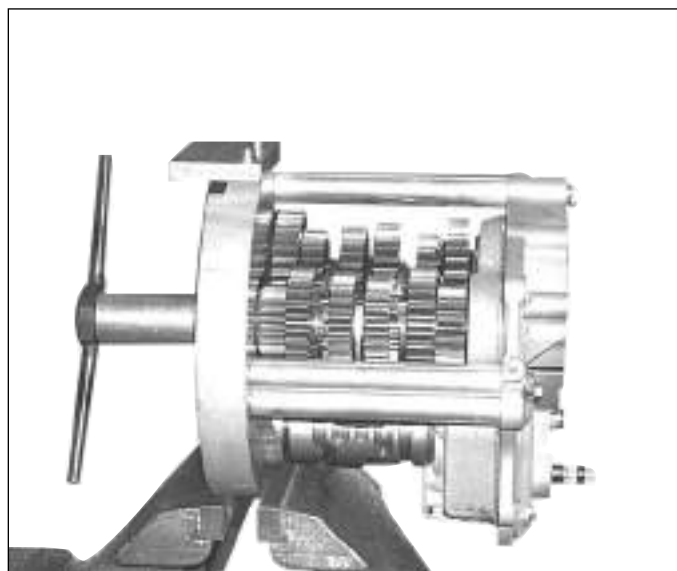
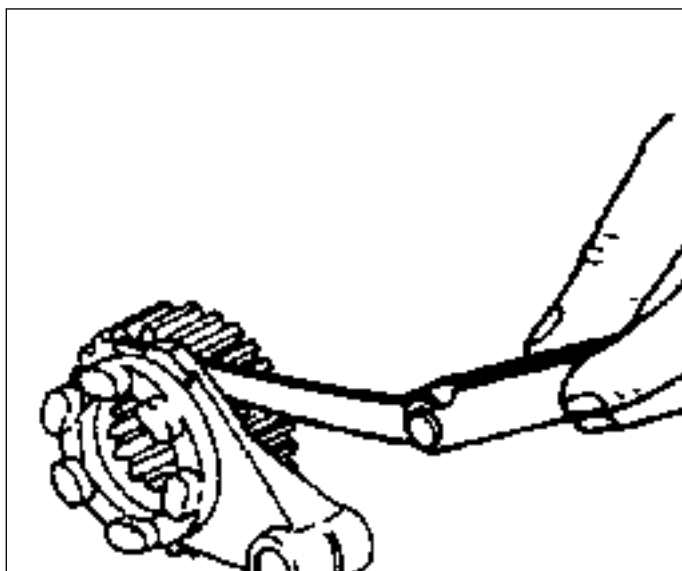
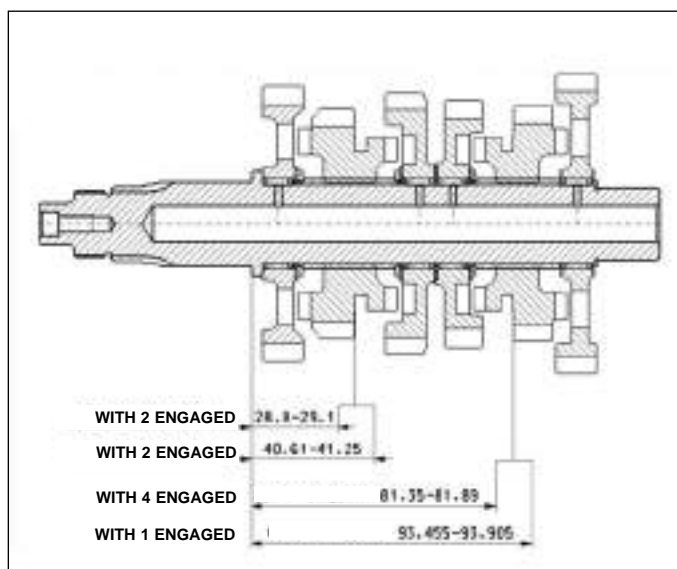
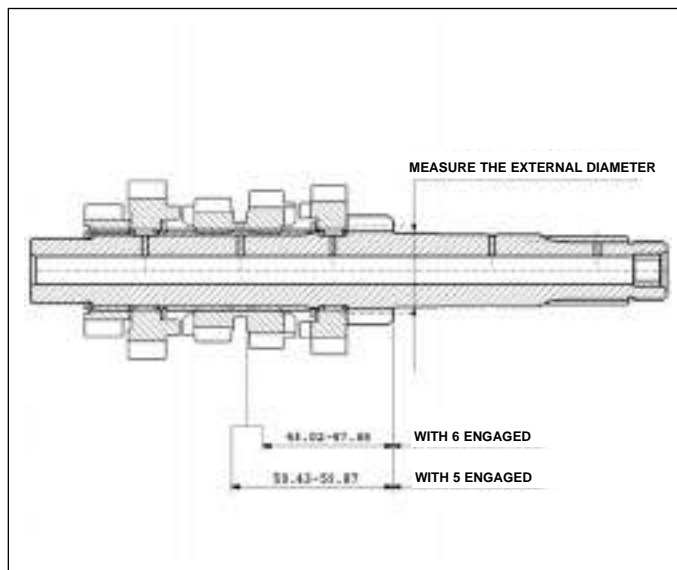
Visually inspect the gear selection forks to look for folds or other damage.

Every fork that appears damaged must be substituted because it can cause difficulty when inserting a gear and causes sudden uncoupling under load. Check the play of each fork using a thick meter in the groove of its gear. If play is above 0.7 mm substitute the gear or fork in relation to service limit of each part.

Gear groove limit	5.6 mm	Primary
	4.6 mm	Secondary
Fork limits	4.65 mm	Primary 5-6 gear
	3.65 mm	Secondary 1-2, 3-4 gear

The fork must be able to move without force.

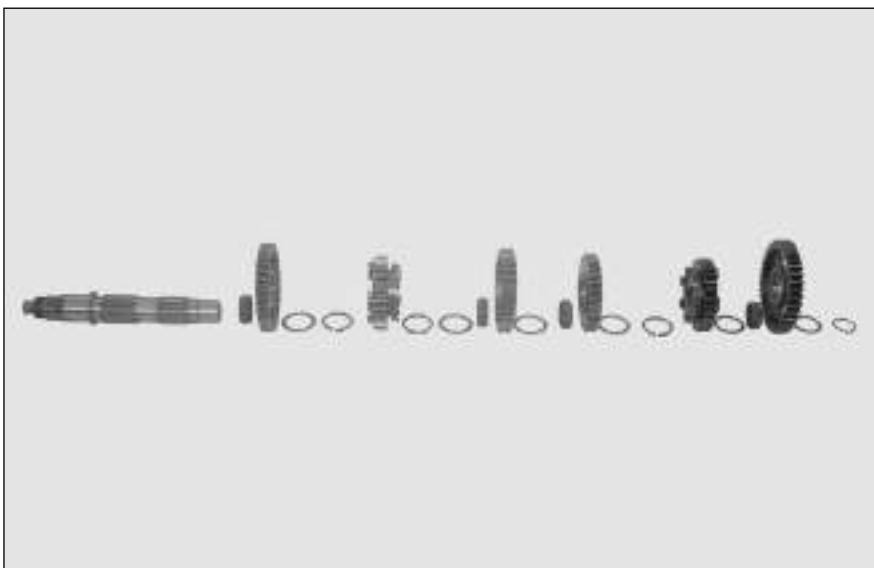
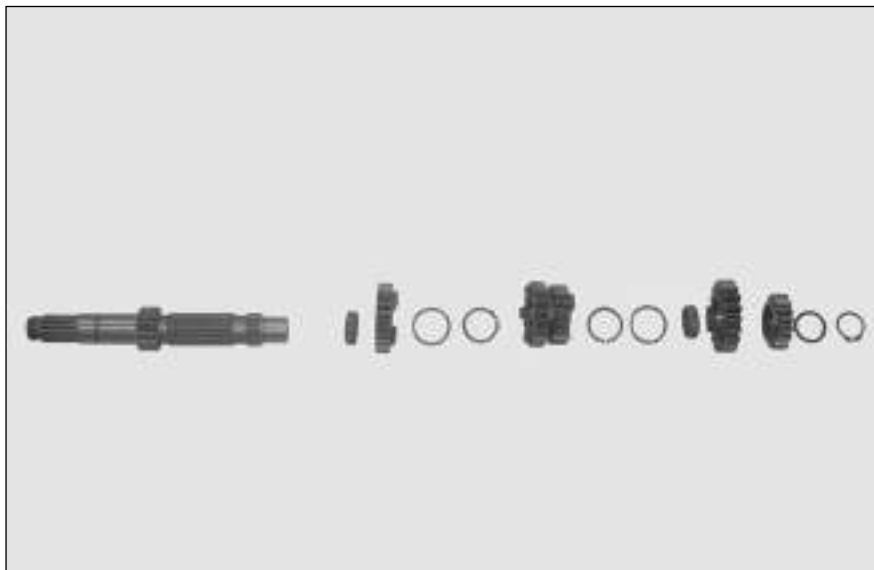
Grippage of the gears must flow without impediments and without excessive attritions.



Installation

To execute this operation you need the following special tools:

n° 8000-94792 o n° 8A00-94792 gear-box tool



Reassembly the various parts by acting in the opposite way.

Install the 2 shafts on the n° 8000-94792 o n° 8A00-94792 engine simulation tool. Install a shift pedal and check the gear box is correctly working.

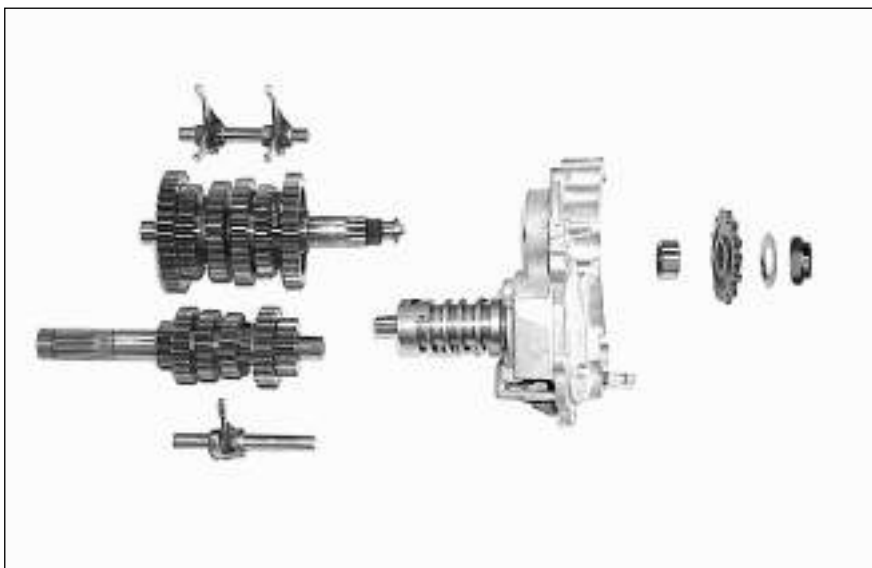
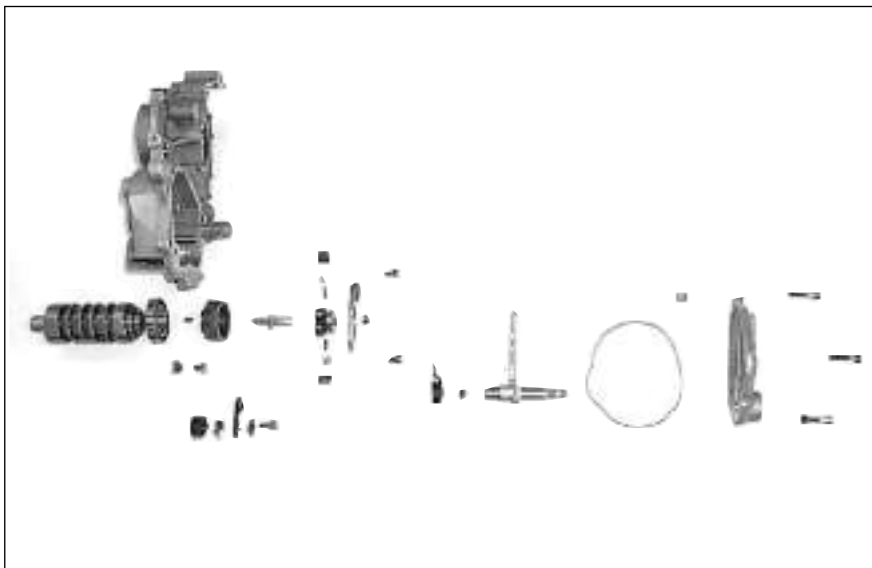


Always install a new washer under the pinion at reassembly. Carefully degrease the threads before reassembly.

Tighten the pinion nut at 150 Nm using a medium thread blocker (Loctite 243). Turn the security washer again so as to avoid the accidental unscrewing of the pinion nut.



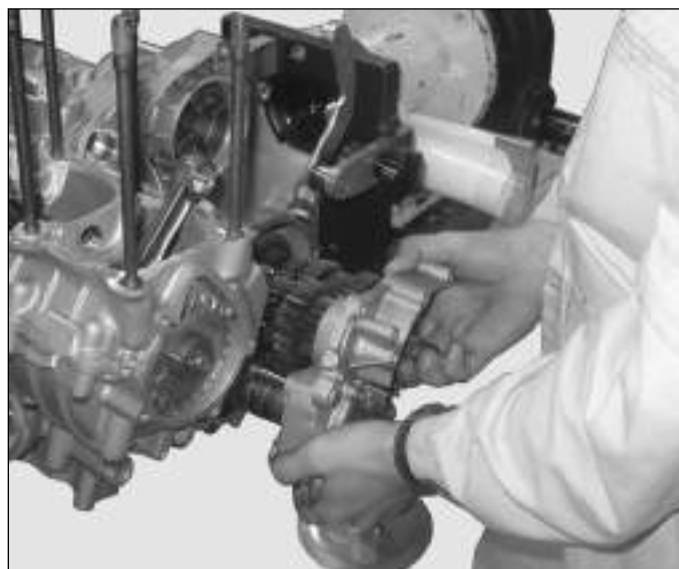
All the gears must be inserted and uninserted without stumbling.
In case of stumbling, verify that the axial play has been correctly restored.
With a thick meter verify that each gearing, once inserted presents a **fork-pit play** equal to $0.2 \div 0.3 \text{ mm}$ placing it on both ends of the coupling.
The fork must be free.
Assemble the gasket on the internal end.



Before inserting the gear group into the bedplate verify that a gear is inserted so as not to damage the neutral indicator switch.



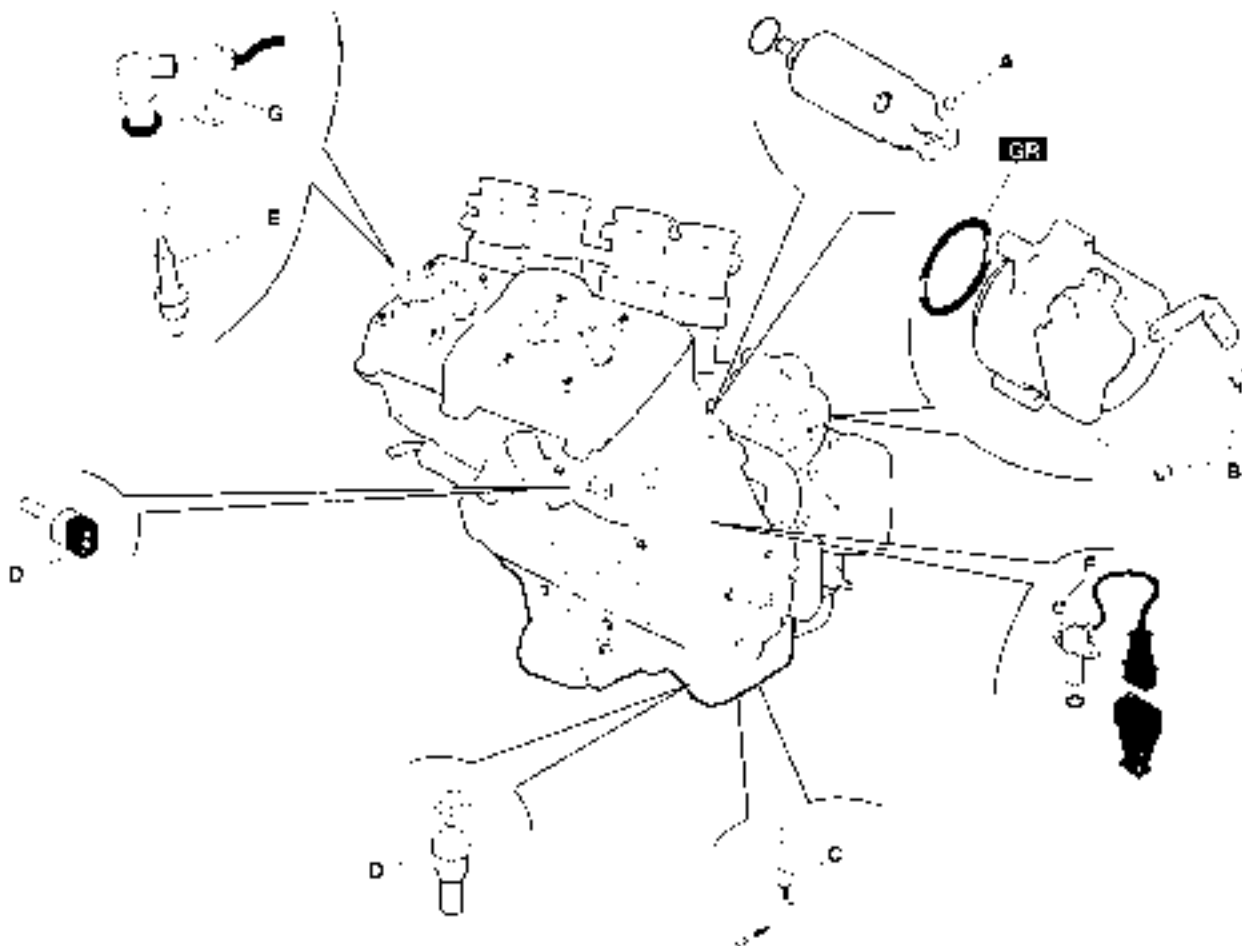
Do not insert the gear group in neutral into the bedplate.
Insert the clutch rod.





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ELECTRICAL COMPONENTS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m	8	25	10	22	12	6	8			
	Kg·m										
	ft·lb										
Thread blockers					Medium		Medium				

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

Remove the pick-up from the phonic wheel.

Alternator

- Removal:

Working on the left side of the motor, remove the three alternators and the stiffening stirrup tightening nuts.

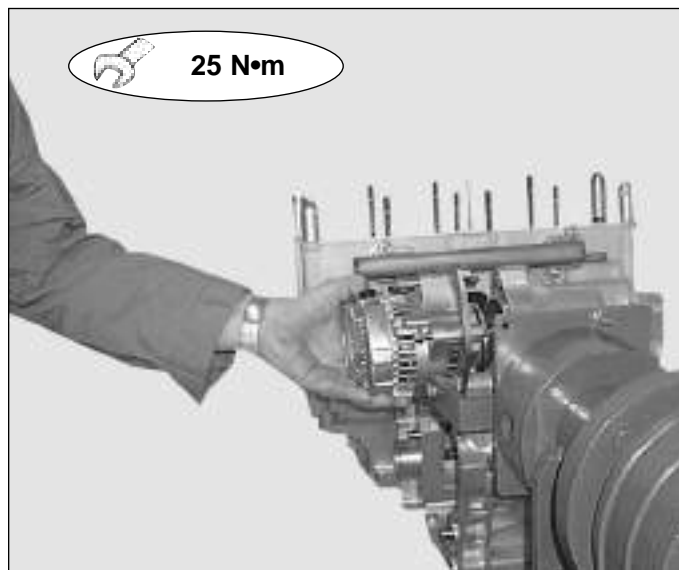
Slide the alternator out being careful not to let the rubber torsions fall .

Assembly:

Grease the torsions and O-Rings.

Insert the pallets together with the torsions.

Manually bring the screws together, thus tighten them at 25 Nm.



Starter motor



- Removal:

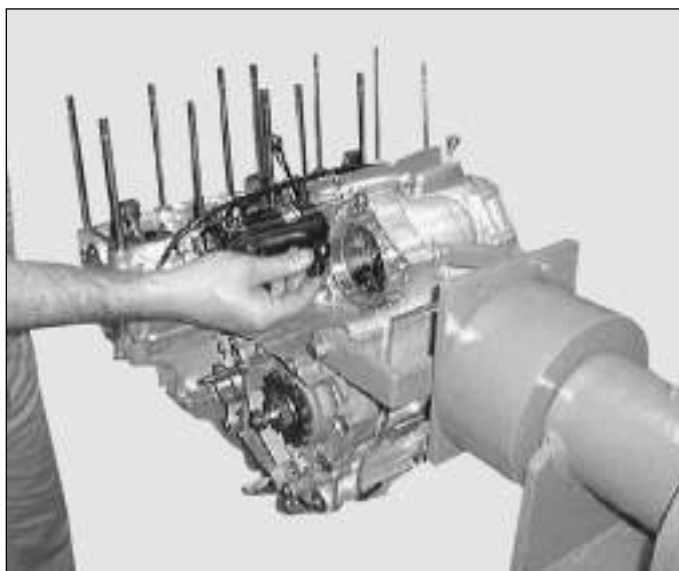
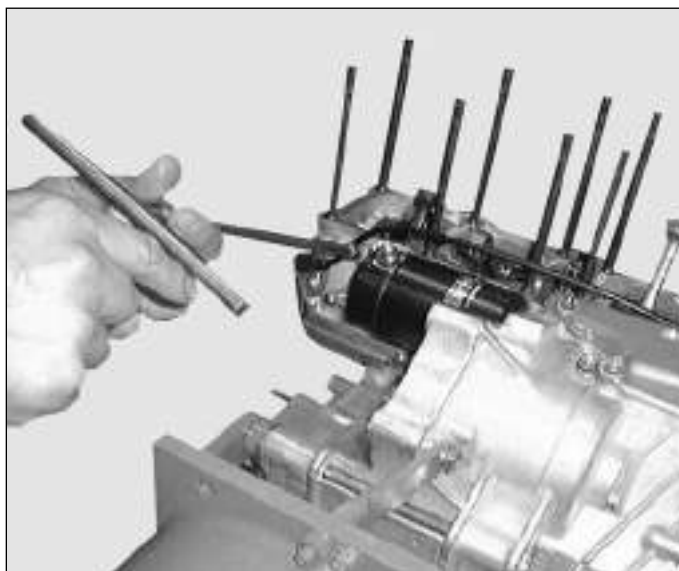
Remove the two tightening screws.

Slide the starter motor out, being careful not to damage the O-Rings on the shaft.

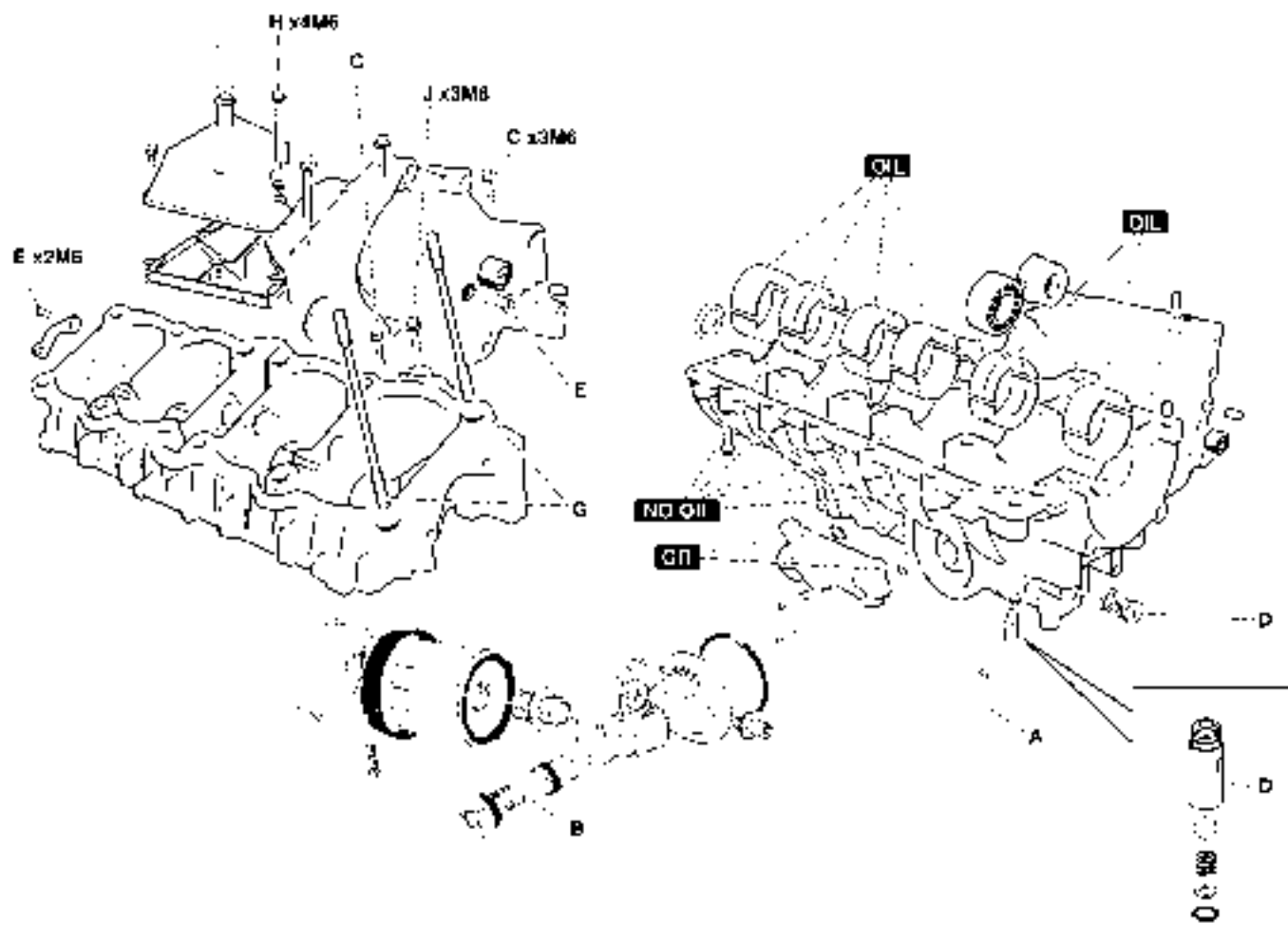
Assembly:

Reassemble the motor on the bedplate.

Manually bring the two screws together, thus tighten them at the prescribed coupling.



BEDPLATE



		A	B	C	D	E	F*	G	H	I	J	K
Tightening torque	N-m	25	40	10	25	10	10+60°	22	8	14	25	30
	Kg-m											
	ft-lb											
Thread blockers					Medium	Medium		Medium				Medium

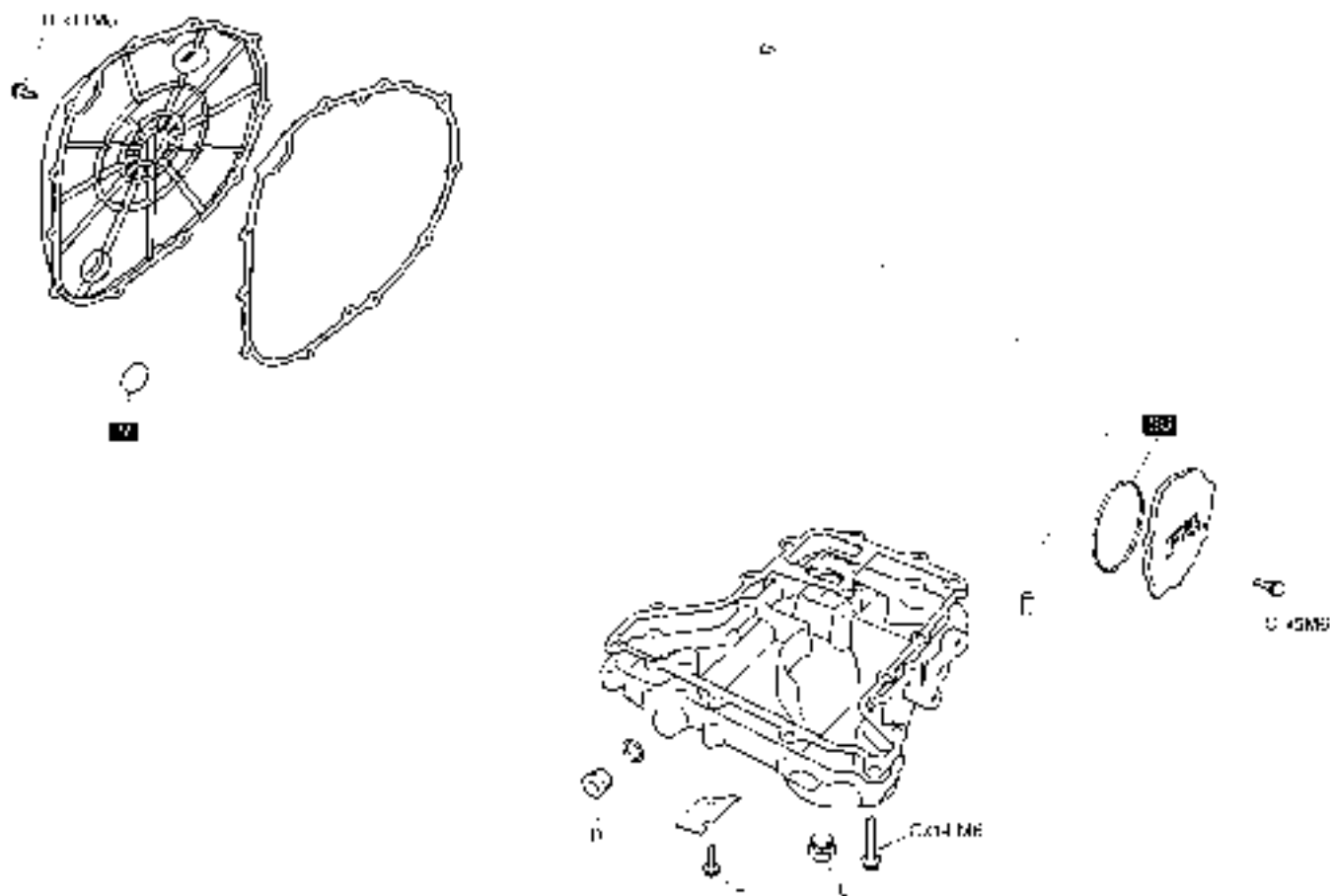
* See text.

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets



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CAPS



		A	B	C	D	E	F	G	H	I	L
Tightening torque	N·m			10	25	10			8		35
	Kg·m										
	ft·lb										
Thread blockers					medium	medium					

OIL	Apply motor oil	SS	Apply silicone sealing
NO OIL	Do not apply neither oil nor other types of substances	HSC	Apply HSC Molikote
GR	Apply grease	M	Apply mastic for gaskets

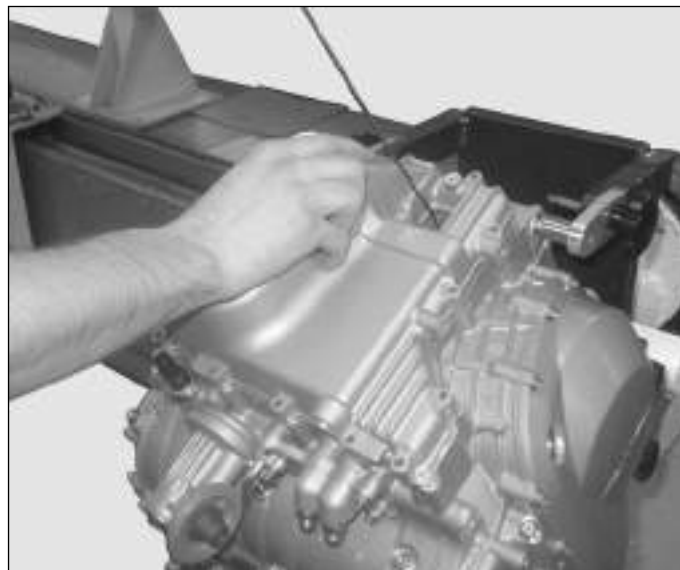
Oil sump

Disassembling and reassembling

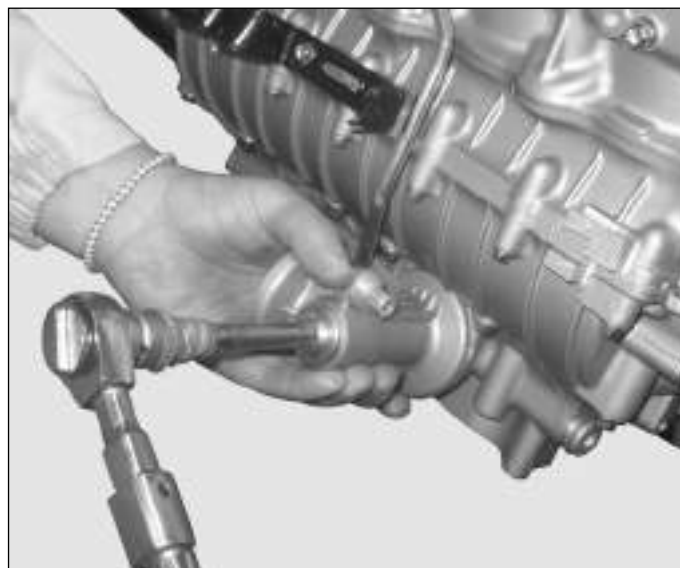
Remove the oil sump by unscrewing the 6mm fixing screws.

Always substitute the gasket when reassembling.

Check the condition of the oil intake filter and make sure that it is free of cracks or clefts; clean it by using compressed air at a low pressure, blown from inside to outside.

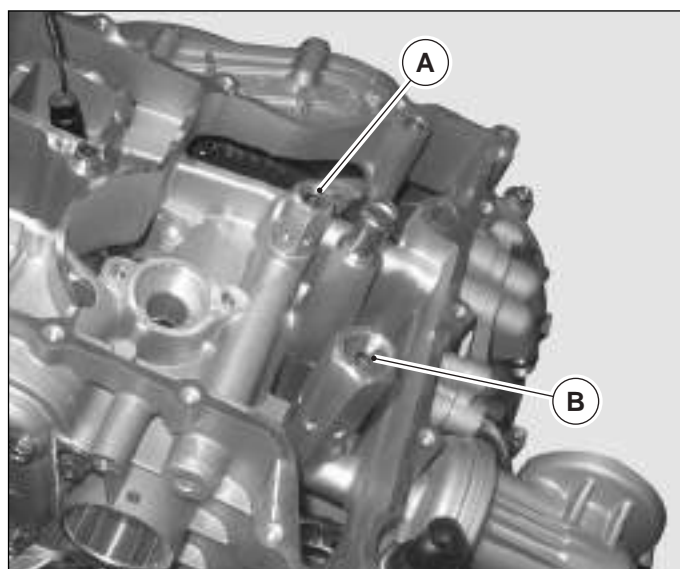


Remove the oil filter support by unscrewing the relative screw.



Check that oil pressure adjusting valves (A) and (B) are also free of cracks or clefts, verifying that they are in good condition; remove them, if necessary. Clean with compressed air blown from inside to outside.

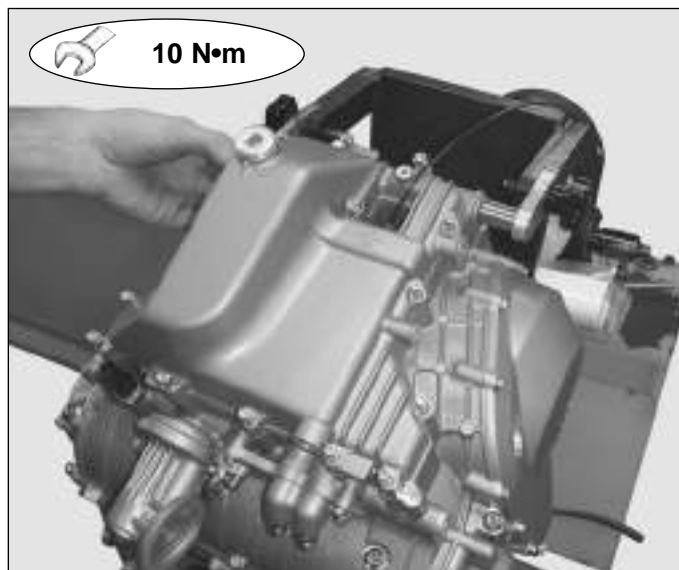
Once the check has been carried out, reassemble them on the base as shown in the figure.



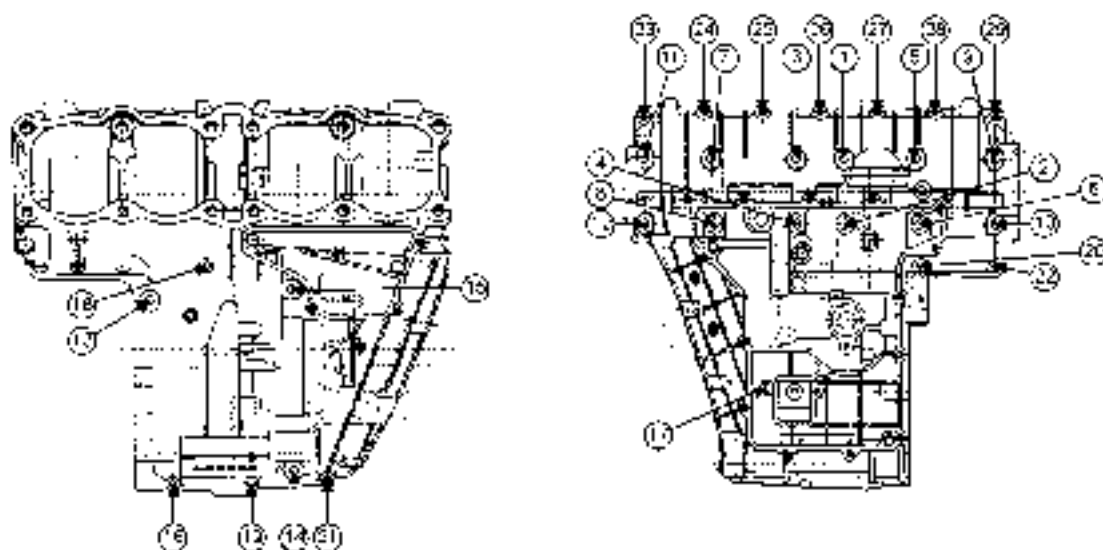


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Position the gasket and move the screws close manually.
Tighten the sump screws to 10 Nm.



H



Disassembly

Remove the oil filter exchanger with heat relative bearing.

Remove as follows as indicated in the relative paragraphs:

- A) The head
- B) The cylinder group
- C) The pistons
- D) The clutch
- E) The gear

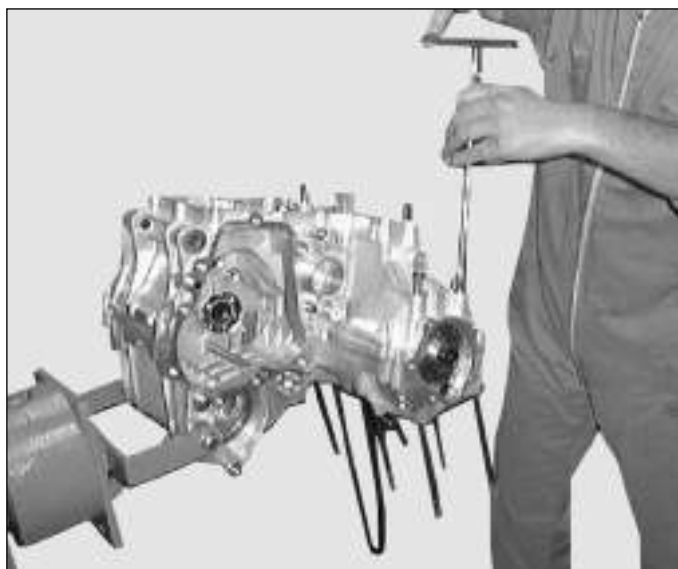
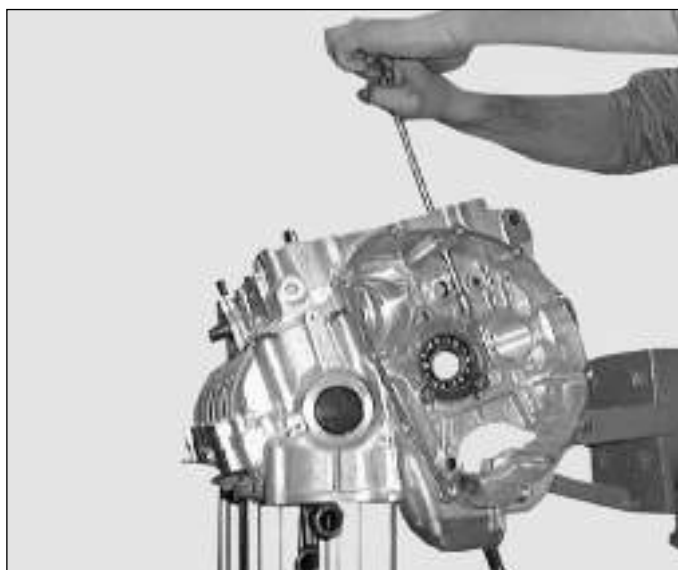
Remove:

F) The screws including the one for the blow-by cap.

NOTA Remember to unscrew the screw inside the carter indicated in the picture at the right.

G) The size 8 screws.

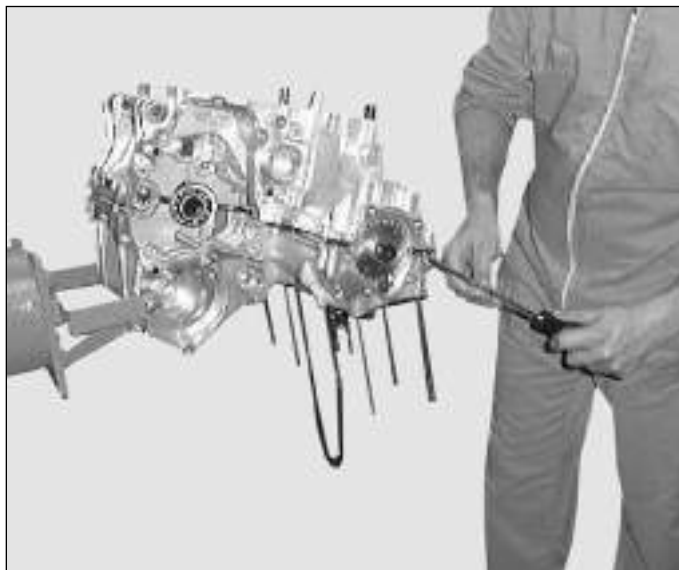
NOTA All the screws are of the same length or visually different; it is therefore impossible to confuse them during reassembly.



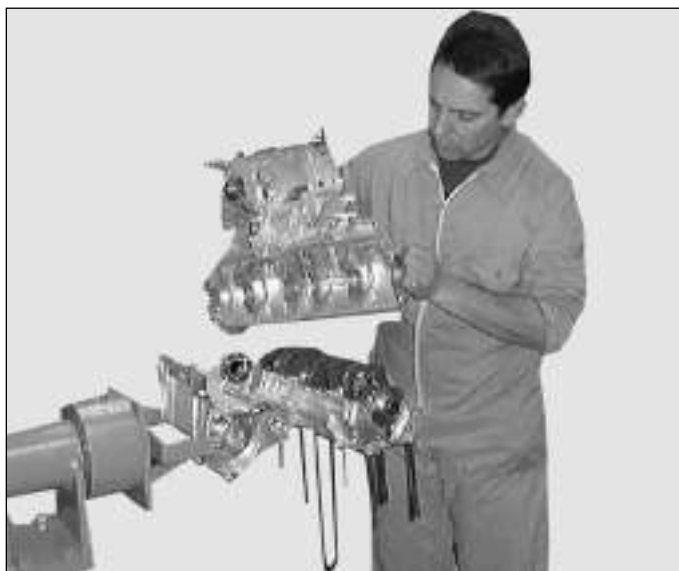


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H) Separate the two carters (1 and 2) by manipulating the protrusions.



I) If necessary remove the bearings (3).

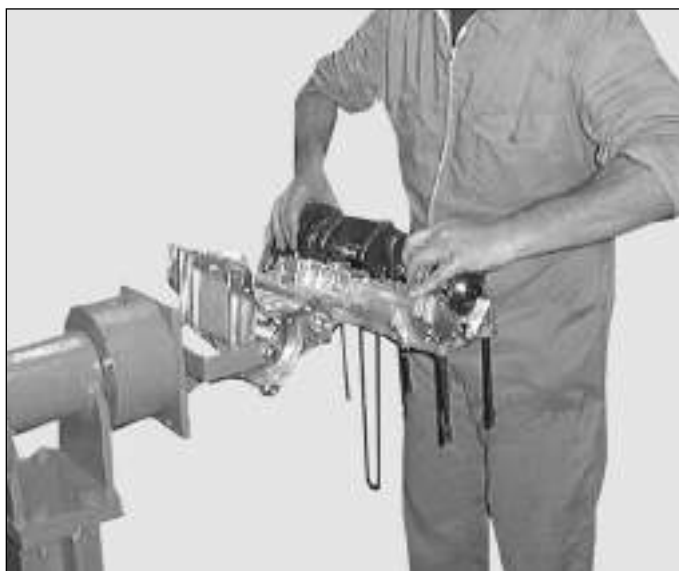


L) Slide the motor shaft out.

In the event that the bushings should be temporarily removed (4) it is a good idea to identify the bearing number and its carter with a number using a marker. For example the bushing removed from the n°1 bearing of the superior carter (starting from the left) will be identified by the mark S1.

For the couplings refer to the groups they belong to shown on the chart.

SELECTION TABLE FOR F4 BEARINGS						
			BEDPLATE SLOT DIAMETER			
			A	38.103 38.111	B	38.112 38.119
BENCH PIN DIAMETER	A	34.981 34.988	1.546/1551 BLUE		1.550/1.555 YELLOW	
	B	34.989 34.997	1.542/1.547 RED		1.546/1.551 BLUE	
FUNCTIONING PLAY 0.012/0.038						



Revision

Once you have disassembled the motor shaft and in case there should be any doubt substitute the bench bushings as well as the connecting rod.

Verify the motor shaft wear tolerance.

The function **play** of the **bench bearings** must be between **0.012 ÷ 0.038 mm**.

Service limit is **0.06 mm**.

The function play of the **connecting rod bearing** must be between **0.036 ÷ 0.061 mm**.

With a service limit of **0.08 mm**.

Reassembly

Carefully degrease and clean from any paste residues
Position the bushings into the carter without lubricating.



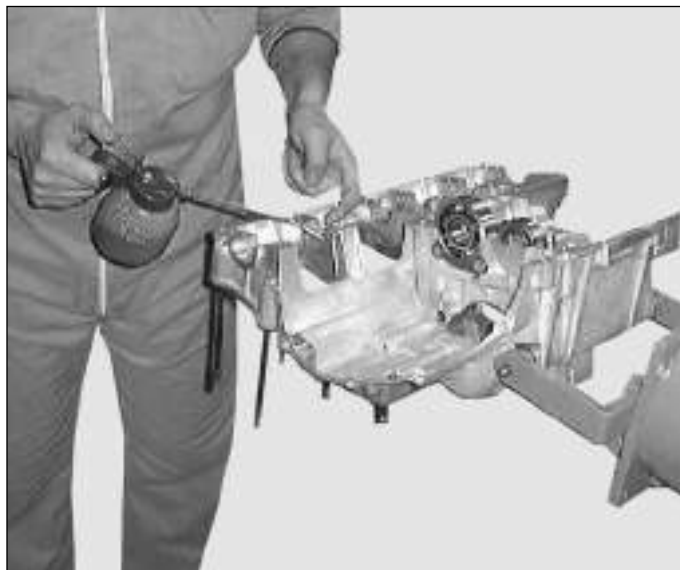
After having positioned them put oil on each bush.





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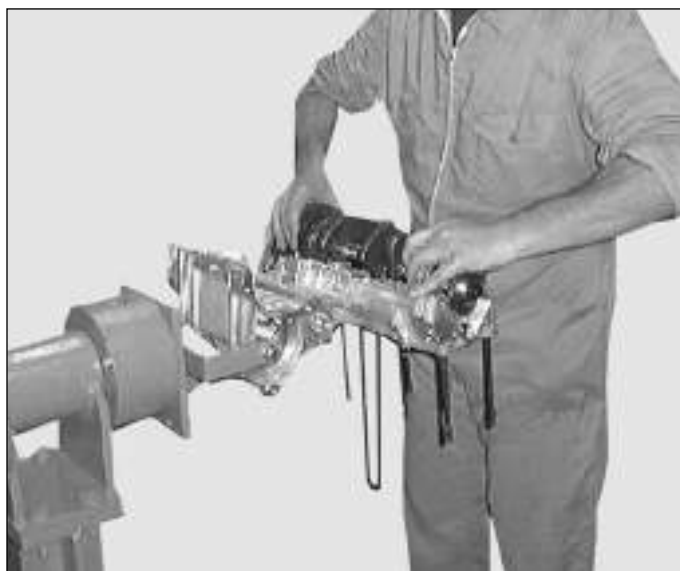
Laterally lubricate the n° 5 support as it carries out the function of the motor shaft centering.



Put the new cap on the right side after having put the silicone type paste on the cap's surface, between cap and carter bearing.



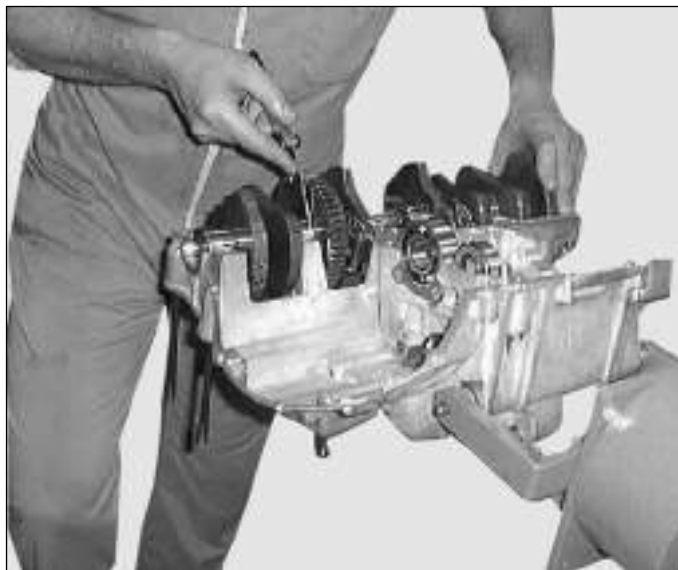
Assembly the motor shaft.



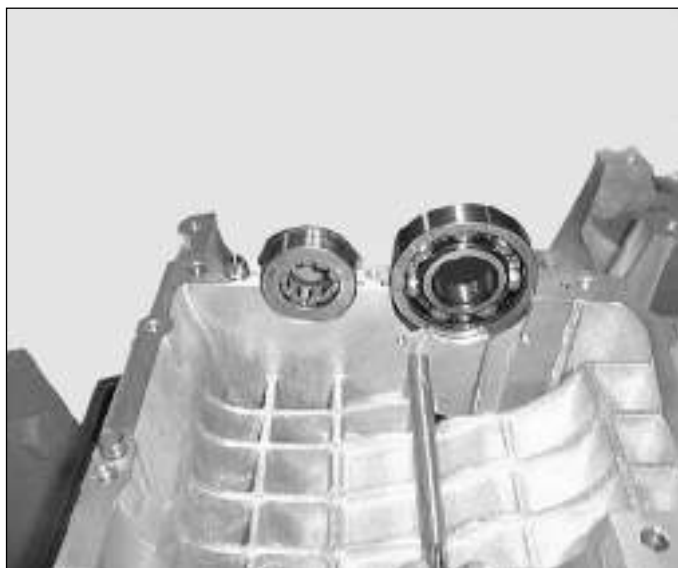


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Verify with a thick meter that the motor shaft has an **axial play** of **0.2 mm** as regards the bench bearings. In case there should be different values contact the manufacturer.

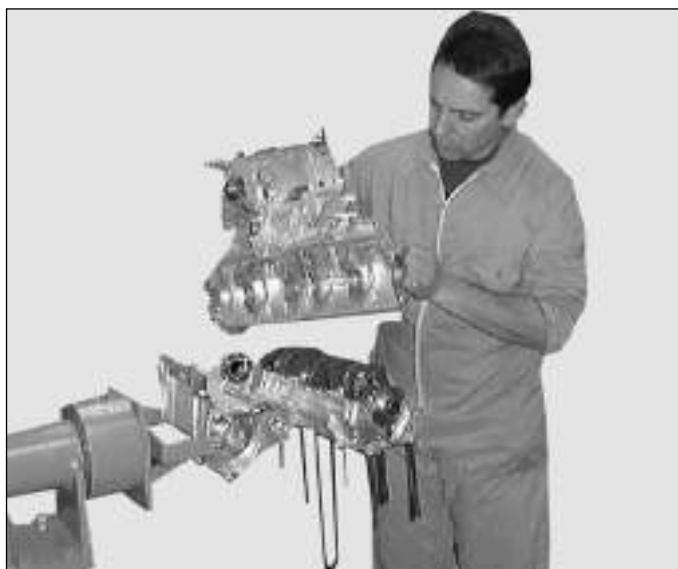


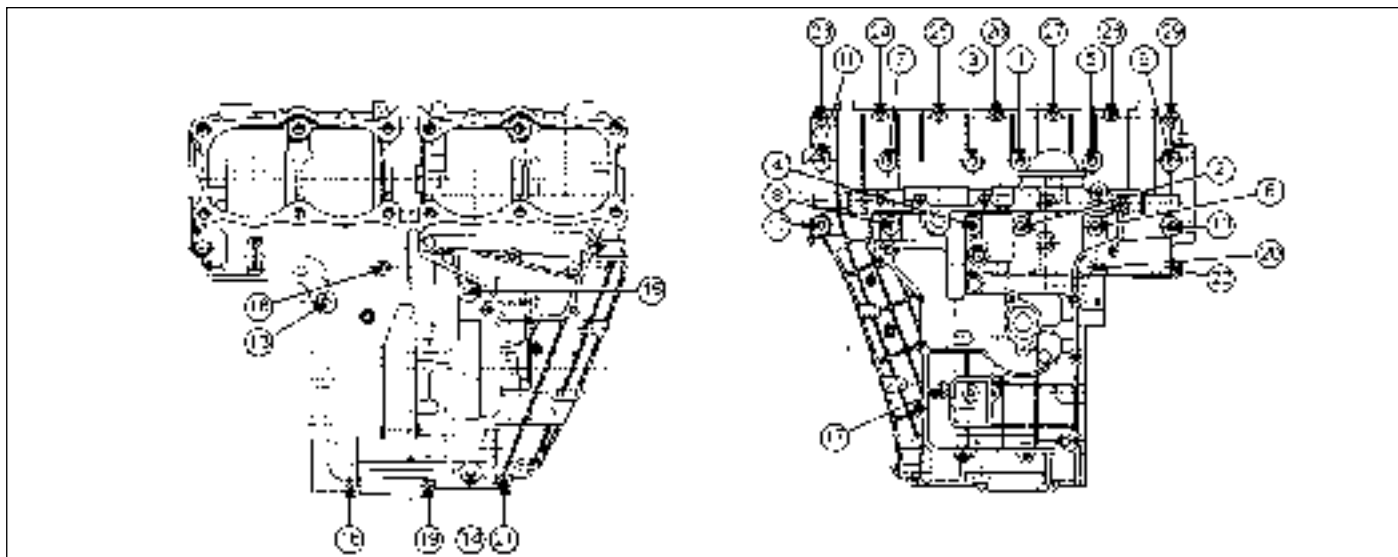
Reassemble the bearing on the inferior semi carter with the locks facing each other and turned inward the bedplate.



Be sure that the centering bushes are installed on the inferior semi carter. Spread a layer of the 1215 THREEBOND type garnish on the stroke points of the two semi carters.

Couple the two semi carters carefully beating them with a plastic hammer until completely closed.





Insert the 8-screws (12) manually and tighten them to the prescribed clamping torque.
Insert the remaining 6-screws manually and tighten them to the prescribed clamping torque.



Tighten all the screws inversely to the order they were disassembled.



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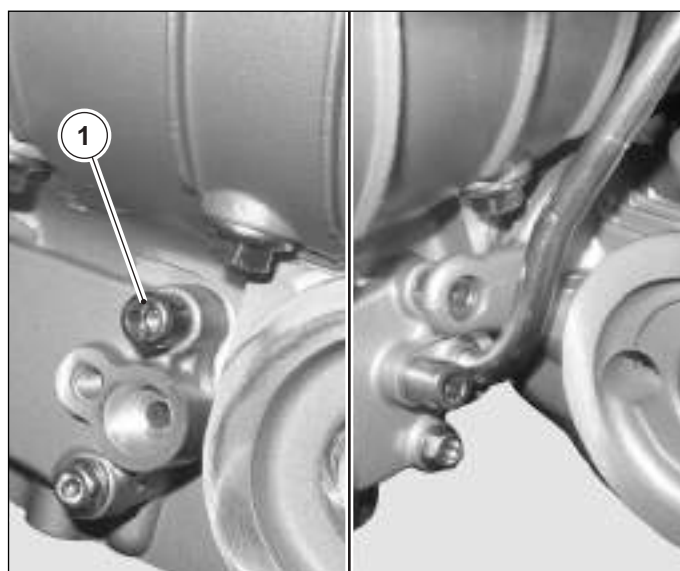
LUBRICATION COMPONENTS: OIL FILTER SUPPORT

Reassembling

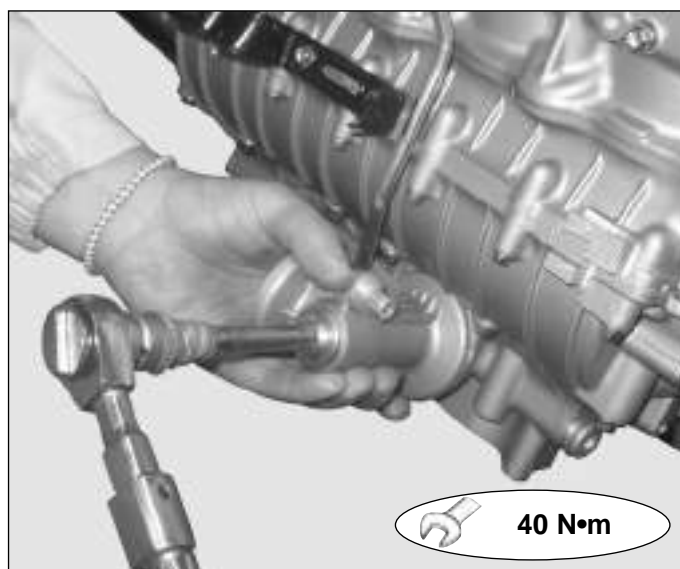
Clean all the surfaces accurately and check the seal rings on the oil filter support screw as well as the O-rings for wear; substitute them, if necessary. Grease both the seal rings and the O-ring and position them in their seats respectively, as shown in the figure.



Position the filter support on the base; as per guiding and centering it refer to the special screw (1) for fixing the oil cooler union plate placed on top left.



Once the support has been positioned, tighten the oil filter support screw to a clamping torque of 40 Nm. Assemble the short end of the oil filter union by applying medium thread blocker (Loctite 243) and tightening to a clamping torque of 30 Nm.



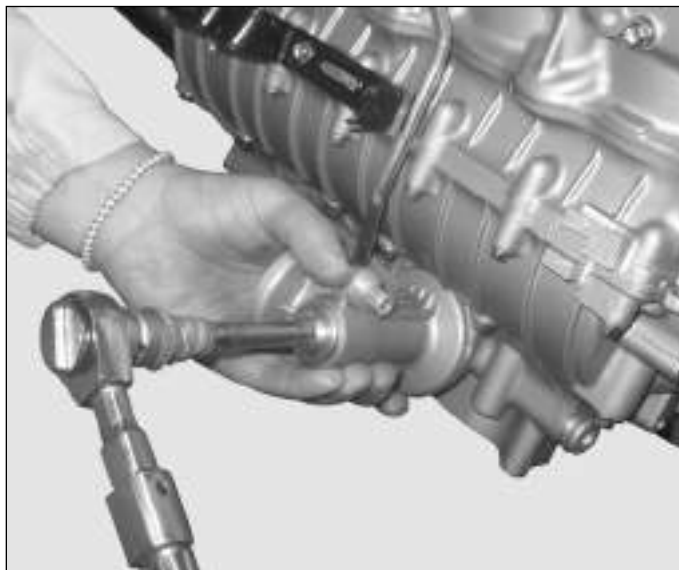


Engine F4 BRUTALE MY 2004

LUBRICATION COMPONENTS: OIL TUBING SUPPORT PLATE

Disassembling and reassembling

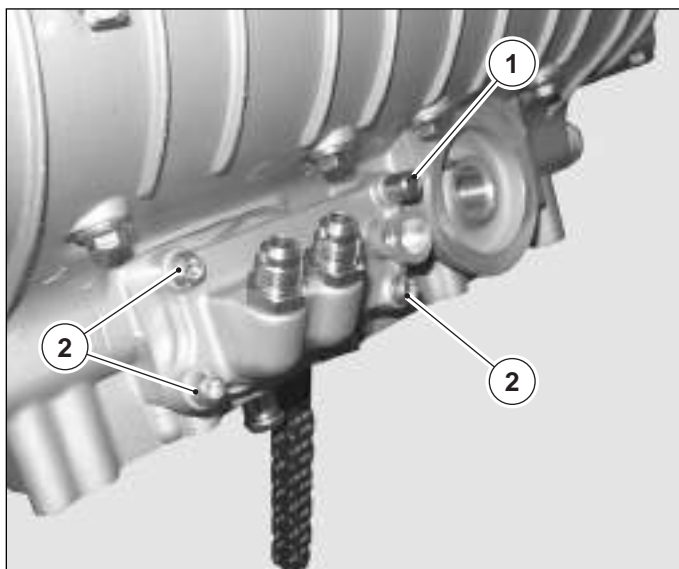
To remove the oil tubing support plate, the oil filter support should be removed first, as described in the "Oil sump" paragraph.



Then, remove the oil head delivery conduit by removing the lower and upper fixing screws respectively.



Unscrew the three screws (2) and remove them; then remove the special screw (1) placed on top left.





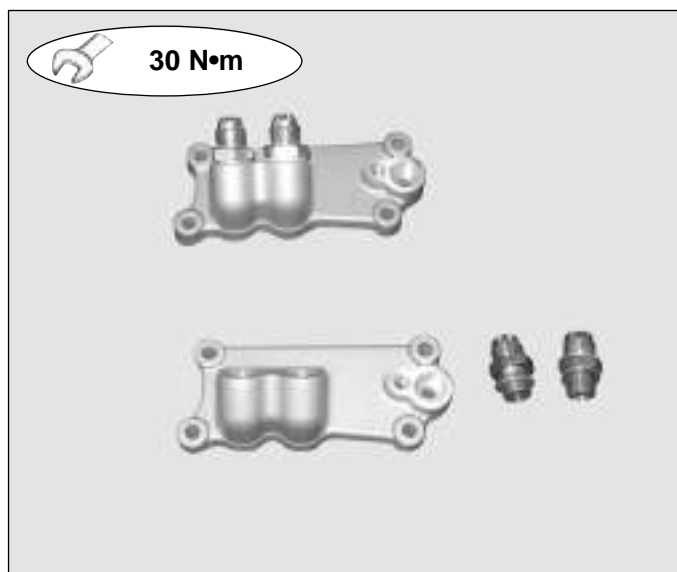
Engine F4 BRUTALE MY 2004

When reassembling, clean the surfaces accurately, and if the nipples have been removed from the oil tubing support plate, reassemble them by always inserting new copper washers between the nipple and the support plate.



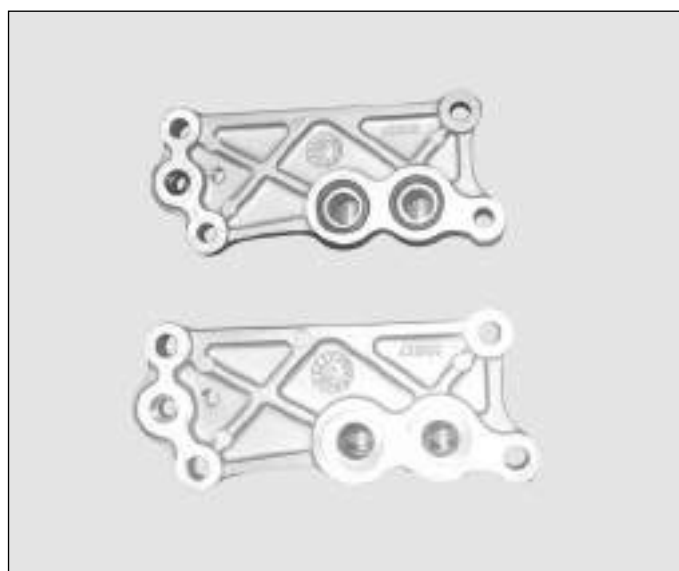
Screw the cylindrical end of the unions verifying that the conical side of each union has been left free.

Apply a medium thread blocker (Loctite 243) and tighten the nipples to a clamping torque of 30 Nm.



Verify the three O-rings placed in the back part of the oil tubing support plate for wear and substitute them, if necessary.

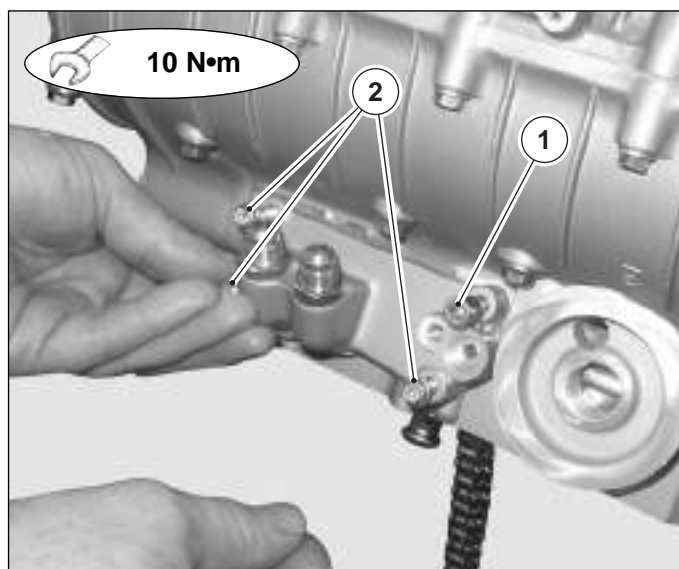
When reassembling, grease the O-rings before reassembling the plate.



Position the plate on the base and fix it by using the three screws (2) and the special screw (1), tightening them to a clamping torque of 10 Nm.



Take care that the special screw positioning (1) follows the one shown in the figure.

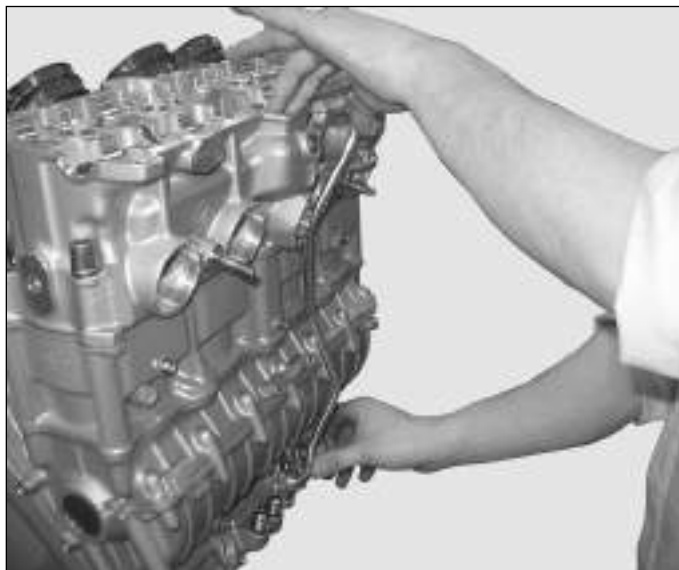




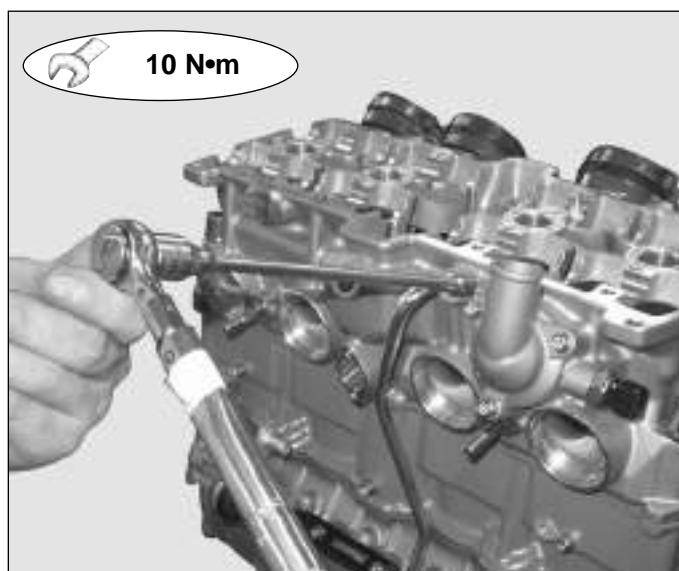
Engine F4 BRUTALE MY 2004

Verify the O-rings placed on the oil head delivery conduit for wear and substitute them, if necessary.

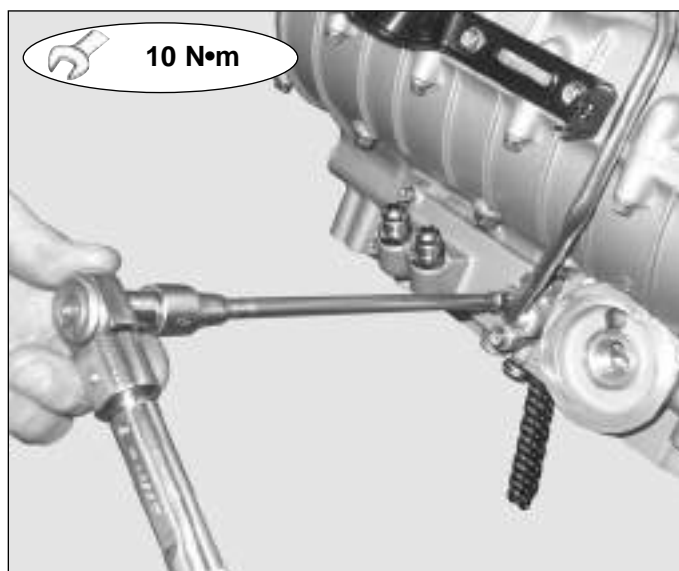
When reassembling, grease both O-rings and position the upper part of the conduit in the seat arranged within the head and the lower part of the conduit in the seat arranged in the oil tubing support plate.



Tighten the upper fixing screw of the oil head delivery conduit to a clamping torque of 10 Nm.



Carry out the same operation for the lower fixing screw by tightening it to a clamping torque of 10 Nm.





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Substitution of the oil filter

Take out the oil filter from the new engine oil filter kit.

- Toyo Roki oil filter kit: Part code 8000A3702
- Champion oil filter kit: Part code 8000A1428



Only use original components of MV Agusta.



If you use an oil filter Toyo Roki (Part code 8000A3702), you should the following preliminary operation.

H Take out the gasket from the engine oil filter kit of new equipment and insert on the filter as shown in the figure on the left.



Only use a new gasket.

Slide the gasket up to bring in contact with the oil filter back ring (see figure on the right).



Lubricate the gasket on the filter with engine oil.





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Insert the filter in its seat.

Turn the filter manually until the gasket is into slight contact with the machined surface.



Tighten the filter using the appropriate tool and a torque wrench.

- TOYO ROKI oil filter:

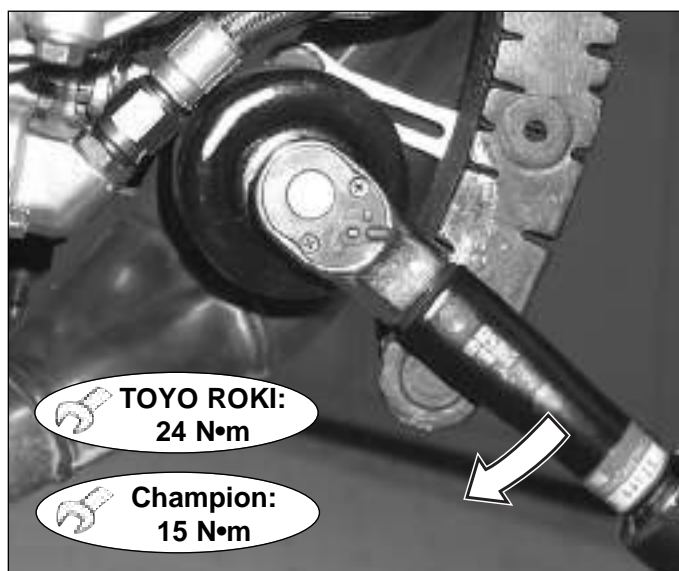
FACOM D. 139 tool
Part code 8000A4317

Oil filter torque wrench:
24 N·m

- Champion oil filter:

Tool code 800099010

Oil filter torque wrench:
15 N·m



After having tightened the filter, take out the clamp for engine oil filter and its screw from the new oil filter kit.



Only use a new clamp.

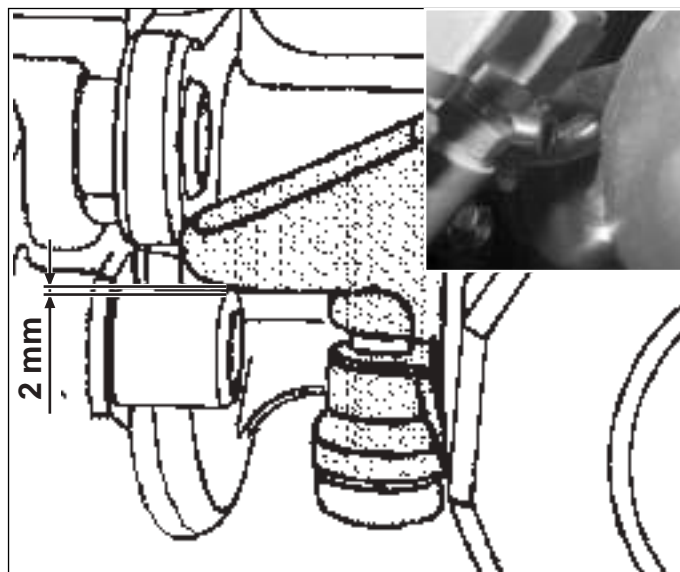
Insert the clamp and slide it until it brings in contact with the oil filter back ring.





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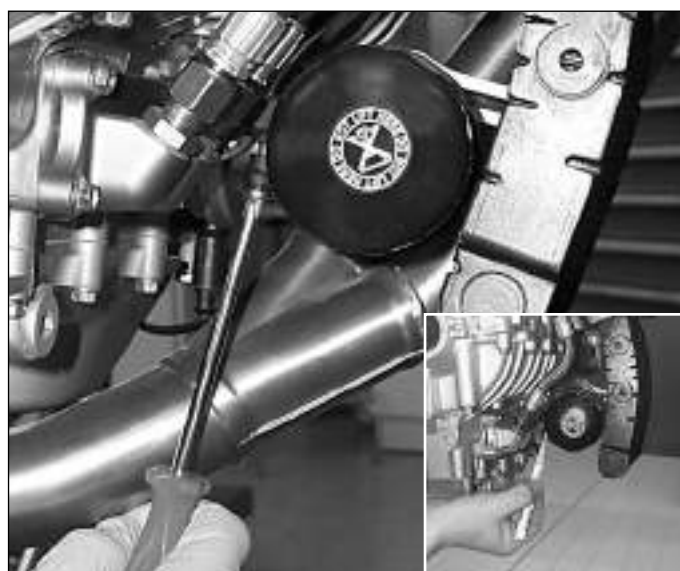
Place the clamp lock at a range of **2 mm** from the screwhead on the supporting plate of oil cooler pipes.



Turn the clamp screw up to bring in contact with the filter without tightening.

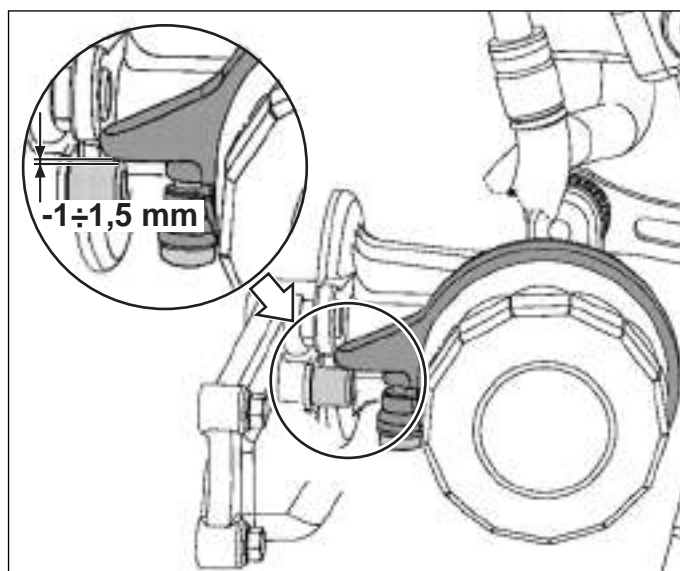
Mark the screw position drawing a line by a felt-tip both on the screw and on the clamp.

Make the last tightening of the screw getting it perform 2 turns and 1/4 further the position marked previously.



Once completed the assembly, ensure that the clamp lock of the engine oil filter is at a range between **1 and 1.5 mm** from the screwhead on the supporting plate of oil cooler pipes. Check any leakages from oil filter.

Mark the position of the definite tightening of the screw using a felt pen, both on the filter and the band fastener. Trace a reference mark also on the band fastener and the relative screw, with the object of eventually checking any slackening of the screw.



Do not use the oil filter as a point of grip or contact.

LUBRICATION COMPONENTS: OIL COOLER

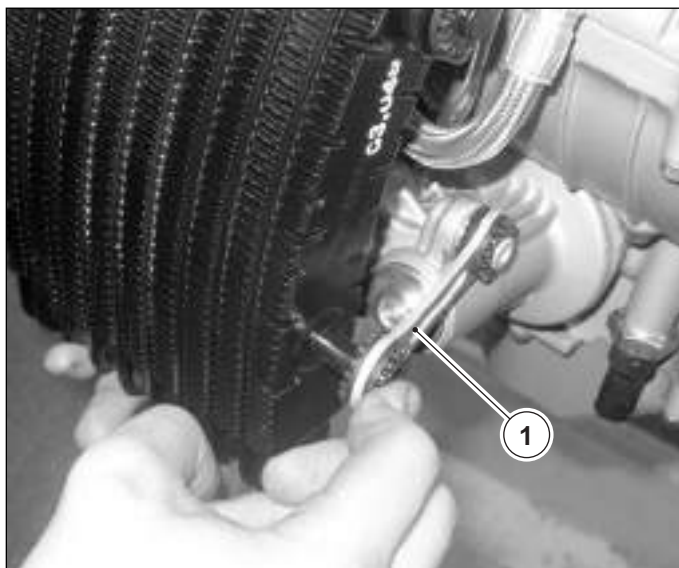
Disassembling

Remove the engine/ radiator support fixing screw placed on the left side.

NOTA This figure and the next ones show an engine assembly which the water radiator has been removed from; but the described operations can be performed also when the radiator is assembled.

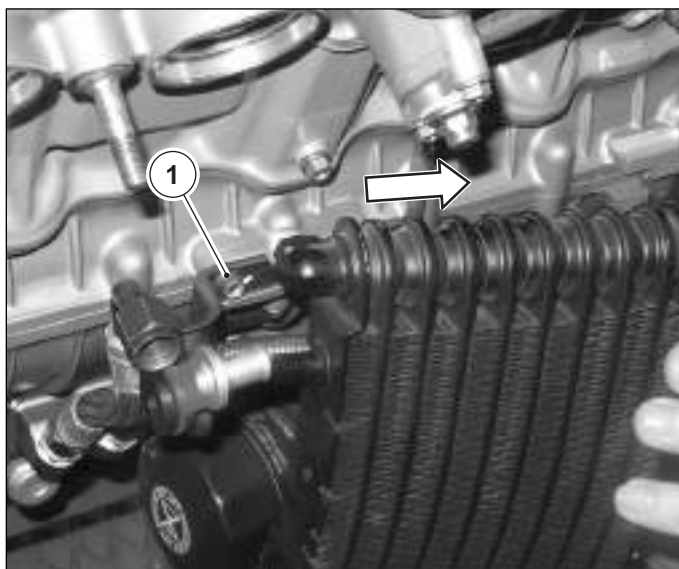


Disconnect the engine/radiator anchor rod (1) on the left side.



Remove the oil radiator moving it from right to left in order to release the support peg inserted in the rubber bulb support (1) on the right side.

! If not necessary, do not remove tubings and unions from the radiator.



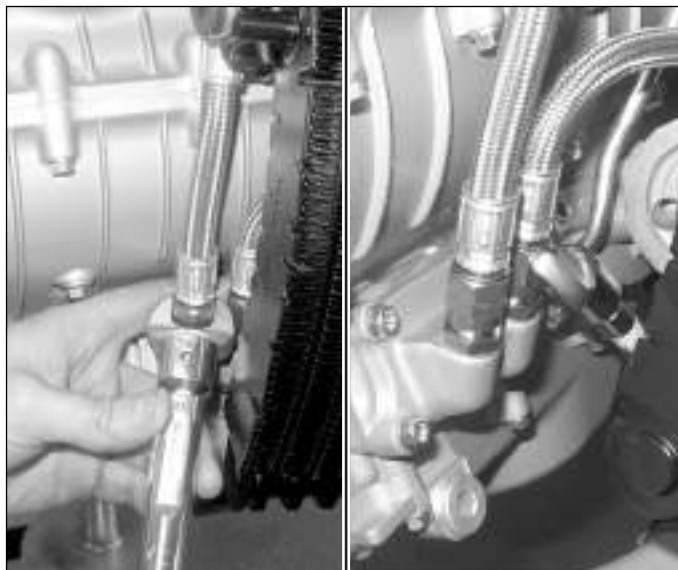


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Remove the oil delivery and return pipings connected with the nipples of the oil piping support unscrewing the fixing nuts.



If the oil radiator should be only removed from its position instead of being replaced, don't intervene either on pipings or on unions.



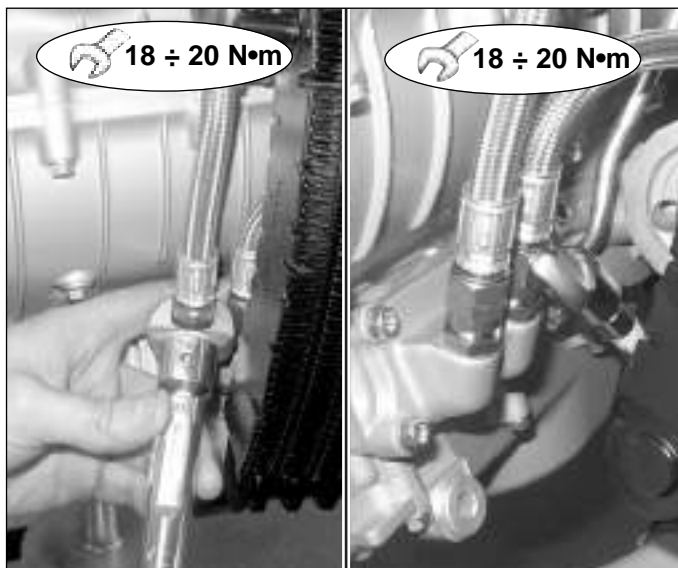
Reassembling



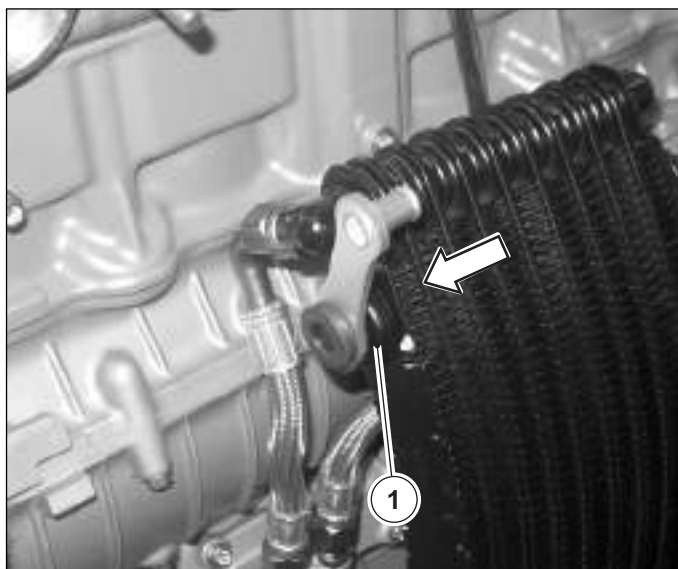
If pipings and unions had been removed from the radiator, reassemble carefully. Lubricate the union threads using engine oil. Tighten pipings and unions to the prescribed torque wrench.

Reconnect the oil delivery and return pipings with the nipples of the oil pipings support flange lubricating previously the nipple threads placed on it by using engine oil.

Tighten the pipe fixing nuts to the radiator to the prescribed torque wrench ($18 \div 20 \text{ Nm}$).



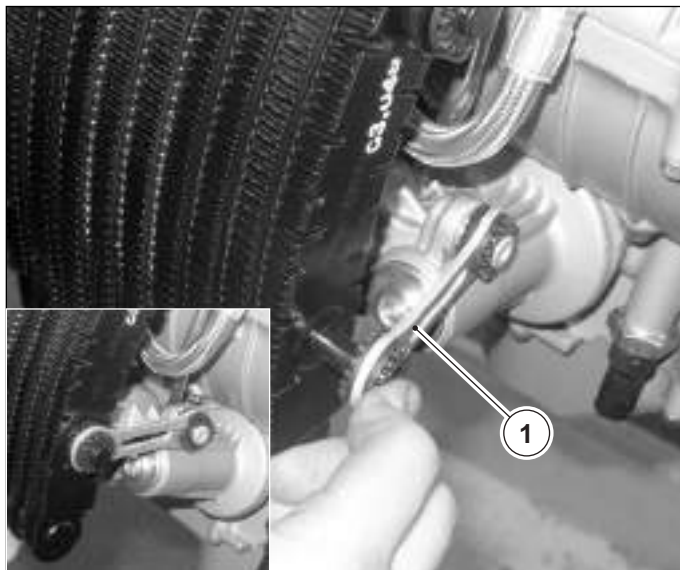
Insert the exhaust manifolds first on their seat on the compensator and then secure them by the flange (1) to the cylinders tightening the nut.





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Connect the engine/radiator anchor rod (1) on the left side.



Put the radiator/engine support on the left side again and secure it tightening the screw. Apply a medium thread-locking fluid (Loctite 243) and fix the engine support by tightening the screw to a clamping torque of 10 Nm.



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Disassembling connecting rod

Remove the driveshaft following the suggested procedure.

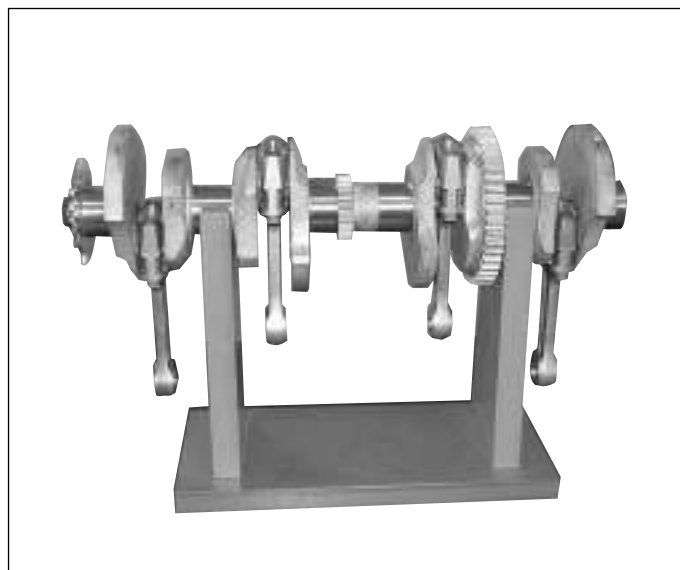
Position the shaft with the connecting rod downwards. Work on each connecting rod separately.

Loosen the two screws that tighten the foot of the connecting rod and the head of the rod.

Remove the two screws that sustain the connecting rod stem.

Move the two motor drive shaft parts away.

NOTA Reassemble every connecting rod before working on the next one.
Lubricate the thread with a **MINIMUM QUANTITY** of Molikote HSC Plus. Do not use too much of this product.



Removing semi bearings

Disassemble the connecting rod following the suggested procedure.

Unscrew the screws and remove the semi bearings from the foot and head of the connecting rod.

H Coupling semi bearings-connecting rod pin

If no substitutions have been made it is sufficient to verify the connecting rod measurement and its pins and refer to the chart included, choose the semi bearings according to the colour.

The measurement has to be carried out on the principal axle of the stem, after having tightened at 35 Nm.

If substitution of one or more parts is necessary, it is sufficient to follow the indications of the letter indicating the class that the connecting rod and bushing belong to, indicated on them.

Assembling semi bearings

Screw the semi bearing to the foot of the connecting rod and to the head.

Tighten at a couple equal to 25 Nm + 55°.

Always use new screws, even with the used connecting rod.

SELECTION TABLE FOR F4 CONNECTIN ROD						
			CONNECTING ROD HEAD DIAMETER			
			A	38.114 38.122	B	38.123 38.130
CONNECTING ROD PIN DIAMETER	A	34.981 34.988	1.540/1.545 BLUE		1.544/1.549 YELLOW	
	B	34.989 34.997	1.536/1.541 RED		1.540/1.545 BLUE	
FUNCTIONING PLAY 0.035/0.061						

Check and placement of distribution chain

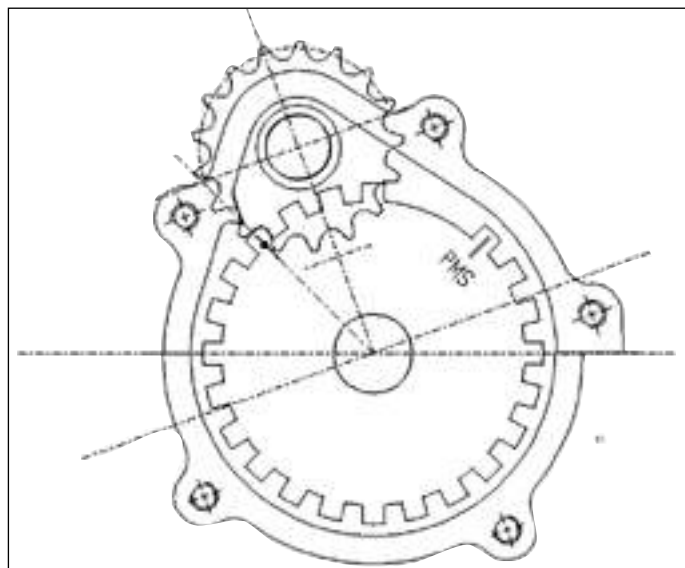
At each motor revision verify the wear state of each transmission distribution component. If the gear teeth appear to be very worn substitute each piece. Substitute the chain at the foreseen mileage (see section 5).



In case wear should result beyond the permitted allowance even of just one of the distribution components, check them all and if necessary substitute them.

Rotate the drive shaft until the pellet on the phonic wheel tooth coincides with the notch on the bedplate, as shown in the following picture.

Attention: the drive shaft in this position is NOT in the MSP position.



Fit the distribution chain on the intermediate gear. Position the intermediate gear being careful that the pellet on the gear corresponds with the pellet on the bedplate, being careful that the drive shaft has not moved from the position priorly described.

Insert the intermediate gear rotation pin and tighten it with the relative seeger.

Without rotating the drive shaft check again to be sure that the pellet on the phonic wheel corresponds to the notch on the bedplate.

At this point, rotate the drive shaft and verify the correct teeth gripping.

Attention: The relative pellet position will repeat itself only after a few rotations of the drive shaft.





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