aprilia

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11/2003-01

engines M192M/M191M M245M/M234M/M282M/M281M

workshopmanual

www.serviceaprilia.com

UK

8140684

SUMMARY

0.1. FOREWORD

0.1.1. FOREWORD

- This manual provides all information necessary for vehicle servicing.
- This manual is intended for use by **aprilia** Dealers and their qualified mechanics. Some information has been omitted intentionally as considered unnecessary. For this reason, people who are using this manual must have a good background on mechanics and procedures for motorcycle servicing. Motorcycles serviced or inspected by incompetent operators might be inefficient or unsafe to ride. As not all servicing and inspection procedures are described in details, proceed with utmost care so to avoid injuries to people and damages to vehicle parts. **aprilia s.p.a.**'s mission is to enhance the riding pleasure by ever improving products and technical literature. All **aprilia** Points of Sale and Subsidiaries worldwide are kept updated on major engineering changes and modifications to repair procedures. All changes and modifications are then included in the next release of the relevant manual. When in doubt about some inspection or repair procedure, please contact **aprilia** CONSUMER SERVICE (A.C.S.) DEPARTMENT staff, who will be glad to provide full information on servicing procedures and technical aspects.

Refer to 0.1.2 for further information.

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Produced and printed by:

DECA s.r.l.
via Risorgimento, 23/1 - 48022 Lugo (RA) - Italia
Tel. +39 - 0545 35235
Fax +39 - 0545 32844
E-mail: deca@decaweb.it
www.decaweb.it

for:

aprilia s.p.a.
via G. Galilei, 1 - 30033 Noale (VE) - Italia
Tel. +39 – (0)41 58 29 111
Fax +39 – (0)41 58 29 190
www.aprilia.com
www.serviceaprilia.com

0.1.2. REFERENCE MANUALS

ENGINE WORKSHOP MANUALS

aprilia part # (description)	
8140680	I
8140681	E
8140682	F
8140683	D
8140684	UK

PARTS CATALOGUES

aprilia part # (description)	
6642	I

SPECIAL TOOLS MANUALS

aprilia part # (description)					
H001	I	F	D	E	UK

0.1.3. ABBREVIATIONS/SYMBOLS/CONVENTIONS

#	= number
<	= is less than
>	= is more than
≤	= is less than or equal to
≥	= is more than or equal to
~	= approximately
∞	= infinite
°C	= degrees Celsius (centigrade)
°F	= degrees Fahrenheit
±	= plus or minus
a.c	= alternated current
A	=ampere
Ah	=ampere per hour
API	= American Petroleum Institute
HT	= High Tension
AV/DC	= Anti-Vibration Double Countershaft
bar	= pressure measurement (1 bar =100 kPa)
DC	= Direct Current
cu cm	= cubic centimeters
CO	= carbon oxide
CPU	= Central Processing Unit
DIN	= German industrial standards (Deutsche Industrie Norm)
DOHC	= Double Overhead Camshaft
ECU	= Electronic Control Unit
rpm	= revolutions per minute
HC	= unburnt hydrocarbons
ISC	= Idle Speed Control
ISO	= International Standardization Organization
kg	= kilograms
kgm	= kilograms per meter (1 kgm =10 Nm)
km	= kilometers
km/h	= kilometers per hour
kΩ	= kiloOhm
kPa	= kiloPascal (1 kPa =0.01 bar)
KS	= clutch side (from the German "Kupplungseite")
kW	= kiloWatt
/	= liters
LAP	= racetrack lap
LED	= Light Emitting Diode
LEFT SIDE	=left side
m/s	= meters per second
max	= maximum
mbar	= millibar (1 mbar =0.1 kPa)
mi	= miles
MIN	= minimum
MPH	= miles per hour
MS	= flywheel side (from the German "Magnetseite")
MΩ	= megaOhm
N.A.	= Not Available
N.O.M.M.	= Motor Octane Number
N.O.R.M.	= Research Octane Number
Nm	= Newton per meter (1 Nm =0.1 kgm)
Ω	= ohm
PICK-UP	
BDC	= Bottom Dead Center
TDC	= Top Dead Center
PPC	= Pneumatic Power Clutch
RIGHT SIDE	= right side
SAE	= Society of Automotive Engineers
TEST	= diagnostic check
T.B.E.I.	= crowned-head Allen screw
T.C.E.I.	= cheese-headed Allen screw

T.E.	= hexagonal head
T.P.	= flat head screw
TSI	= Twin Spark Ignition
UPSIDE-DOWN	= inverted fork
V	= volt
W	= watt
Ø	= Diameter

GENERAL INFORMATION 1

SUMMARY

1.1. MANUAL LAYOUT

1.1.1. CONVENTIONS USED IN THE MANUAL

- This manual is divided in sections and subsections, each covering a set of the most significant components. For quick reference, see the sections index.
- Unless expressly specified otherwise, reassemble/install by following disassembly/removal procedure in the reverse order.
- The terms “left” and “right” are referred to the motorcycle when viewed from the riding position.

In this manual any variants are identified with the following symbols:

OPT	option
⊕	catalyzed version
-	all versions
11KW	11 kw derated version
80km	80km/h version
f.p	full-power version
MP	National homologation
SF	European homologations (EURO 1 limits)

VERSION:

I	Italy	GR	Greece	MAL	Malaysia
UK	United Kingdom	NL	Netherlands	RCH	Chile
A	Austria	CH	Switzerland	HR	Croatia
P	Portugal	DK	Denmark	AUS	Australia
SF	Finland	J	Japan	USA	United States of America
B	Belgium	SGP	Singapore	BR	Brazil
D	Germany	SLO	Slovenia	RSA	Republic of South Africa
F	France	IL	Israel	NZ	New Zealand
E	Spain	ROK	South Korea	CDN	Canada

1.1.2. SAFETY INFORMATION

The following conventions are used to identify safety information throughout the manual:

This symbol identifies safety-related information. Whenever you see this symbol in the manual or attached to the engine, use utmost care to avoid the risk of injury. Failure to comply with the instructions given after this symbol may put your safety, as well as that of other persons or of the motorcycle at risk!

DANGER
Failure to comply with given indications may lead to severe injury or death.

WARNING
Failure to comply with given indications may lead to minor injury or engine damage.

NOTE *The term "NOTE" precedes important information or instructions.*

1.2. GENERAL RULES

1.2.1. BASIC SAFETY RULES

CARBON MONOXIDE
Should it be necessary to perform some operations with the vehicle running, make sure to work outdoors or in a well-ventilated room.
Avoid starting the engine in closed or badly-ventilated rooms.
In case you are working indoors, use a suitable exhauster.

DANGER
Exhaust gases contain carbon monoxide, which is extremely toxic if inhaled and may cause loss of consciousness or even death by asphyxia.

FUEL

DANGER
The fuel used to operate engines is highly flammable and becomes explosive under particular conditions.
Refuel and service the engine in a well-ventilated area with the engine stopped. Do not smoke when refueling and do not stand close to fuel vapors; avoid flames, sparks and anything which might ignite fuel or provoke explosions.

DO NOT DISPOSE OF FUEL IN THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

HOT COMPONENTS
The engine becomes hot and stays hot for some time after it has been stopped.
Before handling engine parts, wear heatproof gloves or allow the engine to cool down.

HUB AND ENGINE OIL

DANGER
Wear latex gloves when servicing.
Oil may can cause serious damage to the skin if handled daily and for long periods.
Wash your hands carefully after use.
Collect exhausted oil into suitable containers and take it to or have it collected by your Supplier or an authorized collection company.
Wear latex gloves when servicing.

DO NOT DISPOSE OF OIL IN THE ENVIRONMENT.

KEEP AWAY FROM CHILDREN.

COOLANT
The coolant is composed of ethylene glycol that, under certain conditions, can become inflammable and send out invisible flames causing severe burns.

DANGER
Do not to spill the coolant on the red-hot parts of the engine: it may catch fire and send out invisible flames.
Wear latex gloves when servicing.
Even if toxic, coolant has a sweet flavor. Never leave it inside open containers or within the reach of animals.

KEEP AWAY FROM CHILDREN.

GENERAL PRECAUTIONS AND INFORMATION

The following indications should be strictly complied with when servicing, disassembling or reassembling the engine.

DANGER
Never use naked flames when servicing. Before servicing or inspecting the motorcycle: stop the engine and remove the key from the ignition switch; allow for the engine and exhaust system to cool down; where possible, lift the engine using adequate equipment placed on firm and level ground. Do not touch engine hot parts. Risk of scalds and burns.
Never put any mechanical parts or other engine components in your mouth when you have both hands busy. None of the engine components is edible.
Unless expressly specified otherwise, install/reassemble by following removal/disassembly procedure in the reverse order. Where a procedure is cross-referred to relevant sections in the manual, proceed sensibly to avoid disturbing any parts unless strictly necessary. Never polish matte-finished surfaces with abrasive substances.
Never use fuel as solvent to clean the engine.
Do not clean any rubber or plastic parts with alcohol, petrol or solvents. Clean with water and neutral detergent.
When two or more persons are servicing the same motorcycle together, special care must be taken to avoid personal injury.
Please read 1.3.1 **carefully**.

BEFORE REMOVING OR DISASSEMBLING ANY COMPONENTS

- Clean off all dirt, mud and dust and clear any foreign objects from the engine before removing or disassembling any parts.
- Use the model-specific special tools where specified.

REMOVING OR DISASSEMBLING THE COMPONENTS

- Never use pliers or similar tools to loosen and/or tighten nuts and bolts. Always use a suitable spanner.
- Mark all connections (hoses, wiring, etc.) with their positions before disconnecting them. Identify each connection using a distinctive symbol.
- Mark each part clearly to avoid confusion when refitting.
- Thoroughly clean and wash any components you have removed using a detergent with low flash point.
- Mated parts should always be refitted together. These parts have seated themselves against one another in service as a result of normal wear and tear.
- Certain components are matched-pair parts and should always be replaced as a set.
- Keep away from heat.

INSTALLING OR ASSEMBLING THE COMPONENTS

DANGER
Used circlips or snap rings must always be replaced.
When fitting a new circlip or snap ring, take care to move the open ends apart just enough to allow fitment to the shaft.
Make a rule to check that a newly –fitted circlip or snap ring is properly and firmly seated.
Never clean a bearing with compressed air.

NOTE *All bearings must rotate freely with no hardness or noise. Replace any bearings that do not meet these requirements.*

- Use **aprilia** ORIGINAL SPARE PARTS only.
- Use the specified lubricants and consumables.
- Where possible, lubricate a part before assembly.
- When tightening nuts and bolts, start with the largest or innermost nut/bolt and observe a cross pattern. Tighten evenly in subsequent steps until achieving the specified torque.
- Replace any self-locking nuts, gaskets, seals, circlips or snap rings, O-rings, split pins, bolts and screws which have a damaged thread.
- Lubricate the bearings abundantly before assembly.
- Make a rule to check that all components you have fitted are correctly in place.
- After repairing the motorcycle and after each service inspection, perform the preliminary checks, and then operate the motorcycle in a private estate area or in a safe area away from traffic.
- Clean all joint surfaces, oil seal edges and gaskets before assembly. Apply a light coat of lithium grease along the edges of oil seals. Fit oil seals and bearings with the marking or serial number facing outwards (in view).

ELECTRICAL CONNECTORS

To disconnect the electrical connector, follow the procedures below. Failure to comply with these procedures may lead to irreparable damages to connector and wiring.
Press the special safety hooks, if available.

WARNING
Do not pull cables to disconnect the two connectors.

- Grasp the two connectors and disconnect them by pulling them in the two opposite directions.
- In case of dirt, rust, moisture, etc.., thoroughly clean the inside of the connector with compressed air.
- Make sure that the cables are correctly crimped to connector terminals.

NOTE *The two connectors have just one correct positioning. Make sure to position them in the right direction.*

- Then fit the two connectors. Make sure they are correctly coupled (if equipped with the special hooks, a click will be heard).

TIGHTENING TORQUE SETTINGS

DANGER
Always remember that the tightening torque settings of all fastening parts play a fundamental role to ensure engine safety. Always tighten to the specified values.
Check fastening parts tightening torque settings at regular intervals. Upon reassembly, always use a torque wrench.
Failure to comply with these recommendations could lead to the loosening and detachment of one of these parts with a consequent seizure or locking or engine parts or causing other serious troubles affecting the vehicle operation with possible damages and the risk of serious injuries or death.

1.3. DANGEROUS ELEMENTS

1.3.1. WARNINGS CONCERNING FUEL, LUBRICANTS, COOLANT AND OTHER COMPONENT PARTS

DANGER
The fuel used to operate engines is highly flammable and becomes explosive under particular conditions.
Refuel and service the engine in a well-ventilated area with the engine stopped. Do not smoke when refueling and do not stand close to fuel vapors; avoid flames, sparks and anything which might ignite fuel or provoke explosions.
Take care not to spill fuel out of the filler, or it may ignite when in contact with hot engine parts.
In case of accidental fuel spillage, make sure the affected area is fully dry before starting the engine.
Fuel expands from heat and when left under direct sunlight.
Avoid contact with skin. Do not inhale vapors. Do not swallow fuel. Do not transfer fuel between different containers using a hose.
DO NOT DISPOSE OF FUEL IN THE ENVIRONMENT.
KEEP AWAY FROM CHILDREN.

Use only premium grade unleaded petrol, min. O.N. 95 (N.O.R.M.) and 85 (N.O.M.M.).

LUBRICANTS

DANGER
A good engine lubrication ensures the vehicle safety.
Failure to keep the lubricants at the recommended level or the use of a non-suitable new and clean type of lubricant can lead to engine seizure, thus leading to serious accidents, personal injury or even death.
Oil may can cause serious damage to the skin if handled daily and for long periods.
Wash your hands carefully after use.
DO NOT DISPOSE OF OIL IN THE ENVIRONMENT.
Collect exhausted oil into suitable containers and take it to or have it collected by your Supplier or an authorized collection company.

WARNING
When filling the engine with oil, take care not to spill it out since it could damage the vehicle paintwork.
In case of leaks, do not start the engine. Check and trace the cause of leaks and service.

COOLANT

DANGER
Coolant is toxic when ingested and is an irritant, contact with eyes or skin may cause irritation.
In case of contact with eyes, rinse repeatedly with abundant water and seek medical advice. In case of ingestion, induce vomiting, rinse mouth and throat with abundant water and seek medical advice immediately.
DO NOT DISPOSE OF COOLANT IN THE ENVIRONMENT.
KEEP AWAY FROM CHILDREN.

DANGER
Do not to spill the coolant on the red-hot parts of the engine: it may catch fire and send out invisible flames. Wear latex gloves when servicing.

1.4. RUNNING-IN

1.4.1. RUNNING-IN RECOMMENDATIONS

The running-in of the engine is essential to ensure its duration and correct functioning.
If possible, drive on hilly roads and/or roads with many bends, so that the engine, the suspensions and the brakes undergo a more effective running-in.
During running-in, change speed.
In this way the components are first "loaded" and then "relieved" and the engine parts can thus cool down.
Even if it is important to stress the engine components during running-in, take care not to exceed.

WARNING
Only after the first 1500 km (932 mi) of running-in you can expect the best performance levels from the vehicle.

Keep to the following indications:

- Do not open the throttle completely and suddenly if the speed is low, both during and after the running-in.
- During the first 100 km (62 mi) pull the brakes with caution, avoiding sharp and prolonged brakings. This ensures a correct bedding-in of the pads on the brake disc.
- During the first 1000 km (621 mi), never use the vehicle beyond 80% of the max. speed, do not fully open throttle and do not keep the vehicle at a constant speed for a long time.

WARNING
After the first 1000 km (621 mi), carry out the checks indicated in the column “After running-in”, in order to avoid injuries to rider and/or other people and/or damaging the vehicle.

- After the first 1000 km (621 mi), increase speed step by step until reaching top performance.

1.5. USING TOOLS AND SPARE PARTS

1.5.1. SPARE PARTS

Should some parts be replaced, use **aprilia** Original Spare Parts only.
aprilia high-quality Original Spare Parts have been expressly designed and manufactured for **aprilia** vehicles.

WARNING
Non-original spare parts can impair the vehicle performance or cause serious damage to the vehicle itself.

1.6. SPECIFICATIONS

1.6.1. TECHNICAL DATA - 125CC 4T-4V-H_2O ENGINE

ENGINE

Type	Single-cylinder 4-stroke engine, 4 valves with auxiliary air system and catalytic muffler
Bore	57 mm
Stroke	48.6 mm
Capacity	124 cm^3
Compression ratio	11. 5÷13 : 1
Carburettor	WALBRO WVF7A
Lubrication	Lobular pump into crankcase controlled by twin-filter chain: mesh filter and paper filter
Fuel system	Premium grade unleaded petrol, min. O.N. 95, through carburetor
Cooling	Water cooling
Max. power output	11 kw at 10000 rpm
Spark advance	Microprocessor-based variable advance: 10° ±1 at 2000 rpm 34° ±1 4500 at 10000 rpm
Plug	Champion RG 4 HC
Transmission	Automatic variator with expandable pulleys, Vee belt, automatic clutch, reduction gear, transmission housing with forced circulation cooling
Valve clearance (cold)	Intake: 0.10 mm Exhaust: 0.15 mm
Recommended engine oil:	Selenia HI Scooter 4 Tech SAE 5W-40
Quantity	1000 cc
Hub oil	TUTELA ZC 90
Quantity	150 cc
Final drive	Engine M245M: 1/21,23 Engine M281M: 1/6,36

1.6.2. TECHNICAL DATA - 200CC 4T-4V-H2O ENGINE

ENGINE

Type	Single-cylinder 4-stroke engine, 4 valves with auxiliary air system and catalytic muffler
Bore	72 mm
Stroke	48.6 mm
Capacity	198 cm^3
Compression ratio	11,5 : 1
Carburettor	WALBRO WVF7 ∅ 29mm CVK 30
Lubrication	Lobular pump into crankcase controlled by twin-filter chain: mesh filter and paper filter
Fuel system	Premium grade unleaded petrol, min. O.N. 95, through carburetor
Cooling	Water cooling
Max. power output	14.7 kw (20 HP) at 8500 rpm
Spark advance	Variable (before TDC) 10° ±1 at 2000 rpm 32° ±1 6500 rpm
Plug	NGK CR8EB
Transmission	Automatic variator with expandable pulleys, Vee belt, automatic clutch, reduction gear, transmission housing with forced circulation cooling
Valve clearance (cold)	Intake: 0.10 mm Exhaust: 0.15 mm
Recommended engine oil:	Selenia HI Scooter 4 Tech SAE 5W-40
Quantity	1000 cc
Sump oil	TUTELA ZC 90
Quantity	150 cc
Final drive	Engine M234M: 1/20,11 Engine M282M: 1/6,54

1.7. USE OF PRODUCTS

1.7.1. USE OF PRODUCTS

For all maintenance operations, use only the product listed below.
Listed materials have been tested for many years and are suitable for all the applications specified by the manufacturer.

NOTE *Consumer goods with part numbers are available upon request (see table).*

PRODUCT SPECIFICATIONS

LUBRICANT	PRODUCT
Engine oil	RECOMMENDED: IP SUPERBIKE 4, SAE 5W – 40 or Agip 4T FORMULA RACING, SAE 5W - 40. As an alternative to the recommended oils, it is possible to use select oils having properties in compliance with or even above A.P.I. SJ specifications.
Transmission oil	RECOMMENDED: IP F.C., SAE 75W 90 or Agip GEAR SYNTH, SAE 75W - 90. As an alternative to the recommended oil, use select oils having properties in compliance with or even above A.P.I. GL3 specifications
Fork oil	RECOMMENDED: IP F.A. 5W or IP F.A. 20W, as an alternative Agip FORK 5W or Agip FORK 20W. Should you wish to reach an average behavior between those offered by IP F.A. 5W and by IP F.A. 20W or Agip FORK 5W and by Agip FORK 20W, mix the products as follows: SAE 10W = IP F.A. 5W 67% of the volume, + IP F.A. 20W 33% of the volume. Agip FORK 5W 67% of the volume + Agip FORK 20W 33% of the volume. SAE 15W = IP F.A. 5W 33% of the volume, + IP F.A. 20W 67% of the volume. Agip FORK 5W 33% of the volume + Agip FORK 20W 67% of the volume.
Bearings and other lubrication points	RECOMMENDED: IP BIMOL GREASE 481 + Agip GREASE SM2. As an alternative to the recommended product, use select oil for rolling bearings, useful temperature range -30°C…+140°C, dripping point 150°C…230°C, highly anticorrosive, water and oxidization resistant.
Battery terminals	Neutral grease or vaseline.
Brake fluid	The braking system is filled with IP Autofluid FR. DOT 4 (DOT 5 can be used as well) + Agip BRAKE 5.1 DOT 4 (DOT 5 compatible). ***NOTE*** *Before mixing different makes or types of oil, check their compatibility.* As an alternative to the recommended fluid, use fluids having properties in compliance with or even above SAE J1703, NHTSA 116 DOT 4, ISO 4925 specifications.
Engine coolant	RECOMMENDED: IP ECOBLU – 40° C + Agip COOL. As an alternative to the recommended fluid, use fluids having properties in compliance or even above basic ethylene glicol CUNA NC 956-16 specifications.

1.8. TIGHTENING

1.8.1. GENERAL TIGHTENING TORQUE SETTINGS

The table shows the tightening toque settings for 8.8 class screws made of steel/aluminum or other similar materials.

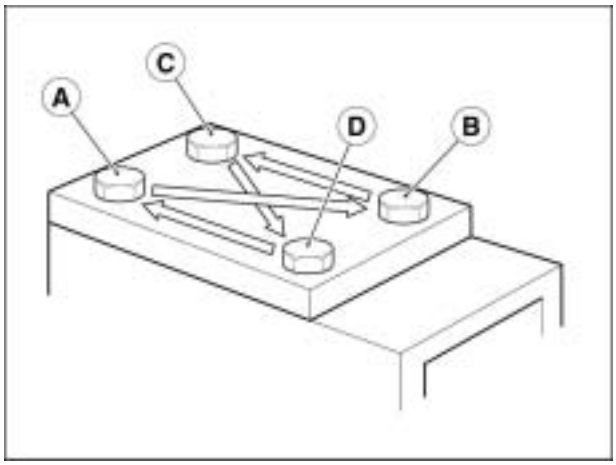
Screw or bolt thread	Wrench	Tightening torque	
		Nm	kgm
M 4	7	3	0.3
M 5	8	6	0.6
M 6	10	10	1.0
M 8	12	25	2.5
M 10	14	50	5.0
M 12	17	80	8.0
M 14	19	135	13.5
M 16	22	210	21.0

If not otherwise specified, the tightening torque settings refer to clean, dry and ambient temperature threads.

***NOTE** In order to avoid any possible deformation and/or wrong coupling, please tighten screws and bolts as follows:*

- Tighten all fasteners by hand.
- Apply half of the recommended tightening torque value and tighten the opposite parts: (A) and (B); (C) and (D).
- Repeat the above operation by tightening to the specified torque value.

***NOTE** The pressure on the fastening parts will be thus evenly distributed on the coupling surface.*



SPECIAL TOOLS 2

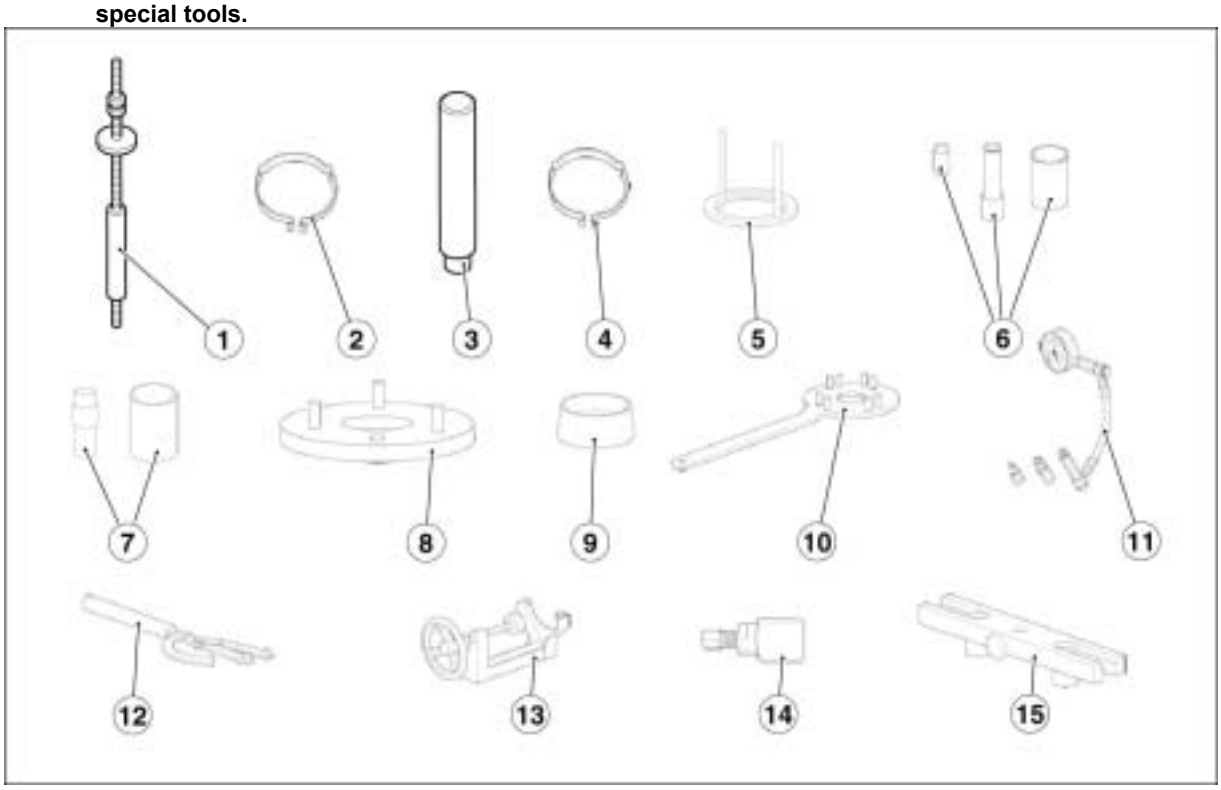
SUMMARY

2.1. SPECIAL TOOLS

2.1.1. SPECIAL TOOLS

Special tools are required for correct part removal, installation and tune-up.
Improper and/or makeshift tools might cause damages. The list below includes special tools, which have been especially designed for this engine.
Order special tools, if needed, from the special tools manual.

WARNING
Read the supplied documents before using any special tools.



Legend.

Position	Tool description and function	Part number
1	Small items for crankshaft axial play	8140657
2	Piston ring tool (engines M192M / M245M / M281M) (125 cc)	8140658
3	Valve oil seal drift	8140659
4	Piston ring tool (engines M191M / M234M / M282M) (150 - 200 cc)	8140660
5	Clutch housing lock wrench	8140661
6	Driven pulley needle bearing drift	8140662
7	Water pump overhauling tools	8140663
8	Adapter for clutch unit disassembly	8140665
9	Guide for mobile pulley onto fixed roller	8140664
10	Driving pulley lock wrench (engines M192M / M245M / M281M) (125 cc)	8140535
11	Pressure gauge fitting	8140181
12	Driving pulley lock wrench (engines M191M / M234M / M282M) (150 - 200 cc) (adjustable face wrench)	8106702
13	Universal tool for clutch assemblies	8140259
14	Flywheel puller	8140276
15	Dial gauge holder	8140266

ENGINE 3

SUMMARY

3.1. TRANSMISSION

3.1.1. TRANSMISSION COVER

- Remove the plastic cover.
- Remove the driven pulley shaft lock nut and washer using the clutch housing lock wrench (8140661).

- Remove the plug/dipstick from engine oil filler.
- Remove the screws.
- Remove the transmission cover.

3.1.2. FAN GUARD

- Remove the screws and guard.

NOTE *125 c.c. engine fan guard has four fasteners. The 200 c.c. guard has five at two levels.*

3.1.3. REMOVING THE INTAKE VENT

- Remove the screws.
- Remove the vent.

3.1.4. DRIVEN PULLEY SHAFT BEARING

- Remove the circlip from inside the cover.

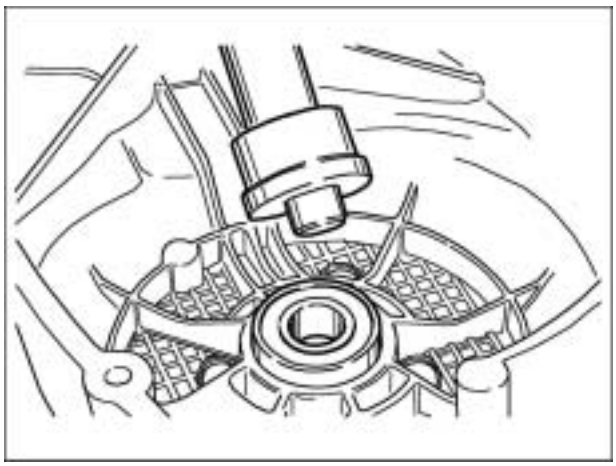
- Remove the bearing from the case.

3.1.5. INSTALLING THE DRIVEN PULLEY SHAFT BEARING

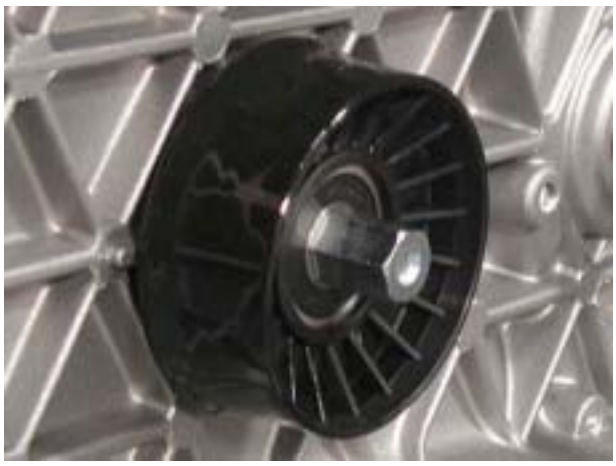
- Warm up the case a little from the inside so not to damage outer paintwork. Fit the bearing into its seat.
- Replace the circlip.

WARNING
Place the case on a suitable surface to prevent damage to outer paintwork.

NOTE *Always fit a new bearing when reassembling.*



3.1.6. BELT ROLLER (ENGINES M234M / M282M) (200 cc)



- Ensure that the roller shows no signs of irregular wear and can turn freely.

REMOVING THE ROLLER

- Remove the screw, spacer and roller complete with bearing.

INSTALLING THE ROLLER

- Install the roller.
- Tighten the screw and spacer to the specified torque value.

TIGHTENING TORQUE SETTINGS

Screw: 11 - 13 Nm

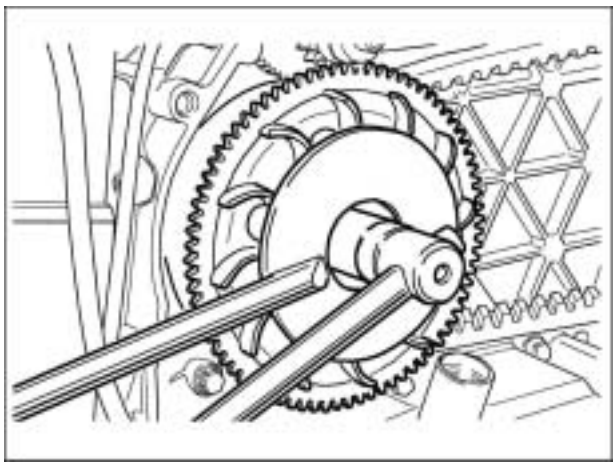
3.1.7. REMOVING THE DRIVING PULLEY

Engines M192M / M245M / M281M / M191M (125 - 150 cc)

- Remove the nut and the cup washer, the drive common to all kick-starter versions and the steel washer.

Driving pulley lock wrench: 8140535

- Remove the fixed driving half pulley and the second steel washer.

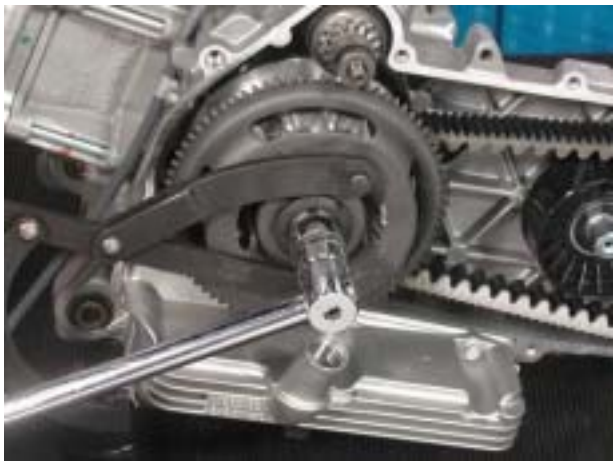


Engines M234M / M282M (200 cc)

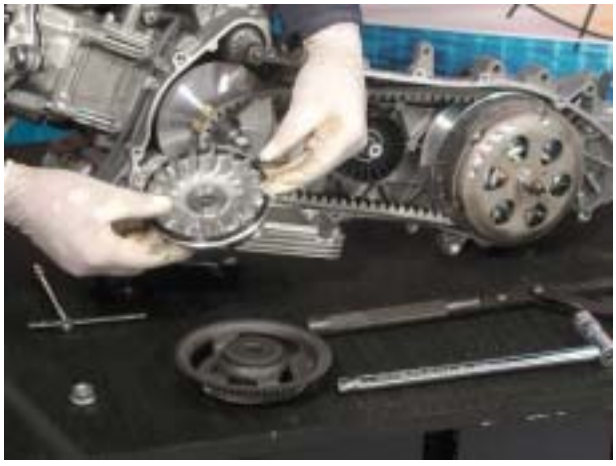
- Fit the special tool into the inner slots and then remove the nut with the cup washer.

Pulley lock wrench: 8106702

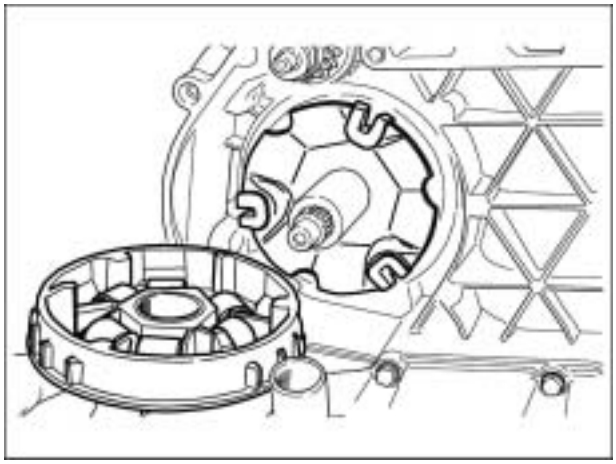
- Remove the starting sprocket and the torque limiter.
- Remove the fixed driving half pulley and the steel washer in contact with the bushing.



- Remove the belt and pull out the movable half pulley with bushing. Make sure the rollers do not escape.



- Remove roller counter plate and its shoes.

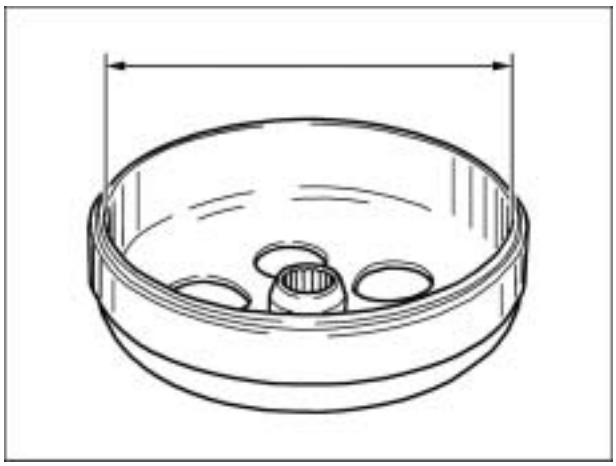


3.1.8. REMOVING THE DRIVING PULLEY FROM THE ENGINE

- Remove the spacer, clutch housing the whole driven pulley assembly and transmission belt.

NOTE *The assembly can be removed even with the driving pulley still fitted.*

3.1.9. CLUTCH HOUSING



- Make sure the clutch housing is neither worn nor damaged.
- Measure its inside diameter:

standard value: Ø 134.2 mm
max. value: Ø 134.5 mm

NOTE *Max. run out value: 0.20 mm.*

3.1.10. REMOVING THE CLUTCH

- Use the adapter ring with its pins facing the clutch to mount the clutch on the specific tool.

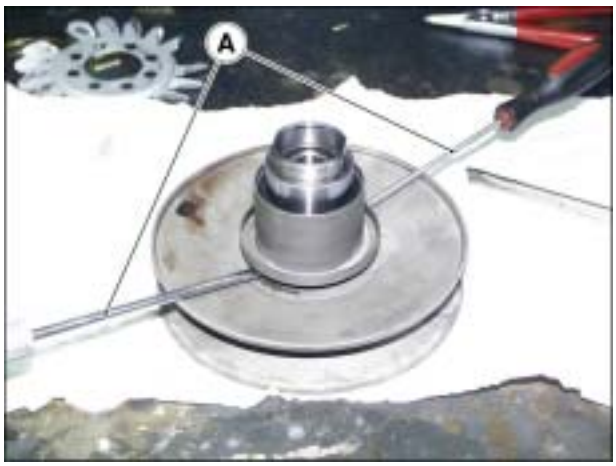
Universal tool for clutch assemblies: 8140259
Adapter for clutch unit disassembly: 8140665

WARNING
The tool must be firmly held in the vice with the middle screw in contact with the tool.
Over tightening will damage the tool.

- Check the proper insertion of the clutch in the ring before locking/unlocking the nut.
- Ensure that clutch may be fully fitted into the adapter ring.
- Remove the nut. Open the tool and take out the driven pulley, spring and clutch.

3.1.11. PIN COLLAR

- Remove the collar with two screwdrivers (A) or a ring tool (B).
- Remove the guide pins (1) and the moving half pulley (2).

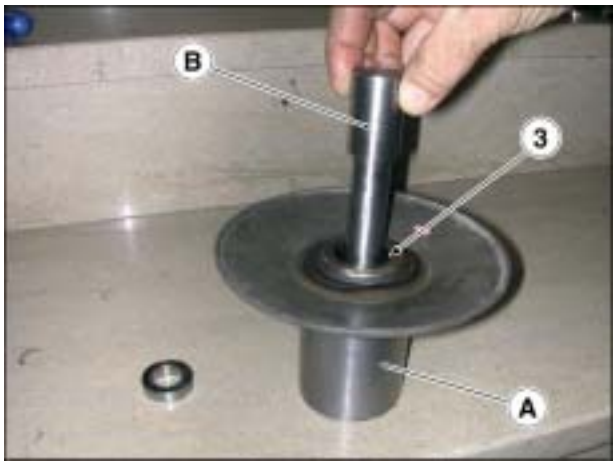


3.1.12. FIXED DRIVEN HALF PULLEY BEARINGS

- Check that parts are not worn out and/or noisy and replace, if necessary.
- Remove the stop ring with two flat-tip screwdrivers.

- Remove the ball bearing with a suitable drift and a hammer.

- Turn the pulley and fit a suitable support. Remove the ball bearing with a drift of appropriate diameter and a hammer.



3.1.13. FIXED DRIVEN HALF PULLEY

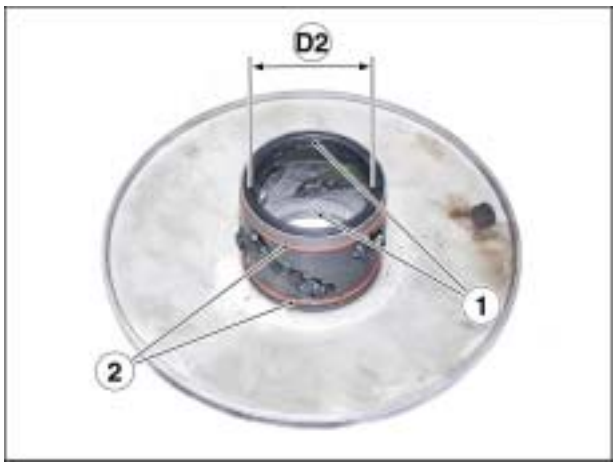
- Measure outside diameter of the bushing.

D1:
Min. diameter allowed: Ø 40.96 mm
Standard diameter: Ø 40.985 mm

3.1.14. MOVABLE DRIVEN HALF PULLEY

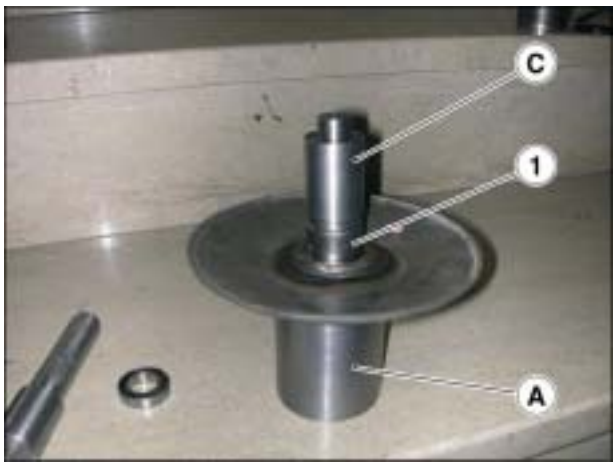
- Remove the two inner seal rings (1) and the two O-rings (2).
- Measure insider diameter of the bushing.

D2:
Max. diameter allowed: Ø 41.08 mm
Standard diameter: Ø 41.000 ÷ 41.035 mm



3.1.15. INSTALLING FIXED DRIVEN HALF PULLEY BEARINGS

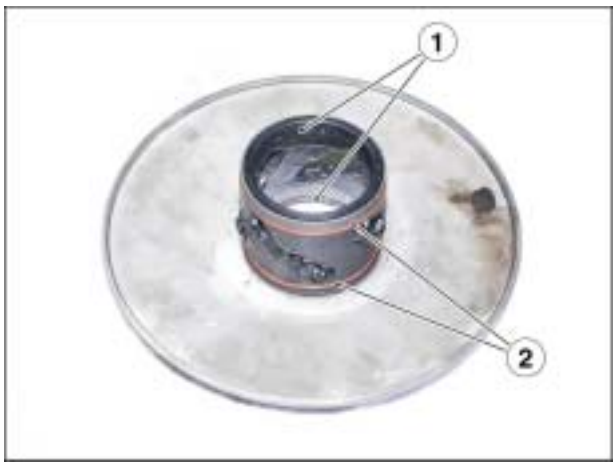
- Take tool number: 8140662
- Fit the support (A) into the driven pulley and fit a new needle bearing (1) with the drift (C) (larger end).



- Turn the pulley and then fit a new ball bearing (2) with the drift (C) (smaller end).
- Mount a new retaining ring with the drift.

3.1.16. ASSEMBLING THE DRIVEN PULLEY

- Fit the new oil seals (1) and O-rings (2) onto the moving half pulley.
- Check parts in contact with the belt.



- Fit the half pulley (3) on the bushing with the special tool:

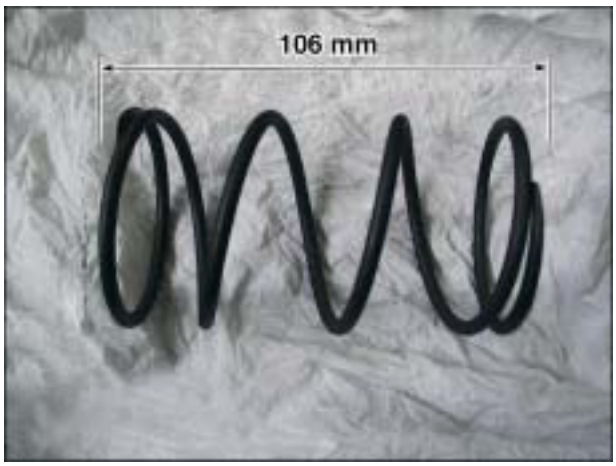
Moving pulley-to-fixed pulley guide (4): 8140664

- Ensure that pins and collar show no signs of wear and refit them.
- Lubricate the driven pulley assembly with approx. 6 g of TUTELA MRM2 grease through a bent-end lubricator. Lubricate through one bushing inner hole until the grease comes out from the opposite one. This must be done to prevent the grease from going beyond the O-rings.

3.1.17. SPRING

- Measure the free length of the movable driven half pulley spring.

Standard length: 106 mm



3.1.18. CLUTCH WEIGHTS

- Check thickness of friction material on clutch weights.

Min. thickness allowed: 1 mm

- Weights should show no traces of lubricants. If they do, leak test the driven pulley assembly.

NOTE *During running in, clutch weights should have middle contact surfaces, and be all the same. If not, the clutch may jerk.*

WARNING
Do not open clutch weights with any tools to avoid load variations in the return springs.

3.1.19. INSTALLING THE CLUTCH

- Mount the spring, clutch and driven pulley.
- Use the adapter ring to mount the clutch on the specific tool.

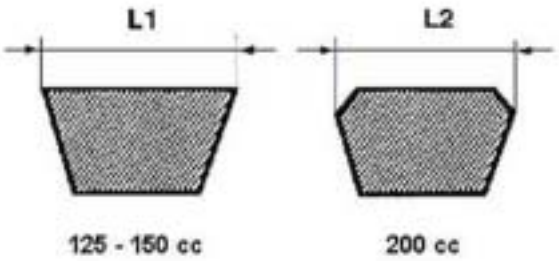
Universal tool for clutch assemblies: 8140269
Adapter for clutch unit disassembly: 8140665

- Insert the lever pin in the hole of the adapter ring.
- Tighten the nut to the specified torque value.

TIGHTENING TORQUE SETTINGS
Nut : 45 ÷ 50 Nm (4.5 ÷ 5.0 kgm)

3.1.20. DRIVE BELT

- Check drive belt for damage.
- Check the correct belt width.



L1: ENGINES M192M / M191M / M245M / M281M (125 - 150 CC)
Min. width: 21.5 mm
Standard width: 22.5 ± 0.2 mm

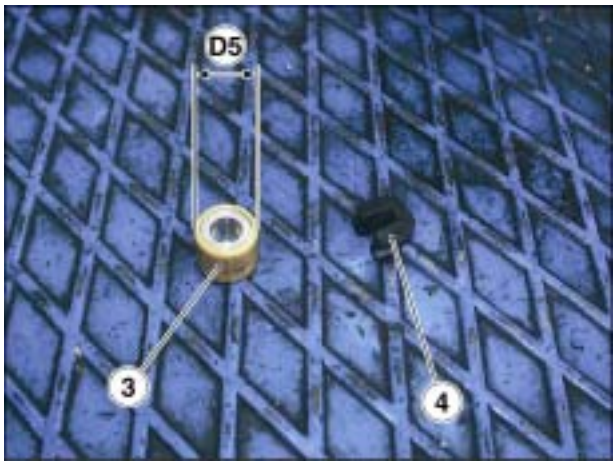
L2: ENGINES M234M / M282M (200 CC)
Min. width: 21.5 mm
Standard width: 22.5 ± 0.2 mm

3.1.21. MOVABLE DRIVING HALF PULLEY

- Measure the outside diameter of the pulley sliding bushing.

D4:
Min. permitted diameter: Ø 25.95 mm
Standard diameter: Ø 25.959 ÷ 25.98 mm

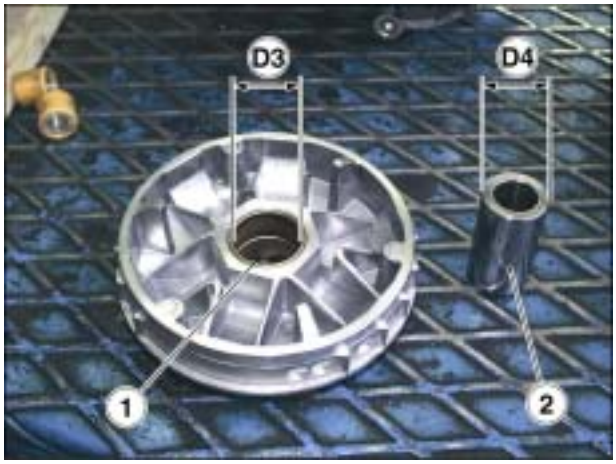
- Check the rollers for damage or wear.



D5: ENGINES M192M / M191M / M245M / M281M (125 - 150 CC)
Min. permitted diameter: Ø 18.5 mm
Standard diameter: Ø 18.9 ÷ 19.1 mm

D5: ENGINES M234M / M282M (200 CC)
Min. permitted diameter: Ø 20.1 mm
Standard diameter: Ø 20.5 ÷ 20.7 mm

- Check the degree of wear of the brass bush and measure its inside diameter.



D3:
Min. permitted diameter: Ø 26,12 mm
Standard diameter: Ø 26,000 ÷ 26,021 mm

WARNING
Do not lubricate or clear the brush

- Ensure that counter plate shoes are not worn out.
- Check the wear of roller recesses and belt contact surfaces on both half pulleys.

3.1.22. INSTALLING THE FIXED DRIVING HALF PULLEY (ENGINES M234M / M282M) (200 cc)

- Fit the steel shim against the bushing and the fixed driving half pulley.
- Fit the starting sprocket assembly complete with torque limiter.
- Fit the torque limiter onto the crankshaft to align sprocket marks with fixed driving half pulley marks. If not possible, select a position in which marks are in their closest position for alignment.
- Failure to do this will impair performance of the cooling fan.
- Apply “Super Rapido” (Quick-setting) Loctite 242 on threading and tighten the nut with washer to the specified torque.

Driving pulley lock wrench: 8106702

TIGHTENING TORQUE SETTINGS

Driving half pulley nut: 75 ÷ 83 Nm

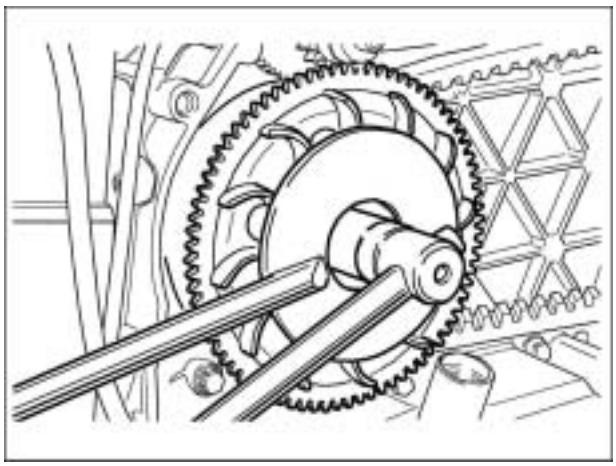
- Torque limiter is set to 100 Nm.
- The lock wrench acts on the starting sprocket.
- If the torque limiter is worn out, this can be detected when tightening the nut to the crankshaft.
- A worn torque limiter cannot be repaired. Apply a new starting sprocket complete with torque limiter.

3.1.23. INSTALLING MOVABLE HALF PULLEY AND BUSHING

- Preassemble the movable half pulley (1) with the calotte (2); seat the rollers (3).
- Fit the assembly complete with bushing onto the crankshaft.

- Open the rear pulley and fit the belt in its rotation direction.

3.1.24. INSTALLING THE FIXED DRIVING HALF PULLEY (ENGINES M192M / M245M / M281M /M191M) (125 - 150 cc)



- Refit all assembly parts (inner shim, fixed half pulley, outer shim, drive and nut), apply “Super Rapido” (Quick-setting) thread locker Loctite 242 and tighten the nut to the specified torque.
- Use the special tool to prevent half pulley rotation.

- Driving pulley lock wrench: 8140535

WARNING
Be sure to install the driving half pulley with fully free belt so that it can be properly tightened.

NOTE *The nut should be replaced at each reassembly.*

TIGHTENING TORQUE SETTINGS
Driving half pulley nut: 75 ÷ 83 Nm

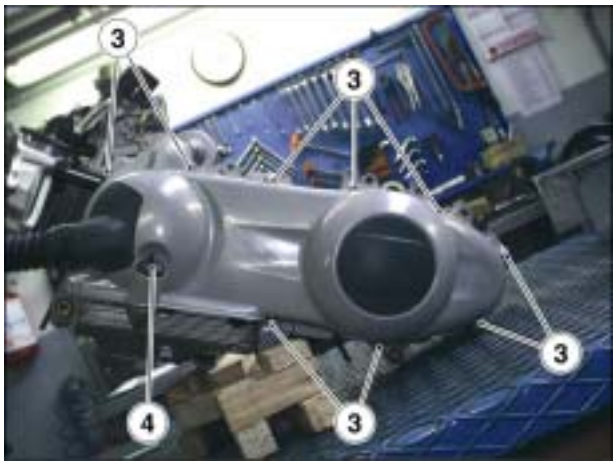
3.1.25. INSTALLING THE CLUTCH HOUSING

- Install the clutch housing and the shim.

3.1.26. FITTING THE TRANSMISSION COVER

- Ensure that centering dowels are in position.

- Refit the cover and tighten the screws to the specified torque.
- Refit the oil filler/dipstick.
- Apply “Super Rapido” (Quick-setting) thread locker Loctite 242E and then refit the steel washer and the driven pulley shaft nut.



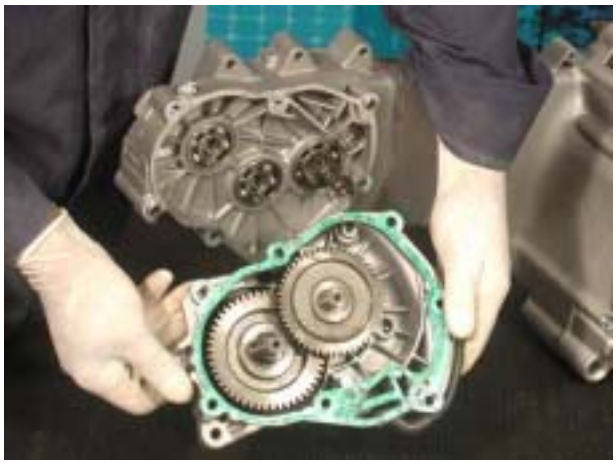
- Tighten the nut to the specified torque using the clutch housing lock wrench (8140661).
- Fit the plastic cover.

TIGHTENING TORQUE SETTINGS
Cover: 11÷13 Nm
Driven pulley shaft: 54 ÷ 60 Nm

3.1.27. REAR HUB

- Remove the dipstick.
- Drain the rear hub oil through the plughole.
- Remove the screws.

- Remove the hub cover complete with wheel shaft, idler gear and gasket.



3.1.28. REMOVING THE WHEEL SHAFT

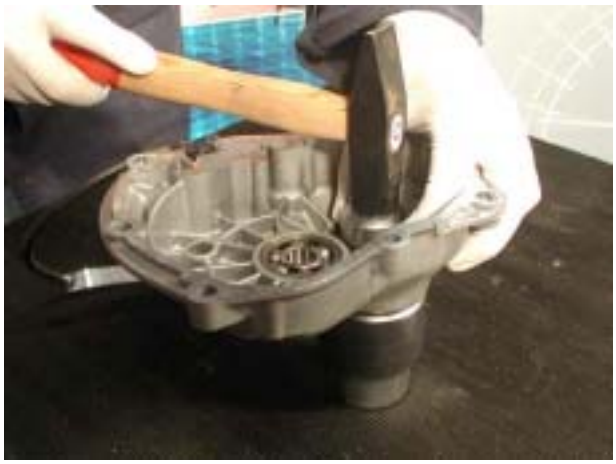
- Remove the idler gear.
- Remove the wheel shaft complete with gear.

3.1.29. HUB CASE BEARINGS

- Check bearings for wear, play and noise level. In case of troubles, proceed as follows.
- Use a suitable extractor to remove the three 15-mm bearings (1) (two on the case and one on the cover).

3.1.30. REMOVING THE WHEEL SHAFT BEARING FROM THE COVER

- Remove the circlip from the outside of the hub cover.
- Remove the bearing; support the hub cover properly.



- Remove the oil seal.

3.1.31. REMOVING THE DRIVEN PULLEY SHAFT

- Remove the transmission cover and the clutch assembly.
- Withdraw the driven pulley shaft from the bearing.

- Remove the oil seal from the bearing. Be careful not to damage its seat. Pull it out from the transmission side.

- Remove the circlip.

- Withdraw the driven pulley shaft bearing.

3.1.32. INSTALLING HUB CASE BEARINGS

- Parts should be warmed up with the heat gun first.
- Fit the three 15-mm bearings (1) (two on the case and one on the cover).

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3.1.33. INSTALLING THE DRIVEN PULLEY SHAFT BEARING

- Warm the half case with the heat gun.
- Fit a new driven pulley shaft bearing with its balls visible from inside the hub.
- Fit the snap ring with its open side opposite to the bearing.

- Fit a new oil seal flush with the case on the pulley side.

3.1.34. CHECKING HUB COVER

- Ensure that the mating surface is not dented or bent.
- Check bearing thrust surfaces.
- If necessary, fit a new hub cover.

3.1.35. INSTALLING THE WHEEL SHAFT BEARING IN THE COVER

- Warm the cover with the heat gun.
- Fit the wheel shaft bearing on the cover.
- Fit the circlip.

- Fit the oil seal using the suitable tools. It should be flush with the inner surface and its seal lip facing the inside of the hub.

3.1.36. CHECKING HUB SHAFTS

- The three shafts should show no signs of wear or damages to their toothed surfaces; also check bearing and oil seal thrust surfaces.
- Replace damaged parts, if necessary.

3.1.37. INSTALLING HUB GEARS

- Mount the driven pulley shaft.
- Fit the idler.
- Fit wheel shaft complete with gear.

3.1.38. FITTING THE HUB COVER

- Fit a new gasket on the centering dowels.
- Fit the cover. Make sure the vent hose is properly positioned.
- Position the shortest screw.
- Fit the remaining screws and tighten them to the specified torque value.

TIGHTENING TORQUE SETTINGS
Screws: 24 – 27 Nm

- Mount the oil drain plug complete with a new seal.
- Insert the dipstick.

3.2. FLYWHEEL

3.2.1. REMOVING THE COMPLETE FLYWHEEL COVER (ENGINES M245M / M281M / M234M /M282M) (125 - 200 CC)

- Remove the clamps and cooling sleeve.
- Remove the diaphragm clamp.
- Unscrew the diaphragm screws.
- Unscrew the air duct screws.
- Discount the SAS delivery pipe and remove the duct and diaphragm.

- Remove the four fasteners and the flywheel cover.

- Check that inside and outside secondary air cleaner and inlet and outlet holes are not clogged.

3.2.2. REMOVING THE FLYWHEEL

- Lock the flywheel with the special tool:

Driving pulley lock wrench (Engines M191M / M234M / M282M) (150 - 200 cc) (adjustable face wrench): 8106702

Driving pulley lock wrench (Engines M192M / M245M / M281M) (125 cc): 8140535

- Remove the nut.

WARNING
Use only the adjustable face wrench supplied to prevent damage to the stator coils.

- Remove the flywheel.

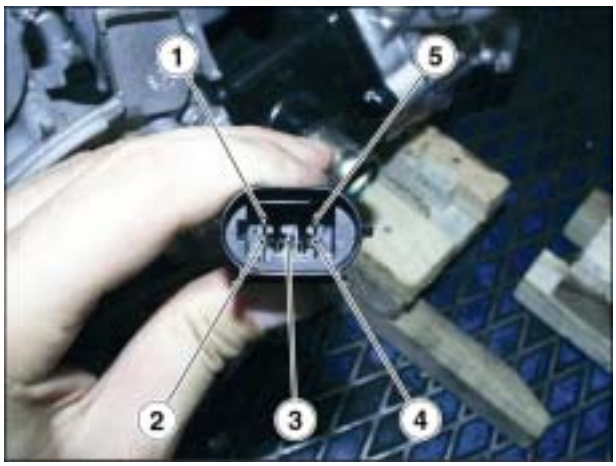
Flywheel puller 8140276

NOTE *The 200 c.c. flywheel has a larger inertia weight.*

3.2.3. REMOVING THE STATOR

- Remove the wiring clamps.
- Remove the terminal from the min. oil pressure switch.
- Remove the Pick-Up screws, the screw securing the wiring to the bracket and the stator retaining screws.
- Remove stator and wiring.

3.2.4. CHECKING THE STATOR



- Check for continuity between connections 5-3 and 5-1 using a tester.
- Check ground insulation of the three-stator phases 5-ground, 3-ground and 1-ground.

Indicative resistance for each phase: 0.7 ÷ 0.9 Ω

Checking min. oil pressure switch

- Check for continuity between connection 4 and ground (engine off) using a tester.

Checking the Pick-Up

- Check for a resistance of about 105 ÷ 124 Ω at 20° C between connection 2 and ground.
- If different values are measured, replace defective parts.

NOTE *The above values apply for tests carried out at room temperature. If a stator is checked when at operating temperature, higher values will be taken.*

3.2.5. CHECKING THE FLYWHEEL

- Check that the inside plastic parts and Pick-UP control plate are not damaged.

3.2.6. INSTALLING THE STATOR ASSEMBLY

- Replace the stator and Pick-up.

NOTE *The Pick-Up cable must be placed between the upper screw and the locating dowel.*

- Connect the minimum oil pressure switch terminal.
- Clamp the wiring
- Mount the wiring bracket and tighten the attachment screw.
- Tighten the stator and Pick-up attachment screws to the specified torque value.

TIGHTENING TORQUE SETTINGS
Stator and Pick-up screws. 3 – 4 Nm

3.2.7. INSTALLING THE FLYWHEEL

- Install the flywheel; ensure that the key is properly positioned.
- Tighten the flywheel nut to the specified torque; lock the flywheel with the special tool:

Driving pulley lock wrench (Engines M191M / M234M / M282M (150 - 200 cc) (adjustable face wrench) (A): 8106702

Driving pulley lock wrench (Engines M192M / M245M / M281M) (125 cc): 8140535.

TIGHTENING TORQUE SETTINGS

Engines M192M / M245M / M281M / M191M (125 - 150 cc) = flywheel nut: 52 ÷ 58Nm (5.2 ÷ 5.8 kgm)

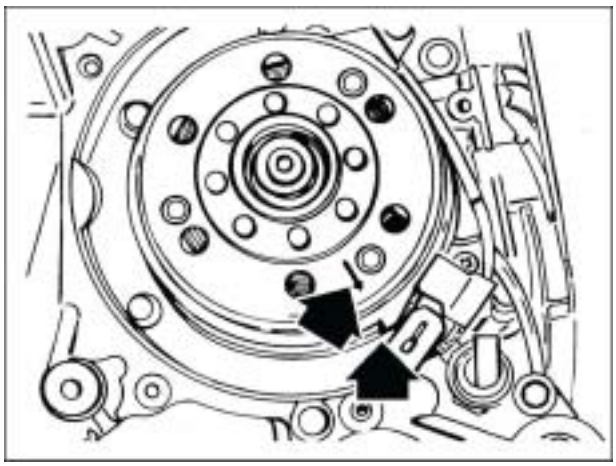
Engines M234M / M282M (200 cc) = flywheel nut: 54 ÷ 60Nm (5.4 ÷ 6.0 kgm)

- Check that Pick-Up air gap is between 0.34 and 0.76 mm. The air gap is not adjusted when the Pick-Up is installed. A warped Pick-Up support will change the air gap value.

NOTE *A variation in the air gap will alter the ignition slow-running speed.*

3.2.8. FITTING THE COMPLETE FLYWHEEL COVER (ENGINES M245M / M281M / M234M /M282M) (125 - 200 CC)

- Position the flywheel with its TDC mark aligned with the mark on the crankcase.



- Prepare the flywheel cover: align marks between drive and case cover.
- Fit the outside SAS cleaner and mount the cover.
- Fit the inside SAS cleaner.

WARNING
Make sure the two centering dowels are present.

- Fit the cover on the engine; fit the three rods into the holes for the water pump drive.

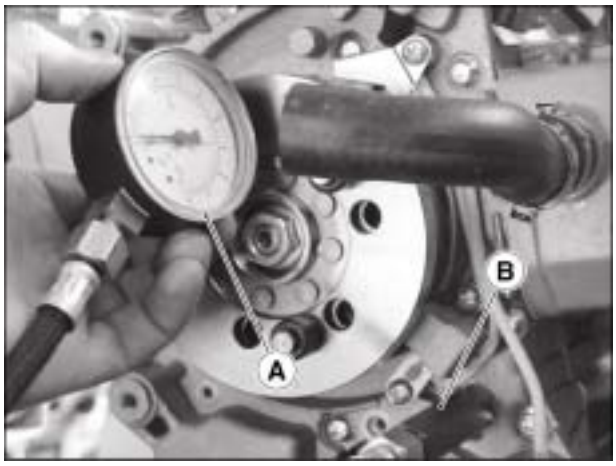
WARNING
Ensure that the flywheel connector is properly fitted.

- Tighten the cover screws.
- Connect the diaphragm to the SAS delivery pipe and close the clamp.
- Position the air duct.
- Tighten the diaphragm and duct screws.
- Connect the cooling sleeve and close the clamp.

3.3. LUBRICATION

3.3.1. CHECKING THE OIL PRESSURE

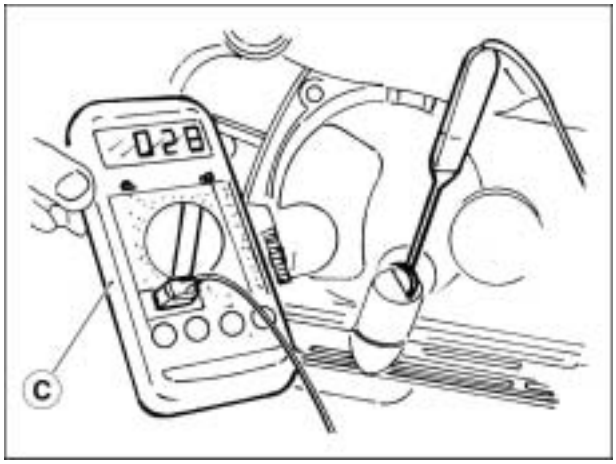
- After having removed the flywheel cover as described under section 4, disconnect oil min pressure switch connector (1) and remove switch (2).



- Provide yourself with the following tools:

Oil pressure gauge (A)
Pressure gauge coupling 8140181 (B)
Multimeter with temperature probe (C)

- Insert coupling (B) into switch (2) thread.
- Fit gauge (A) onto coupling and insert multimeter probe into the oil filler cap.
- With the engine running at an idling speed of 1650 rpm and the oil at a temperature of ~90°C, check that oil pressure is between 0.5 and 1.2 atm.
- With the engine running at 6000 rpm and the oil at a temperature of ~90°C, check that oil pressure is between 3.2 and 4.2 atm.
- Once finished, remove the special tools previously installed on engine, then refit oil pressure switch (1) with its washer. Tighten switch to the specified torque, connect the “oil min. pressure switch (1)” connector and refit flywheel cover.
- In case pressure readings are outside the specified limits check, in a sequence, oil filter, by-pass valve, oil pump and crankshaft seals.



NOTE *This check shall be carried out with a perfect oil level and with the oil filter in good conditions.*

Min. allowed pressure at 6000 rpm: 3.2 atm.

TIGHTENING TORQUE VALUES

Tightening torque: 12 ÷ 14 Nm (also for check coupling).

3.3.2. REMOVING THE OIL SUMP AND THE PRESSURE-ADJUSTING BY-PASS

- Remove the oil filler cap, the transmission cover and the driving pulley with belt and sprocket.
- Drain the sump
- Unscrew the attachment screws. Remove the sump.
- Remove spring, by-pass piston, seal and centering dowels.

3.3.3. CHECKING THE BY-PASS

- Check the free length of the spring.

Standard length: 54.2 mm.

- Check that piston is free from scoring.
- Make sure that piston can run smoothly along casing and that sufficient sealing is ensured.
- If necessary, remove foreign bodies or change the faulty parts.

3.3.4. REMOVAL OF THE CHAINS HOUSING COVER (ENGINES M245M / M281M / M191M) (125 - 150 cc)

- Undo the attachment screws to remove the chains housing cover.
- Extract the cover by means of the lugs.

***IMPORTANT**: Pull the cover parallel to the drive shaft to prevent breaking the lugs.*

3.3.5. DISASSEMBLY OF THE CHAINS HOUSING COVER (ENGINES M192M / M234M / M282M) (125 - 200 cc)

- Use the bolts supplied to mount the base of the tool on the cover.

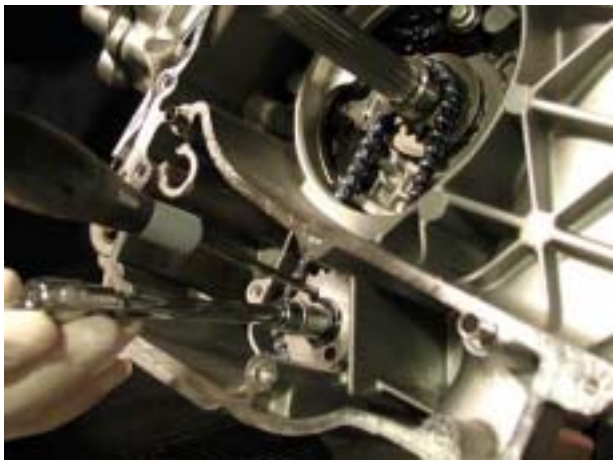
- Screw the threaded bar on the base of the tool and extract the cover.

3.3.6. REMOVING THE OIL PUMP

- Take out the two bolts and remove the pump driving pulley cover.

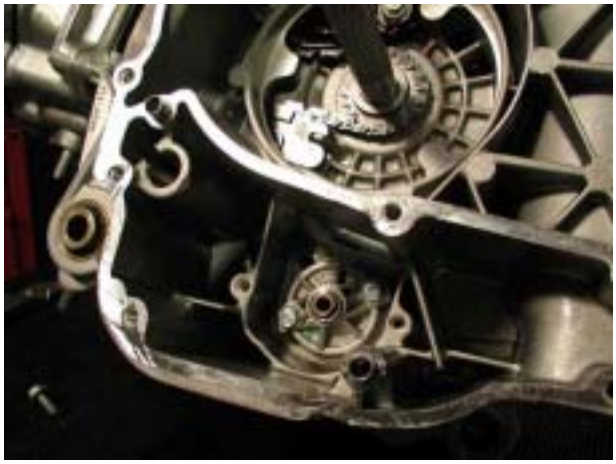
- Insert a screwdriver in the pulley to prevent it from turning.
- Remove center screw with Belleville washer.
- Remove the pulley and chain.

NOTE *It is advisable to mask the chain so as to maintain its original turning direction.*



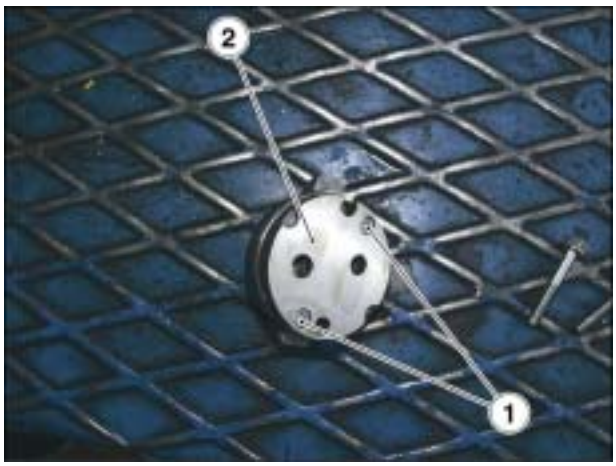
- Remove drive sprocket, washer and O-ring.

- To remove the oil pump, loosen the two screws.
- Remove the oil seal.

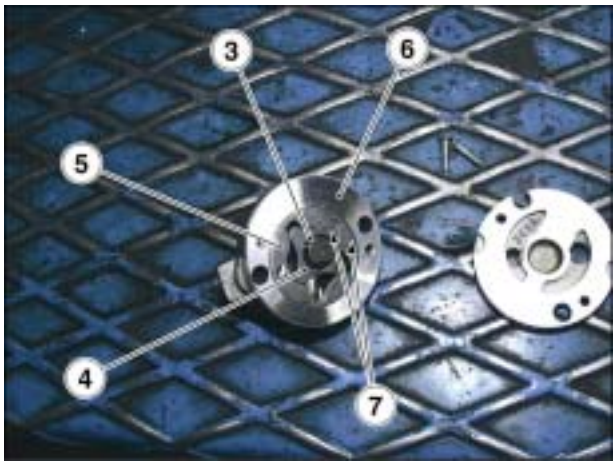


3.3.7. CHECKING THE OIL PUMP

- Remove the two screws (1) and the oil pump cover (2).



- Remove the inner rotor circlip (3).
- Remove the oil pump shaft and circlip.
- Remove rotors (4) and (5). Thoroughly wash with petrol and blow with compressed air.
- Reassemble rotors on pump body (6). Make sure that the two marks (7) are visible.
- Replace the pump shaft and circlip.



- Use a feeler gauge to check the distance between the outer rotor and the pump body.

Max. permitted gap: 0.20 mm

- Check the distance between the rotors.

Max. permitted gap: 0.12 mm

- Check the axial play of the rotors with a ground bar.

Limit: 0.09 mm

- Mount the oil pump cover and tighten the attachment screws.

3.3.8. ASSEMBLING THE OIL PUMP

- Check the pump body-shaft for wear.
- Check that pump cover is not worn or scored.
- In case of excessive wear or scores, change the damaged parts or the whole unit.
- Fit the pump cover so as to align the holes of the attachment screws.

TIGHTENING TORQUE VALUES
Pump cover screws: 0.7 ÷ 0.9 Nm.

- Make sure that gasket is correctly positioned and refit pump to crankcase. Pump can be positioned in one way only. Tighten screws to the specified torque.

TIGHTENING TORQUE VALUES
Pump retaining screws: 5 ÷ 6 Nm.

- Fit washer and sprocket with a new O-ring.
- Fit chain in the turning direction indicated when disassembling.
- Fit pulley, Belleville washer and center screw. Tighten to the specified torque.

TIGHTENING TORQUE VALUES
Pulley screw: 10 ÷ 14 Nm

NOTE *Fit the Belleville washer, with its outer edge resting against the pulley. Check that pump turns freely.*

- To refit the pump cover guard, tighten the two screws to the specified torque.

TIGHTENING TORQUE VALUES
Cover guard screws: 0.7 ÷ 0.9 Nm

3.3.9. ASSEMBLY OF THE CHAINS HOUSING COVER (ENGINES M192M / M234M / M282M) (125 - 200 cc)

- Prepare the new cover and lubricate the sealing edge.

WARNING
Do not lubricate the surface used to key the cover on the engine housing.

- Preassemble the cover with the special tool and bring the screws together.
- Insert the tool bush on the drive shaft.

- Insert the complete cover tool on the drive shaft until contact is made with the housing.

WARNING
Set the cover with the chain channel downwards. If this is not done, the oil shield lead sheath will be incorrectly positioned.

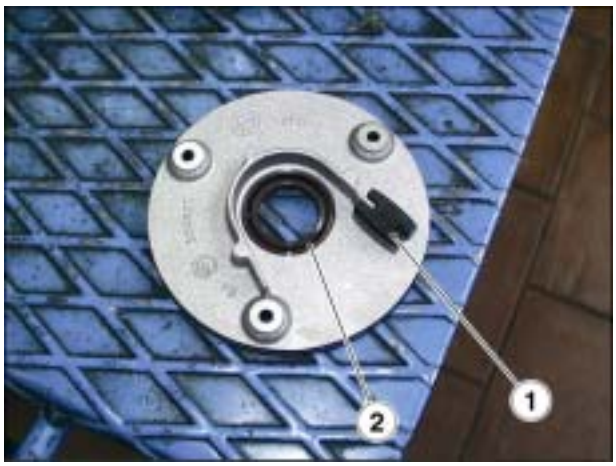
- Install the tool bracket to correctly position the cover.

- Screw the threaded bar right down on the drive shaft.
- Use the nut on the base of the tool to check that the cover is driven fully home.
- Remove the tools.

WARNING
Failure to comply with this assembly procedure is likely to result in serious damage to the engine due to incorrect tightening of the oil pump drive chain.

3.3.10. ASSEMBLY OF THE CHAINS HOUSING COVER (ENGINES M245M / M281M / M191M) (125 - 150 CC)

- Check the chain tightener shoe (1) for signs of wear.
- If the shoe is worn, change it or mount it in the opposite direction so that it works from the opposite side.
- Remove the oil shield.



- Fit a new oil shield flush with the outer edge.
- Fit a new O-ring (3) and lubricate it with grease.
- Position the cover on the engine housing and mount it in its seat with the three screws and copper washers.
- Tighten the three screws to the specified torque value.

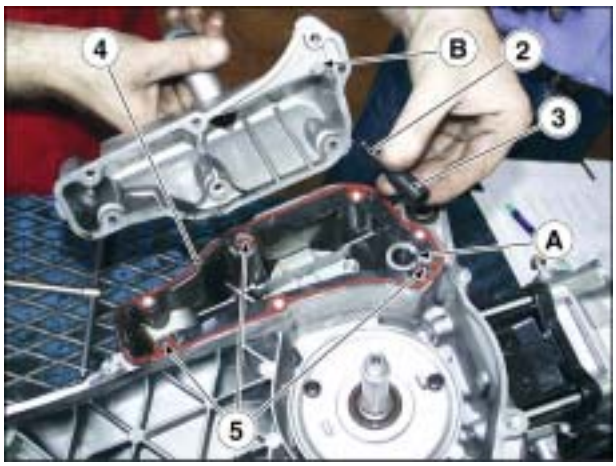
TIGHTENING TORQUE VALUES

Cover screws: 3.5 ÷ 4.5 Nm

3.3.11. ASSEMBLING THE BY-PASS AND THE OIL SUMP

- Refit the by-pass piston (3) into its seat (A).
- Install the adjuster spring (2).
- Apply a new sump seal (4).
- Refit the three centering dowels (5).
- Install sump and fit the spring into the tailpiece (B).
- Refit sump screws (1).
- Tighten the screws to the specified torque value.

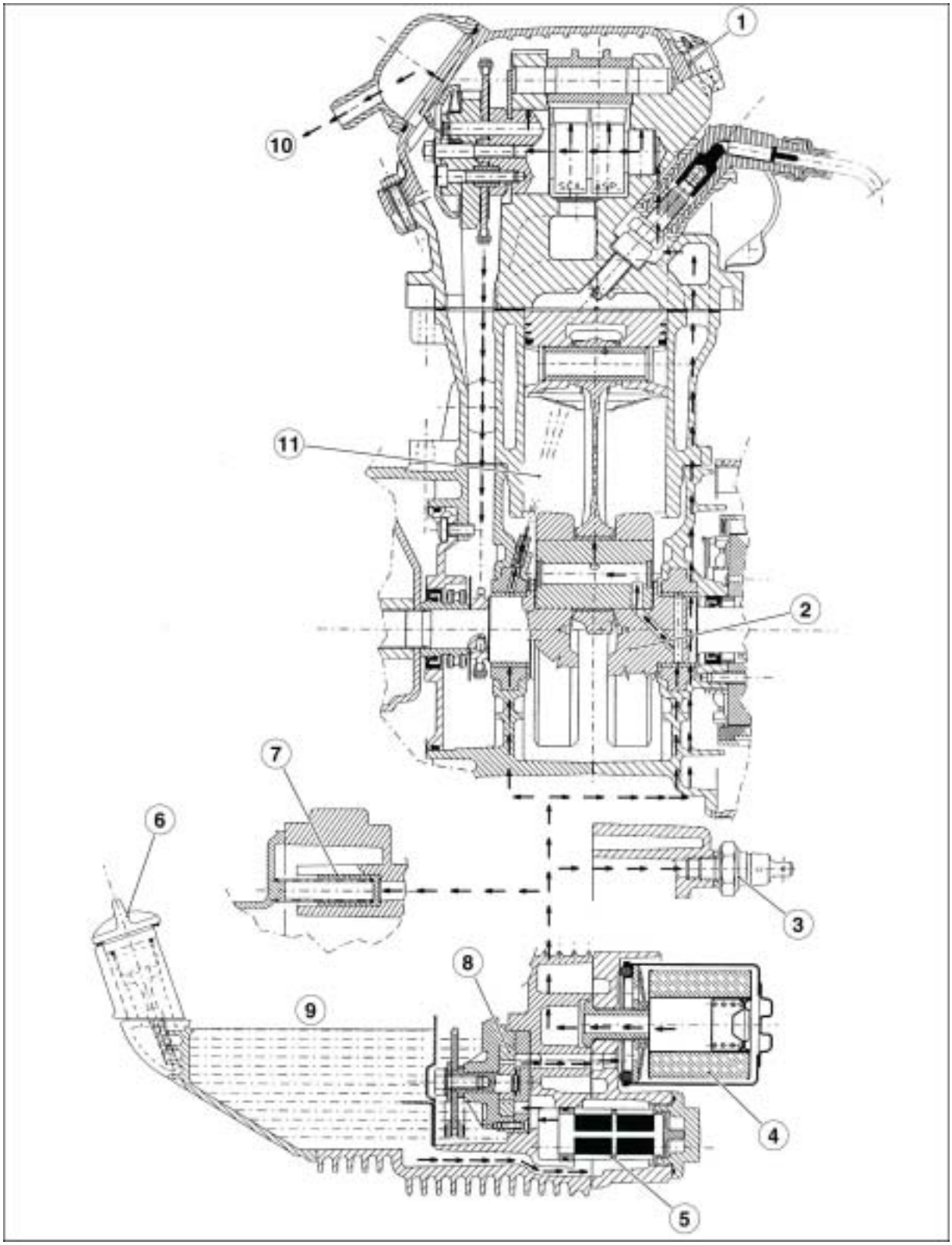
TIGHTENING TORQUE VALUES
Screws (1): 10 ÷ 14 Nm



- Refit drive belt roller assembly, belt roller, sprocket and transmission cover.

For con-rod lubrication troubleshooting, please refer to "Crankcase and crankshaft".

3.3.12. LUBRICATION DIAGRAM



Key:
1. Tappet cover
2. Crankshaft
3. Min. pressure switch
4. Cartridge filter
5. Mesh pre-filter
6. Oil filler
7. By-pass valve
8. Oil pump
9. Oil level in the sump
10. Engine breather
11. Piston cooling nozzle

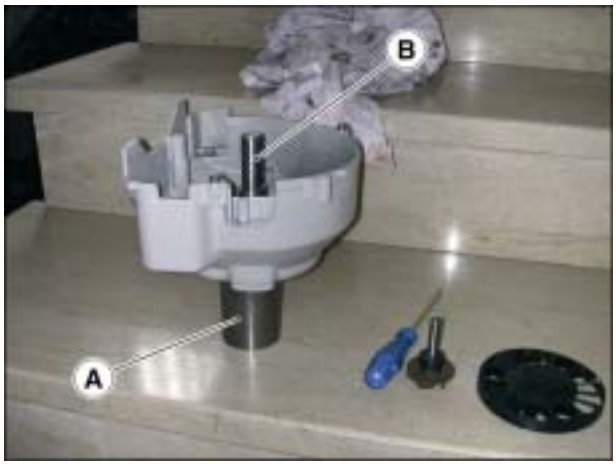
3.4. COOLING

3.4.1. REMOVING THE WATER PUMP

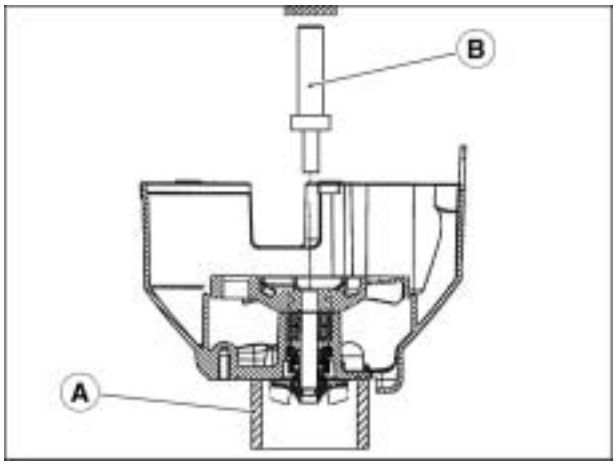
- In the event of noise at the bearings or oil leaks at the cover inner drain hole, overhaul water pump.
- Remove flywheel cover (1) with water pump from engine.
- Undo the three fasteners (3) and remove rotor cover (2).

- Position flywheel cover on ring base

NOTE *To avoid damage to the cover surface used to the coolant-sealing surface of the cover, position the ring bases with its machined surface facing the flywheel cover.*

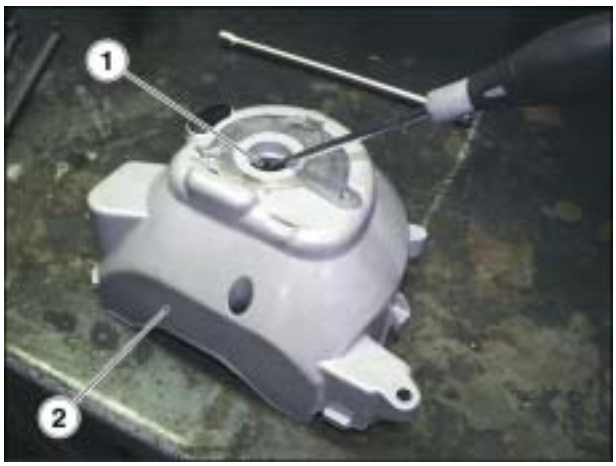


- Use a press and the drift (B) of tool 8140663 to push the shaft and rotor out of the drive and bearings.

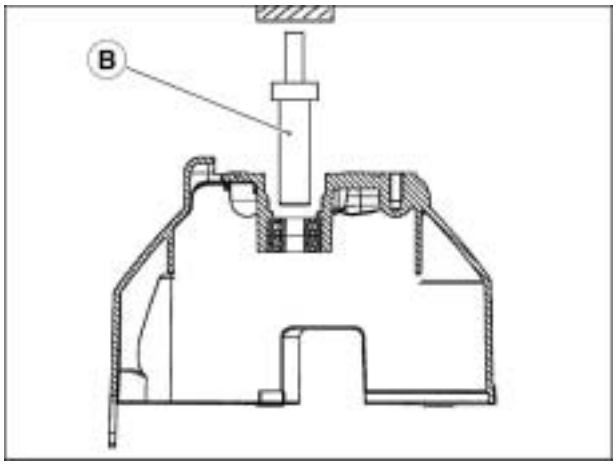


- Remove the shaft washer.
- Remove the drive.

- Remove ceramic seal static side (1) from flywheel cover (2) with a screwdriver.



- Position flywheel cover under a press. Make sure it is perfectly flat.
- Use drift (B) of tool 8140663, in reversed position to push out the two ball bearings.



3.4.2. CHECKING THE COMPONENTS

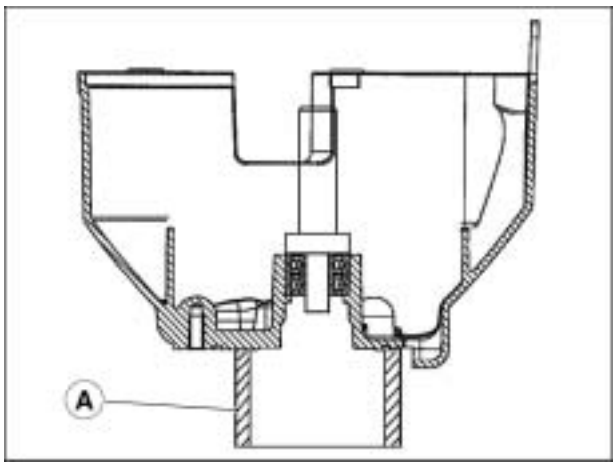
- Check that rotor is free from excessive wear or cracks.
- Check that rotor shaft is not oxidized.
- Check that bearing seats and ceramic seal are not oxidized.
- Check that the drive is free from cracks and integral with the steel hub.

3.4.3. ASSEMBLING THE WATER PUMP

- Use a heat gun to heat the flywheel cover from the inside.

NOTE *Overheating may damage the painted surface.*

- Position flywheel cover on ring base (A) of tool 8140663, as already described for the disassembly procedure.
- Position the two bearings on special drift.



NOTE *Always use new bearings.*

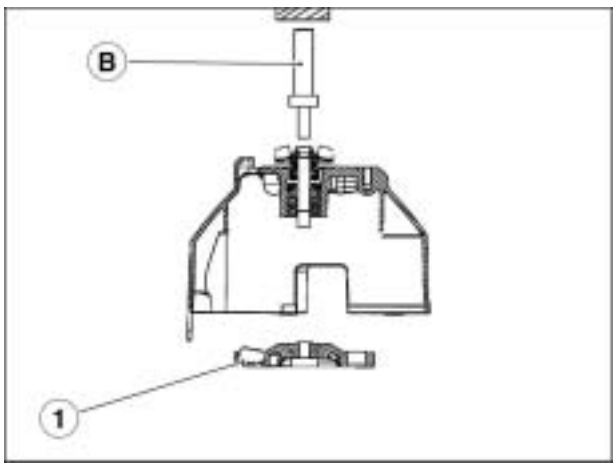
- Use grease to keep bearings on tool.
- Drive bearings fully home into casing with a plastic mallet.

- Assemble the ceramic ring with rubber seal. The chamfered edge of the ring must face the seal.
- Lubricate rubber seal and install unit on flywheel cover. If necessary, use drift (B) of tool 8140663.

NOTE *Always use new ceramic ring and seal. If a ceramic ring is not fitted manually, it may be damaged.*

- Position drive on a suitable support.
- Position the flywheel cover.
- Lubricate the rotor shaft and fits its washer.
- Use a press to fit the shaft in the rotor.

NOTE *Make sure that drift is perfectly centered on rotor. Put shaft under stress and make sure flywheel cover turns in a flat plane. Failure to comply with this recommendation can cause damage to the drive.*

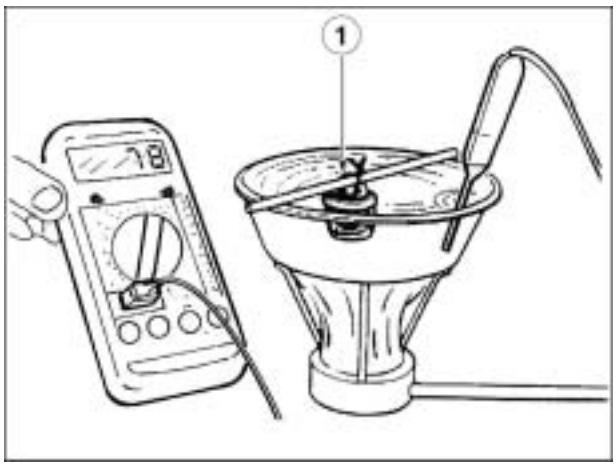


- Fit a new O-ring on the rotor cover.
- Remount the rotor cover.
- Tighten the retaining screws to the specified torque value.

TIGHTENING TORQUE VALUES
Screws (3): 3 ÷ 4 Nm

NOTE *Do not lubricate the O-ring. Failure to comply with this recommendation leads to ring deformation.*

3.4.4. CHECKING THE THERMOSTAT



- Visually inspect thermostat (1) for damage.
- Fill a metal container with about 1 liter of water.
- Immerge the thermostat (1). Keep it at the center of container.
- Immerge multimeter thermal probe close to the thermostat.
- Heat container with a thermal gun.
- Check thermostat opening start temperature:

Engines M245M / M281M (125 cc H_2O)= Opening start temperature: 69.5 ÷ 72.5°C
Engines M234M / M282M (200 cc)= Opening start temperature: 77.5 ÷ 80.5°C

Continue heating until thermostat is fully open:

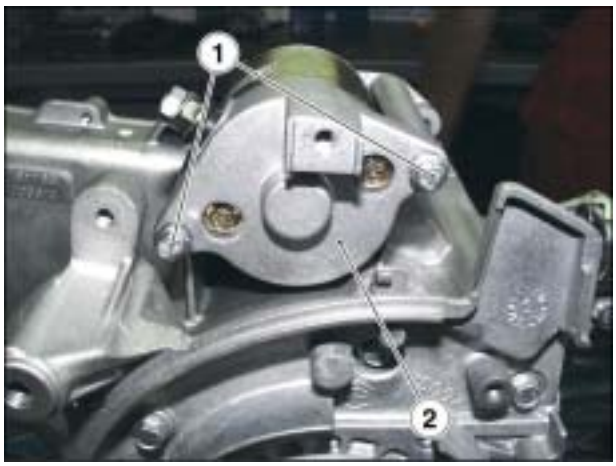
Engines M245M / M281M (125 cc H_2O) = Opening stroke: 3.5 mm a 80°C
Engines M234M / M282M (200 cc) = Opening stroke: 3.5 mm a 88°C

WARNING
For a correct test procedure, avoid direct contact between thermostat and container.

- In case of faulty operation, change thermostat (1).

3.5. CRANKCASE AND CRANKSHAFT

3.5.1. REMOVING THE STARTER MOTOR



- First remove transmission cover, driving pulley, driven pulley and belt, rear wheel hub cover, gears, bearings and oil seals.
- Remove the oil sump, the by-pass, the chain compartment cover and the oil pump.
- Remove the flywheel cover with water pump, the flywheel and stator.
- Remove the oil filter and the oil pressure switch.
- Remove the head-piston-cylinder assembly.
- Remove the two fasteners and the starter motor.

3.5.2. CHECKING CRANKSHAFT AXIAL PLAY

- Before opening the crankcase, check crankshaft axial play with the specific tools:

Dial gauge holder: 8140266
Small parts for crankshaft axial play: 8140657

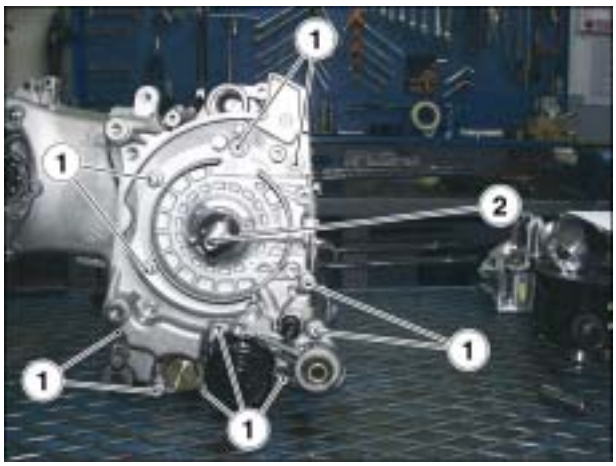
- Mount the dial gauge holder and the parts needed to measure the axial play.
- Install a dial gauge in the holder and tighten it with the knob.
- Measure crankshaft axial play.

Standard play: 0.15 ÷ 0.40 mm

- If this value is exceeded, the crankcase-crankshaft mating surfaces are worn.

3.5.3. OPENING THE CRANKCASE

- Remove the crankcase coupling screws (1).
- Detach the two casings. Keep the shaft (2) installed on one of them.



WARNING
The crankshaft may drop out if this is not done.

- Remove the crankshaft.

NOTE *The crankshaft of the 200 cc version is installed with two re-timing steel washers. Mark washers assembly position.*

WARNING
When opening the crankcase and removing the crankshaft, make sure that its threaded ends do not damage the main bearings.

- Remove the oil precleaner.
- Remove the screws and guard.
- Remove the flywheel-side oil seal.
- Remove the oil pressure sensor.
- Remove the oil filter.

- Remove flywheel-side oil seal.

- Check the con-rod axial play.

Standard play: 0.20 ÷ 0.50 mm

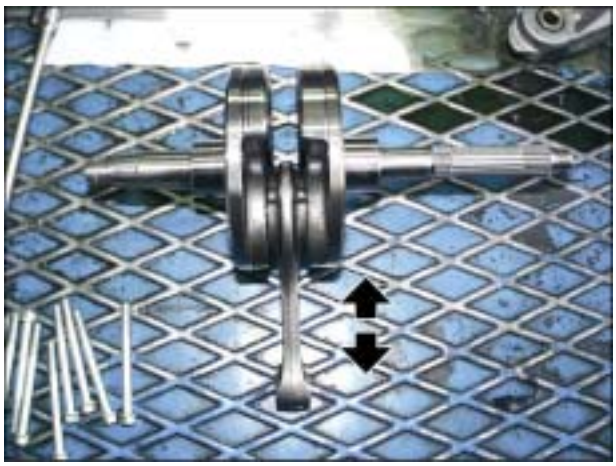
- Check the con-rod radial play.

Standard play: 0.036 ÷ 0.054 mm

- Check that axial play holding surfaces are not scored and use a gauge to check crankshaft width.

NOTE *Make sure that the measurement is not altered by the connection radii with crankshaft bearings.*

Standard dimensions: 55.75 ÷ 55.90 mm (125 - 150 cc)
51.40 ÷ 51.45 mm (200 cc)



WARNING
Crankshaft can be re-used if its width is within the standard values and its surfaces are not scored.

Shims (200 cc only)

- Check shim thickness.

Standard thickness: 2.175 ÷ 2.225 mm

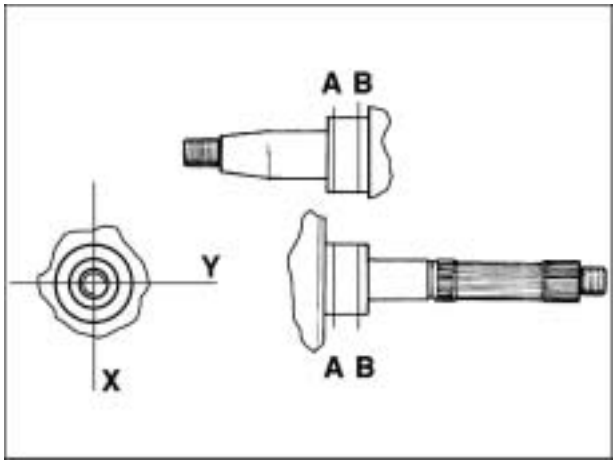
- Check shims for scoring

NOTE *Refit shims in their original assembly position.*

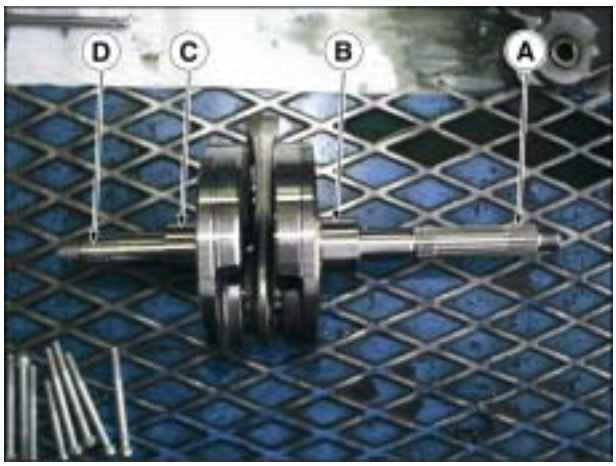
- If the crankshaft axial play is above the standard values and the crankshaft is not damaged, the problem is due to wear or to faulty crankcase machining.

- Check diameters of both bearings of the crankshaft. Shafts are classified into two categories: Cat. 1 and Cat. 2, as shown in the table below.

	Standard diameter
Cat.1	28.994 ÷ 29.000
Cat.2	29.000 ÷ 29.006



Checking crankshaft alignment



- Measure crankshaft misalignment in the four points indicated.

Max. misalignment allowed:
A = 0.15 mm
B = 0.01 mm
C = 0.01 mm
D = 0.10 mm

- Check that crankshaft cone, keyway, oil seal thrust surface, ribbed end and threaded dowels are in good condition.
- If necessary change the crankshaft.

NOTE *Main bearings cannot be ground. Con-rod big-end bearings cannot be changed.*

Con-rods cannot be changed for the same reason when cleaning the crankshaft, take special care to prevent dirt from entering the crankshaft lubrication hole.

To avoid damage to con-rod bearings, do not clean lubrication duct with compressed air.

- Make sure that the two buffers are correctly installed on crankpin.
- Lubrication pressure to con-rod bearings can be impaired if one buffer is not correctly installed.

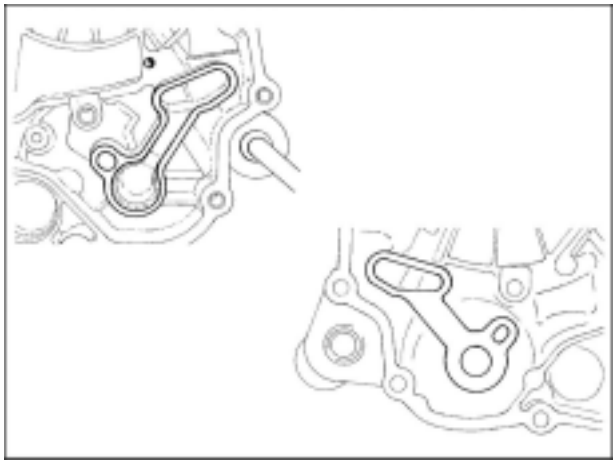
3.5.4. CHECKING CRANKCASE

- Before checking the casing, thoroughly clean all surfaces and lubrication ducts.
- On the transmission-side casing, pay particular attention to the oil pump ducts and seat, by-pass duct, main bearings and cooling jet (1).

NOTE *Jet is fed through main bearings. Piston crown cooling is improved if this part is working properly. In case of obstruction, some hidden problems (piston temperature increase) will arise. If this part is not installed or if it leaks, main bearings and con-rod lubrication pressure could be abruptly reduced. As already described under section lubrication, the by-pass seat does not have to be worn in order not to affect piston correct sealing for lubrication pressure adjustment.*

- On the flywheel pay particular attention to the side main bearings lubrication ducts, oil delivery to head duct and oil seal drain duct.

NOTE *Oil delivery to head drain duct is equipped with a shutter jet: this allows a head "low-pressure" lubrication in order to keep the sump oil temperature low. In case jet is blocked, head and timing system mechanisms lubrication will be impaired. In case jet is not present, main bearings and con-rod bearings lubrication pressure will be reduced.*



- Check that surfaces are neither dented or out of shape, carefully inspect casing-cylinder and casing mating surfaces.
- In the event of a fault of the casing jointing gasket or the surfaces pressurized oil could leak and lower the main bearings and con-rod bearings lubrication pressure.
- Check crankshaft axial play holding surfaces for wear. For dimensional check, follow the instructions given to check axial play and to take crankshaft readings.

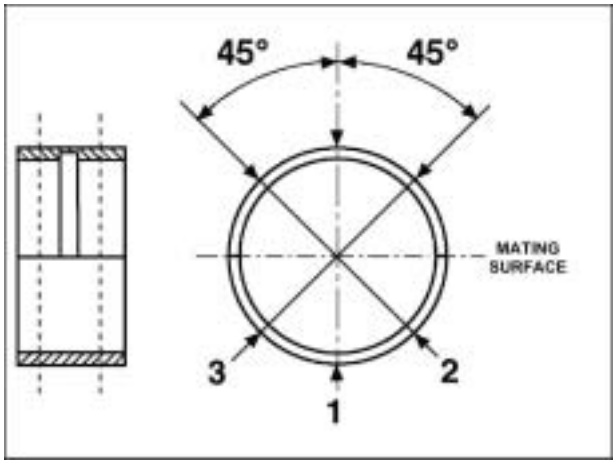
3.5.5. CHECKING THE MAIN BEARING

- Optimal lubrication pressure (4 bar) and good oil delivery are necessary to ensure good lubrication. Bearings must be correctly positioned so to prevent choking of oil delivery lines.
- Main bearings are composed of two half-bearings; one is solid, the other is provided with special slots for lubrication.
- The solid half-bearing withstands the thrusts due to combustion and is positioned opposite the cylinder.

- To prevent choking of the oil delivery lines, the mating surface of the two half bearings must be at right angles to the cylinder axis.
- The section of the ducts is influenced by the depth to which the bearings are driven.

Standard driving depth: 1,35 ÷ 1,6

NOTE *To keep bearings in their correct position on casing, they are fine-fitted on steel rings when the casings are cast.*



- Check bearings diameter in the three directions.
- Repeat readings on the other half bearing.

NOTE *Do not take readings on the mating surface between the two shells, as the outer edges are chamfered to allow distortion during driving operations.*

- Standard bearing diameter after driving varies is determined by the coupling class.
- Bearing locations on casing are classified into 2 categories, like the crankshaft, namely Cat. 1 and Cat. 2.
- Bearings are divided into three categories, based on the thickness. See table below:

TYPE	DESCRIPTION
A	Red
B	Blue
C	Yellow

Bearing category	Casing category	Bearing inner diameter after assembly	Assembling possibility
A	1	29.025 ÷ 29.040 mm	Original
B	1	29.019 ÷ 29.034 mm 29.028 ÷ 29.043 mm	Original and spare
	2		
C	2	29.022 ÷ 29.037 mm	Original

NOTE *Casings for spares are of the same category and are equipped with bearings of the B (blue) category. Match crankshaft with two shoulders of category 1 with casing of category 1 (or cat. 2 with cat.2). A spare casing cannot be combined with a crankshaft composed of mixed categories. Crankshaft for spares is equipped with axle shafts belonging to the same category.*

Casing	Axle shaft	Bearing
CAT.1	CAT.1	B
CAT.2	CAT.2	B
CAT.1	CAT.2	A
CAT.2	CAT.1	C

3.5.6. CLOSING THE CRANKCASE

- Fit inner guard (1), tighten the two screws (2) to the specified torque.

TIGHTENING TORQUE VALUES
Screws (2): 4 ÷ 6 Nm

- Fit the oil filter union and tighten to the specified torque value.

TIGHTENING TORQUE VALUES
Oil filter connector (3): 28 ÷ 30 Nm

- Position gasket (4) with centering dowels (5) preferably on the transmission-side casing.

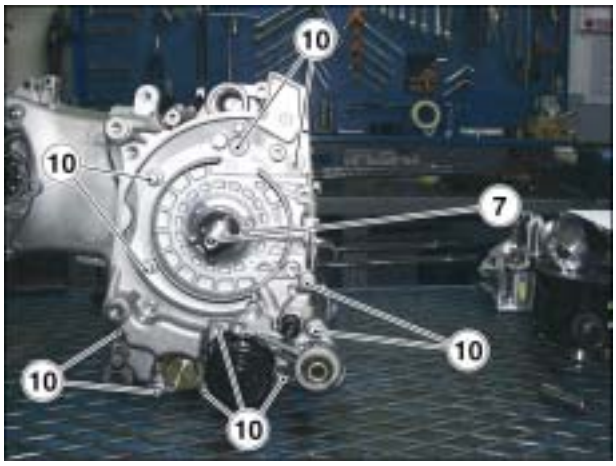
- Lubricate main bearings (6), install crankshaft (7) in transmission-side casing (8).
- Mate the two casings (8 and 9).

NOTE *When assembling the casings and the crankshaft, take care not to damage main bearings with crankshaft-threaded ends. For version 200 cc: set the shims in their original position.*

- Tighten the eleven screws (10) to the specified torque value.

TIGHTENING TORQUE VALUES
Screws (10): 11 ÷ 13 Nm

NOTE *Remove any excess of the casing-to-cylinder mating gasket to ensure better sealing.*



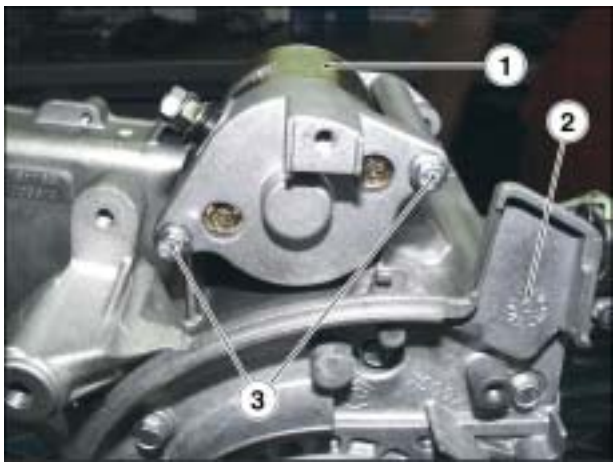
- Lubricate flywheel-side oil seal.
- Refit oil seal.

- Install a new O-ring on pre-filter and lubricate it.
- Install pre-filter with plug on engine. Tighten to the specified torque value.

TIGHTENING TORQUE VALUES
Oil drain plug: 24 ÷ 30 Nm

- Lubricate the gasket and mount the oil filter.

3.5.7. INEASSEMBLING THE STARTER MOTOR



- Fit a new O-ring on the starter motor and lubricate it.
- Fit starter motor (1) on crankcase (2). Tighten the two screws (3) to the specified torque value.

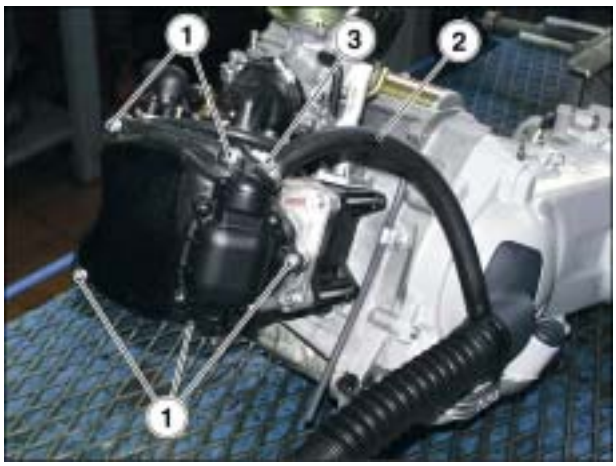
TIGHTENING TORQUE VALUES
Screws (3): 11 ÷ 13 Nm

- Fit sheet cover with fastening screw.

- Refit the other parts head cylinder and timing system, lubrication, flywheel and transmission.

3.6. CYLINDER HEAD AND TIMING SYSTEM

3.6.1. DISASSEMBLY OF THE TAPPET COVER

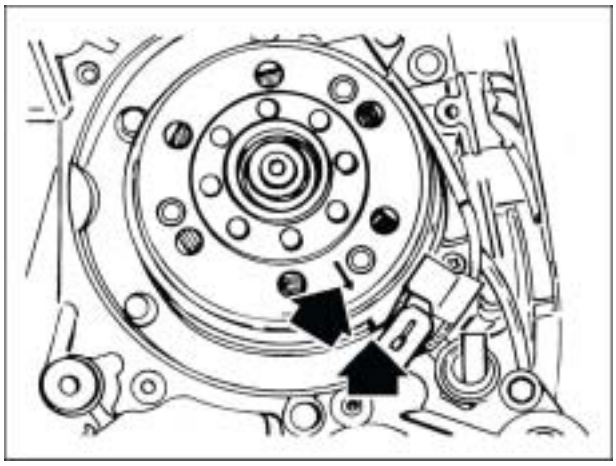


- Remove the fasteners. Remove the tappet cover complete with settler and automatic valve.
- Remove the gasket.

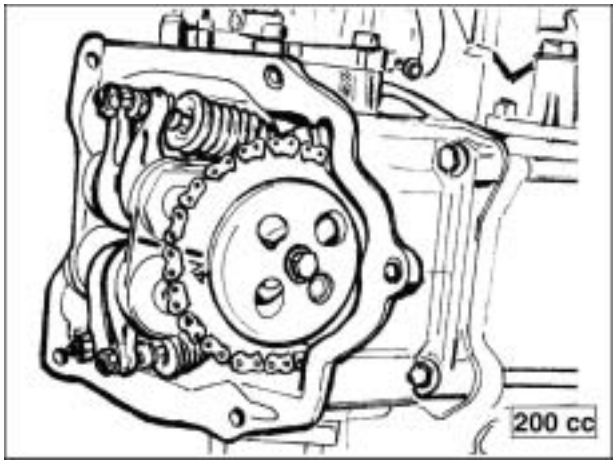
3.6.2. CHECKING THE TIMING SYSTEM

- Remove the retaining screws and then remove the flywheel cover.

- Turn the flywheel to align the case mark to the TDC mark. Ensure that the 4V mark on the camshaft pulley is aligned with the mark on the head, as shown in the second figure. If the mark on the camshaft is opposite to the mark on the head, turn the drive shaft once.



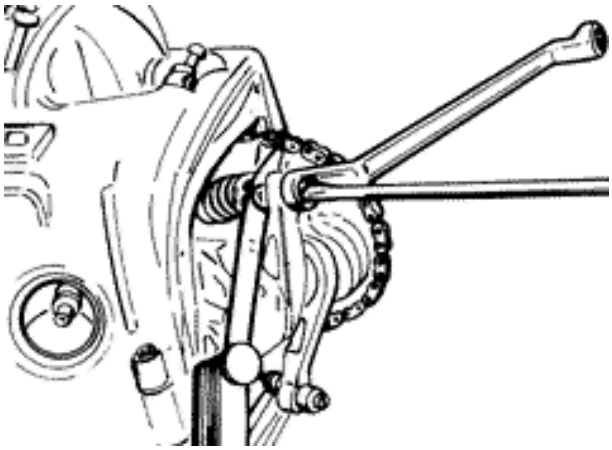
- The TDC mark is also applied in the area between flywheel fan and flywheel cover. To use this mark, remove the spark plug and turn the engine in the opposite direction using an adjustable face wrench on the camshaft pulley housing.



3.6.3. CHECKING/ADJUSTING VALVE CLEARANCE

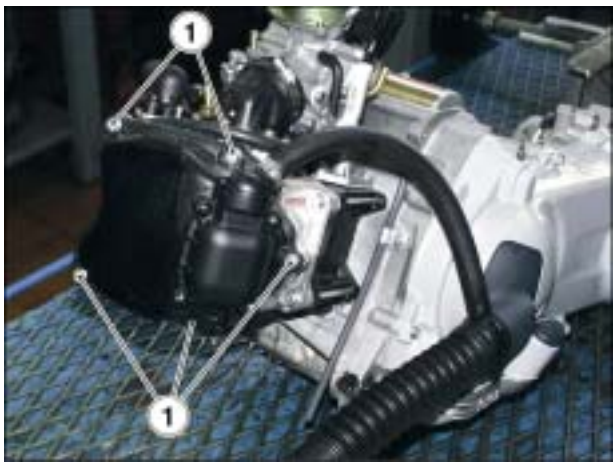
- Align timing marks to check valve clearance.
- Check the valve-shim clearance with a feeler gauge. If valve clearance is not as specified, loosen the check nut and adjust the clearance value with a screwdriver.

Engines M245M / M281M / M191M / M234M / M282M (125 H_2O - 150 - 200 cc)
Intake: 0.10 mm (cold)
Exhaust: 0.15 mm (cold)



Engine M192M (125 cc Aria)
Intake: 0.13 mm (cold)
Exhaust: 0.23 mm (cold)

3.6.4. FITTING THE TAPPET COVER



NOTE *Fit a new O-ring onto the tappet cover.*

- Mount the cover complete with settler.
- Tighten the fastener to the current torque value.

TIGHTENING TORQUE SETTINGS
Tightening torque: 11 ÷ 13 Nm

3.6.5. CHECKING END-OF-COMPRESSION PRESSURE

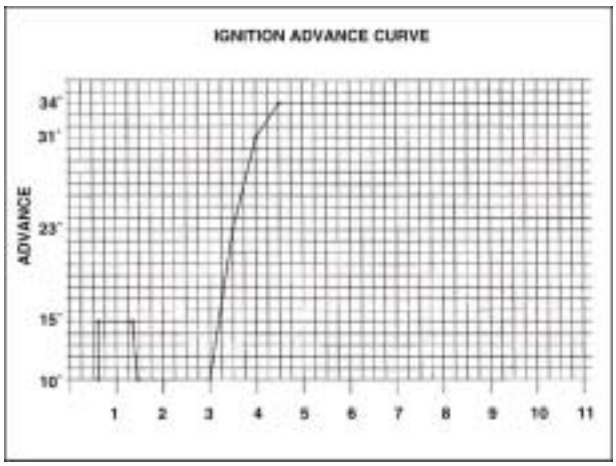
- Remove the spark plug cap when the engine is cold.
- Remove the spark plug.
- Fit a compression pressure gauge into the spark plug seat tightening the 10-mm spark plug fitting to the specified torque.
- Turn the engine by means of the starter motor, keeping the carburettor fully open, until the gauge indicator reads a stabile value. If pressure is over 8-9 bar remove the tool following the above procedure in the reverse order.
- If pressure is under the above value, check engine rotation speed during the test. If under 450 rpm, check starting system. If engine rotation speed is right or just over the optimal value, check timing system.
- Ensure that gasket at cylinder bottom is correct.
- Also check thermal system for possible leaks (piston rings-valves).

TIGHTENING TORQUE SETTINGS
Torque: 12 ÷ 14 Nm

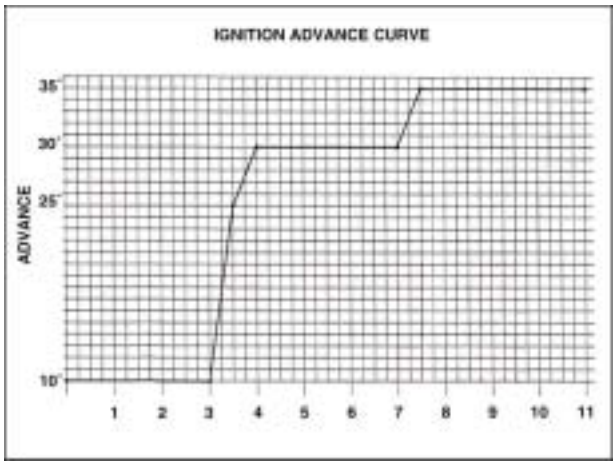
3.6.6. CHECKING IGNITION ADVANCE

- For this check, a strobe lamp with induction clamps connected to the spark plug power cable is required.

- Connect the clamps to the right poles.
- Set the lamp selector to its middle position (1 spark = 1 turn of the shaft as in 2-stroke engines).
- Start the engine; ensure that the lamp works properly and the rev counter can read up to e.g. 8000 rpm.
- In case of instable flash or rpm reading, increase resistive load on spark plug power line.



- Remove the plastic plug from the flywheel cover slot.
- Turn lamp flash control and match the flywheel cover mark with the water pump drive level. Read advance degrees shown by the strobe lamp.
- Check the correspondence between advance degrees and rev speed as shown in the tables.
- In case of problems, check Pick-up and CPU power supplies (positive-negative). Replace CPU, if necessary.
- A virgin CPU prevents the engine from exceeding 2000 rpm.
- A programmed CPU allows the engine to run within the set limits.



Max. 11000 rpm for 125 c.c. Engine
Max. 10100 rpm for 200 c.c. Engine

3.6.7. INTAKE MANIFOLD DISASSEMBLY

- Open the clamps and disconnect the carburettor cooling circuit pipes.
- Open the clamps, disconnect the petrol drainpipe from the bowl and remove the carburettor.
- Unscrew and remove the induction manifold.

3.6.8. REMOVING THE THERMOSTAT

- Loosen the screws and remove thermostat cover.

- Remove thermostat with seal.

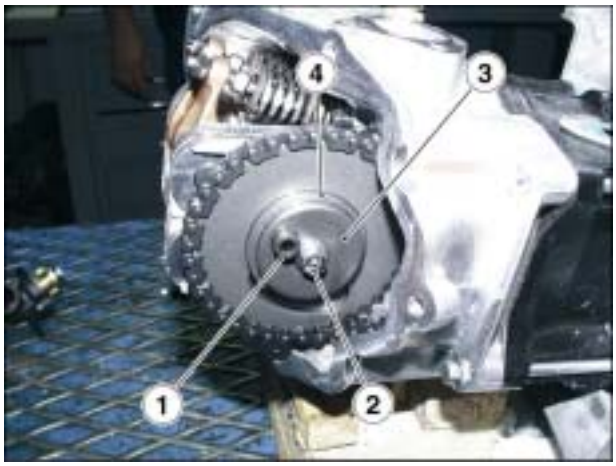
3.6.9. REMOVING THE TIMING GEAR

- First remove the following parts: transmission cover, driving belt roller and belt, sprocket, oil sump with spring and by-pass piston, oil pump pulley cover, crankshaft O-ring and washer between sprockets.
- Remove tappet cover.

- Loosen tensioner center screw.
- Remove the two fasteners.
- Remove tensioner and seal.

ENGINES M245M / M281M (125 cc)

- Remove side screw (1) and center screw (2).
- Slide out washers (3) and (4).



ENGINES M234M / M282M (200 cc)

- Remove screw and valve-lifter holder.

- Remove automatic valve-lifter return spring, valve-lifter with stop washer.
- Remove inner hexagon screw and counterweight.

- Remove camshaft drive pulley and washer.

- Remove screw, spacer and tensioner sliding shoe.
- Remove driving sprocket (17) and timing chain (18).

NOTE *Before disassembly, mark chain so that it can be refitted in its original direction of rotation. To remove tensioner-sliding shoe, work on the transmission side. To remove lower chain guide-sliding shoe first disassemble the head.*

3.6.10. CAMSHAFT AND ROCKER ARMS DISASSEMBLY

- Remove the two screws and the camshaft bracket.

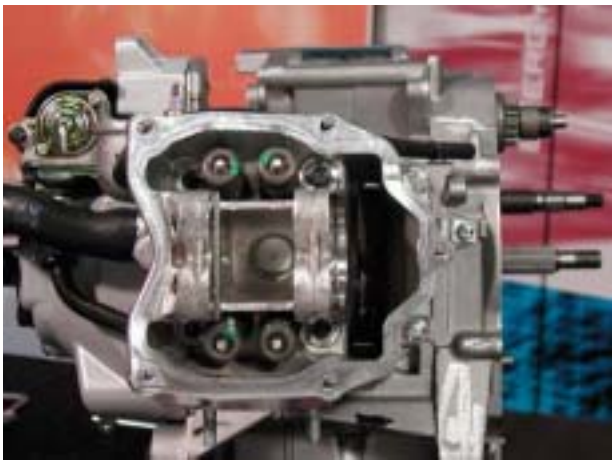
- Remove camshaft.

- Working from flywheel side, remove pinions and rocker arms.

3.6.11. HEAD DISASSEMBLY

- Unscrew and disconnect the SAS pipe. Save the washers.
- Remove the spark plug.

- Remove the two side fasteners.
- Working crossways, loosen cylinder head fastening nuts. Loosen in two or three steps.



- Remove the head, the piston rings, the two centering dowels and gasket.

NOTE *If needed, head can be removed with camshaft, rocker arm shafts and fastening bracket. It can also be removed without disassembling the chain and drive shaft chain tensioner.*

3.6.12. VALVES DISASSEMBLY

- Use the special tool with adapter to remove valve cotter, washers, springs and valves.

WARNING
Arrange valves so as to indicate their original positioning on the head.

3.6.13. CYLINDER AND PISTON DISASSEMBLY

- Remove the timing chain.
- Remove chain-sliding shoe.
- Remove the clamps and detach the cooling sleeve.
- Slide out cylinder.

WARNING
Support the piston, so as not to damage it.

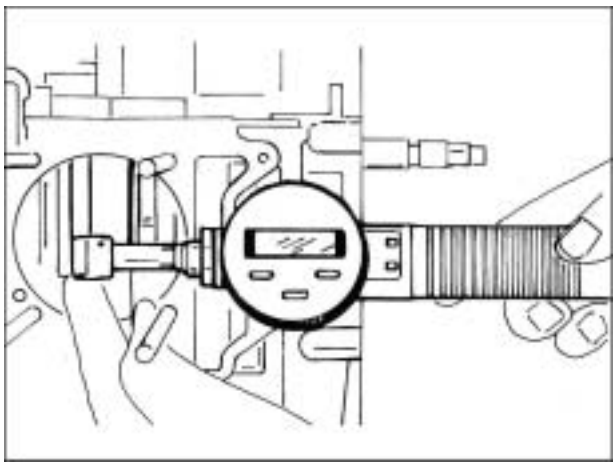
- Remove cylinder base gasket and centering dowels.

- Protect the crankshaft seat before removing.
- Remove the two snap rings, gudgeon pin and piston.
- Remove the two piston rings from piston.

NOTE *During disassembly, take care not to damage piston rings.*

3.6.14. CHECKING CON-ROD SMALL END

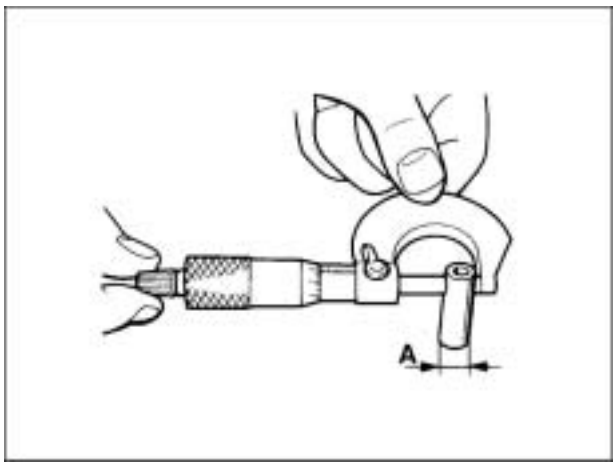
- Using an inside micrometer gauge, check con-rod small end diameter.



Standard diameter: 15.015 ÷ 15.025 mm
Max. allowed diameter: 15.030 mm

NOTE *Should con-rod small end diameter be above the specified limits, be worn or overheated, change crankshaft as described in "Crankcase and crankshaft".*

3.6.15. GUDGEON PIN DIAMETER

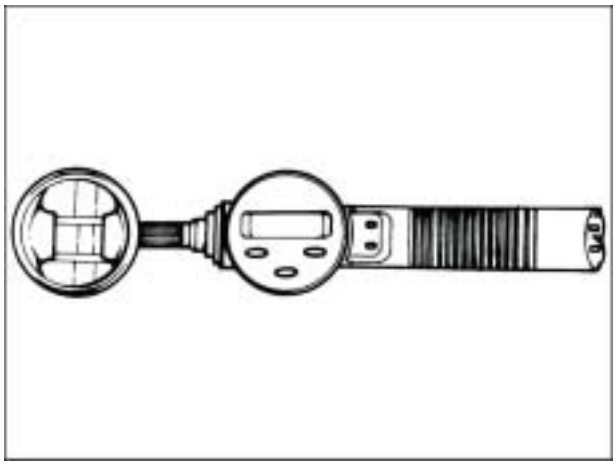


- Check gudgeon pin outside diameter (A).

Diameter (A) (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc): Ø 14,996 ÷ 15,000 mm
Diameter (A) (Engine M191M) (150 cc): Ø 14,994 ÷ 15,000 mm

- Check gudgeon pin small end clearance.

Standard clearance: 0.015 ÷ 0.029 mm



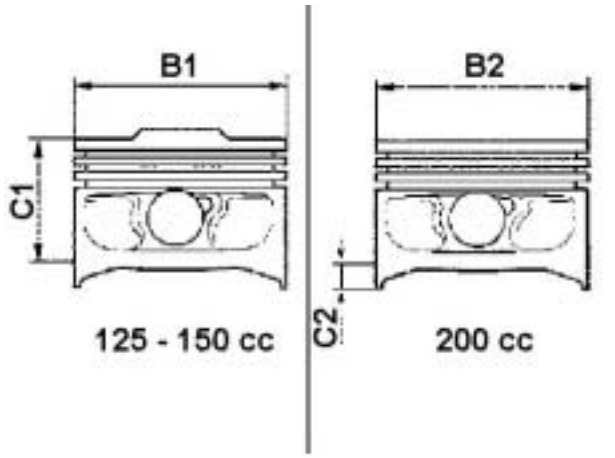
- Measure thrust surface diameter on piston.

Standard diameter: Ø 15.001 ÷ 15.006 mm

- Calculate gudgeon pin-piston clearance.

Standard clearance: 0.001 ÷ 0.010 mm

NOTE *Gudgeon pin seats have lubrication ducts. Take diameter reading along piston axis.*

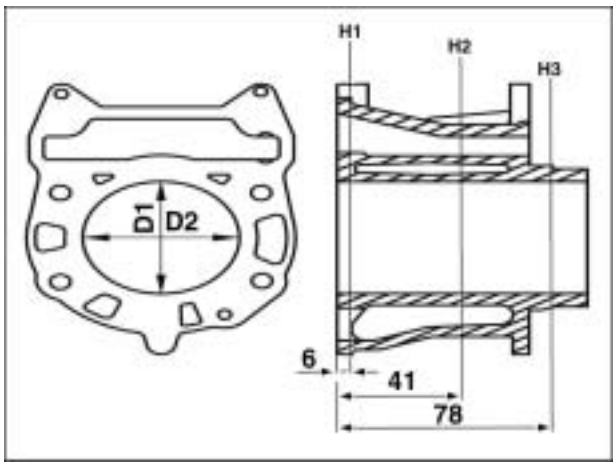


- Measure piston outer diameter (B1 and B2) at right angles to the gudgeon pin axis.
- Take reading in the position shown in the figure:

C1=: (Engines M245M / M281M) (125 cc): 41,1 mm (from piston crown)
C1=: (Engine M192M / M191M) (125 - 150 cc): 36,5 mm (from piston crown)
C2=: (Engines M234M / M282M) (200 cc): 5 mm (from piston base)

B1= diameter (Engines M192M / M245M / M281M) (125 cc): Ø 56.945 ÷ 56.973 mm
B1= diameter (Engine M191M) (150 cc): Ø 56.933 ÷ 56.961 mm
B2= diameter (Engines M234M / M282M) (200 cc): Ø 68.933 ÷ 68.961 mm

- Use a suitable bore gauge to measure cylinder inner diameter (D1 and D2) in the directions shown in the figure. Take readings at three heights (H1, H2, and H3).

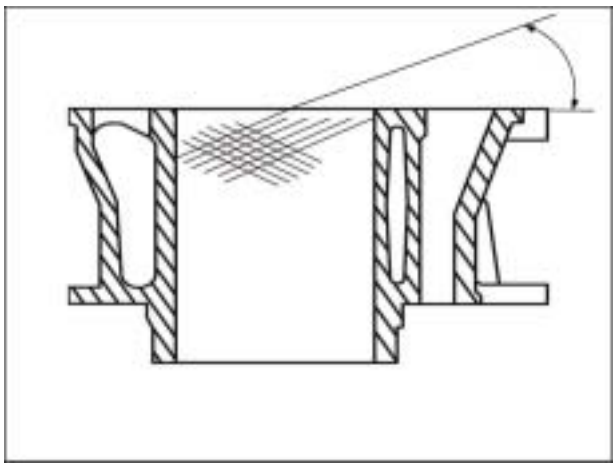


Standard diameter:
D1 and D2= (Engines M192M / M245M / M281M) (125 cc): Ø 56.997 ÷ 57.025 mm
D1 and D2= (Engine M191M) 150 cc: Ø 56,980 ÷ 57,008 mm
D1 and D2= (Engines M234M / M282M) (200 cc): Ø 68.990 ÷ 69.018 mm

- Check that cylinder surface mating with head is not worn or out of shape.

Max. permitted misalignment: 0.05 mm

- Pistons and cylinders are classified by diameter categories. Couples cylinders with pistons from the same category (A-A, B-B, C-C, D-D).
- Cylinders can be ground to the original angle.
- Cylinder surface roughness must be 0.9 micron.
- This ensures correct piston ring bedding, reduced oil consumption and top performance.



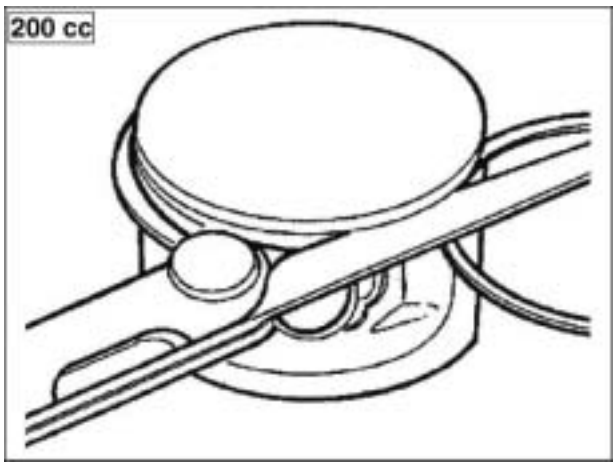
Engines M192M / M245M / M281M / M191M (125 - 150 cc)

- Oversized pistons for ground cylinders are available in three categories: 1°, 2°, 3° equal to an oversize of 0.2-0.4- 0.6 mm. Oversized pistons are also classified in 4 categories A-A, B-B, C-C, D-D.

3.6.16. PISTON

- Thoroughly clean piston ring locations.
- Use suitable probes to measure the clearance between piston rings and grooves.
- If the clearance exceeds the permitted values change the piston.

NOTE *For the 200 cc engine, measure the clearance by inserting the feeler gauge from the 2nd piston ring side.*



		Standard coupling clearance	Max. allowed clearance after use
Engines M192M / M245M / M281M / M191M (125 - 150 cc)	1st piston ring	0.025 ÷ 0.07 mm	0.08 mm
	2nd piston ring	0.015 ÷ 0.06 mm	0.07 mm
	Scraper ring	0.015 ÷ 0.06 mm	0.07 mm
Engines M234M / M282M (200 cc)	1st piston ring	0.015 ÷ 0.06 mm	0.07 mm
	2nd piston ring	0.015 ÷ 0.06 mm	0.07 mm
	Scraper ring	0.015 ÷ 0.06 mm	0.07 mm

3.6.17. PISTON RINGS

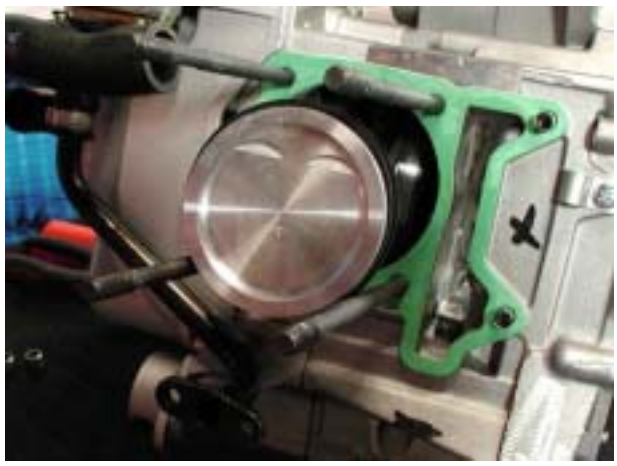
- Install the three piston rings one by one in the cylinder area with original diameter. Use the piston to set the rings at right angles to the cylinder axis.
- Measure rings opening with a feeler gauge.
- If the permitted values are exceeded, change the rings.

		Standard opening	Max. value
Engines M192M / M245M / M281M / M234M / M282M (125 - 200 cc)	1st piston ring	0.20 ÷ 0.40 mm	1 mm
	2nd piston ring	0.10 ÷ 0.30 mm	1 mm
	Scraper ring	0.15 ÷ 0.35 mm	1 mm
Engine M191M (150 cc)	1st piston ring	0.15 ÷ 0.30 mm	0.40 mm
	2nd piston ring	0.20 ÷ 0.40 mm	0.40 mm
	Scraper ring	0.20 ÷ 0.40 mm	0.50 mm

NOTE *Before changing only piston rings, make sure that the rings-piston groove and piston-cylinder clearance values are observed. Installing new piston rings on a worn cylinder could result in non-standard bedding.*

3.6.18. ASSEMBLING PISTON

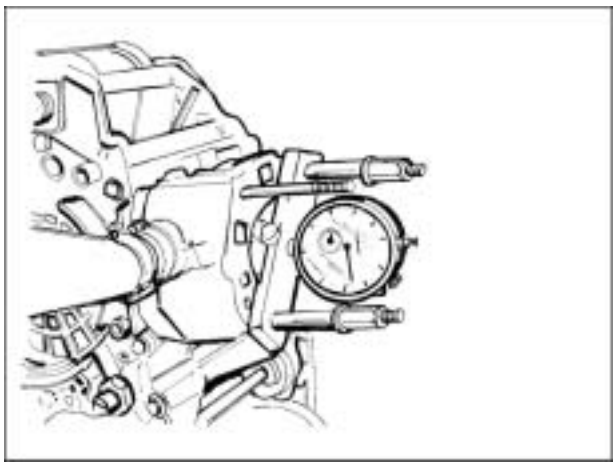
- Fit piston and gudgeon pin to on rod by setting the position piston with the arrow facing the exhaust side.



- Protect the crankshaft sent.
- Install snap ring on piston.
- Fit a ring on each side.

WARNING
Be careful not to score or damage ring seats or piston inner surface.

3.6.19. CHECKING PISTON POSITION



- Temporarily fit cylinder on piston, without bottom gasket.
- Install a dial gauge on special tool.

Dial gauge holder: 8140266

- Reset dial gauge on a reference surface. With dial gauge set at zero, fit tool on cylinder and lock it in place with the four head fastening nuts.
- Turn camshaft to TDC (dial gauge will reverse direction of rotation).
- Position dial gauge on piston as shown in the figure and measure piston drawback.
- Use the table below to determine the thickness of the cylinder bottom gasket to be used at reassembly and thus ensure the correct compression.
- Remove special tool and cylinder.

Note: *The standout is measured on the 125 cc engine, the drawback on the 200 cc engine.*

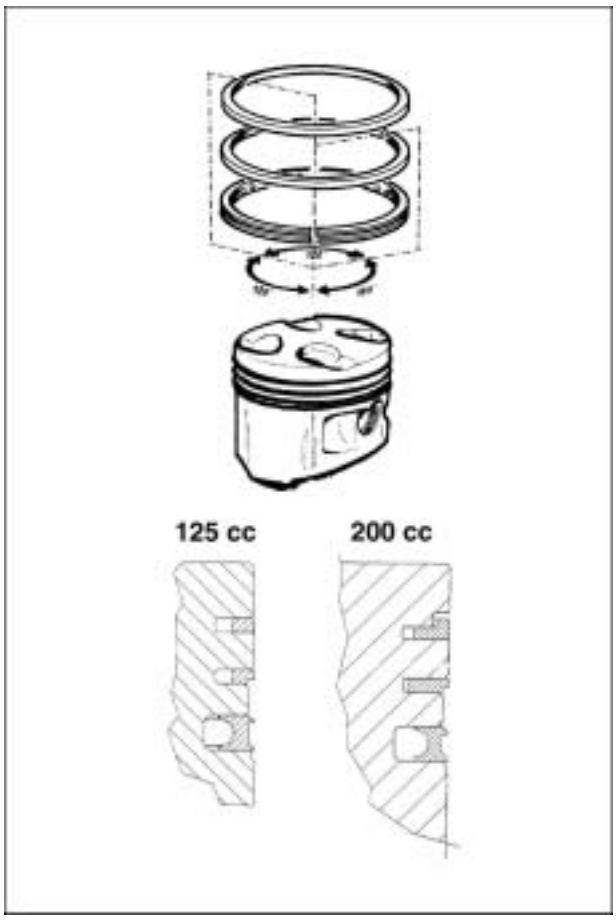
Measured standout		Gasket thickness
Engines M192M / M245M / M281M (125 cc)	2.25 ÷ 2.35 mm	0.4 ± 0.05 mm
	2.35 ÷ 2.55 mm	0.6 ± 0.05 mm
	2.55 ÷ 2.65 mm	0.8 ± 0.05 mm

Measured standout		Gasket thickness
Engine M191M (150 cc)	1.0 ÷ 1.1 mm	0.8 ± 0.05 mm
	1.1 ÷ 1.3 mm	0.6 ± 0.05 mm
	1.3 ÷ 1.4 mm	0.4 ± 0.05 mm

Measured standout		Gasket thickness
Engines M234M / M282M (200 cc)	0.9 ÷ 1.0 mm	0.8 ± 0.05 mm
	1.0 ÷ 1.2 mm	0.6 ± 0.05 mm
	1.2 ÷ 1.3 mm	0.4 ± 0.05 mm

3.6.20. ASSEMBLING PISTON RINGS

- Position scraper ring spring on piston.
- To fit the ring, keep its opening opposite the spring joint with the word top facing the piston crown. The chamfered edge must face the piston crown.
- Fit 2nd ring with its identification mark or the word top facing the piston crown. The working step must be opposite the piston crown.
- Fit the 1st ring with its identification mark or the word top facing the piston crown.



NOTE *The surface of the two rings mating the cylinder is tapered to ensure better settling.*

- Stagger the ring openings at 120°.
- Lubricate with engine oil.
- On the 200 cc version, the 1st ring has a L-shaped section.

3.6.21. ASSEMBLING THE CYLINDER

- Blow through the lubrication duct and oil the cylinder liner.
- Fit the centering dowels.
- Install cylinder base gasket according to the previously calculated thickness.
- Take the following tools:

Engines M245M / M281M (125 cc): 8140658
Engines M234M / M282M (200 cc): 8140660

- Use the piston ring tool to fit the cylinder.
- Connect and clamp the cooling sleeves.

3.6.22. CHECKING THE HEAD

- Using a ground bar and a feeler gauge, check that the head surface is not worn or out of shape.

Max. misalignment allowed: 0.05 mm

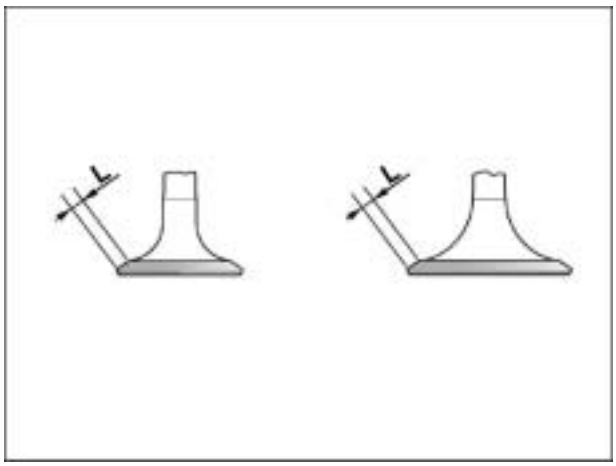
- Check camshaft and rocker arm shaft thrust surfaces for wear.
- Check head cover, intake manifold and exhaust manifold surfaces for wear.

	Standard diameter
A	∅ 12.000 ÷ 12.018
B	∅ 20.000 ÷ 20.021
C (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)	∅ 37.000 ÷ 37.025
C (Engine M191M) (150 cc)	∅ 32.500 ÷ 32.525

3.6.23. CHECKING VALVES FOR WEAR

- Measure valve seats and valves sealing surface width.

WARNING
Do not change valves assembling position (RH-LH).

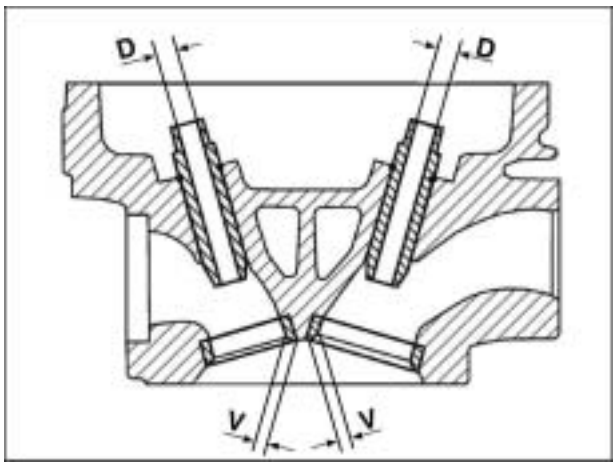


Sealing surface depth (Engines M245M / M281M / M234M / M282M) (125 - 200 cc):
(L) Standard: Intake and exhaust: 0.99 ÷ 1.27 mm
(L) After use: Intake and exhaust: 1.6 mm

Sealing surface depth (Engines M192M / M191M) (125 - 150 cc):
(L) Intake: 3.1 mm
(L) Exhaust: 3 mm

- In case valve sealing surface is wider that the recommended limit, interrupted in one or more points, or bent, change valve.

3.6.24. CHECKING VALVE SEATS FOR WEAR

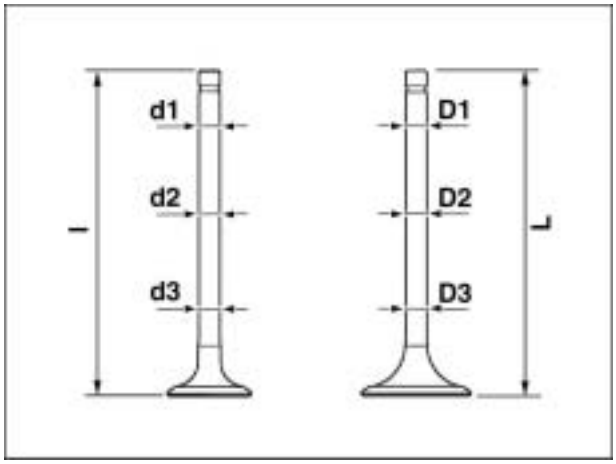


- Measure "**V**" mark depth on valve seat. Max. wear limit 1.6 mm.
- Clean valve guide from any carbon deposits.
- Measure the inner diameter of all valve guides (D).
- Make the measurements at three different heights in the rocker arm thrust direction.

Exhaust valve guide
D = Standard diameter: 5.000 ÷ 5.012 mm
D = Allowed limit: 5.022

Intake valve guide
D = Standard diameter: 5.000 ÷ 5.012 mm
D = Allowed limit: 5.022

- If the valve seat mark depth values or the valve guide diameter are above the specified limits, change the head.



Checking valves
- Check valve stem diameter (d – D) in the three points shown in the figure.

Standard diameter
D1, D2 and D3=Intake: 4.972 ÷ 4.987 mm
d1, d2 and d3=Exhaust: 4.96 ÷ 4.975 mm

Min. allowed diameter
D1, D2 and D3=Intake: 4.96 mm
d1, d2 and d3=Exhaust: 4.95 mm

- Calculate clearance between valve and valve guide.

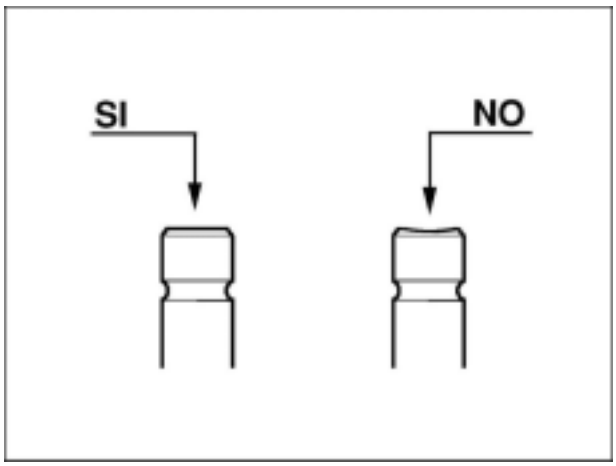
Standard clearance
Intake: 0.013 ÷ 0.040 mm
Exhaust: 0.025 ÷ 0.052 mm

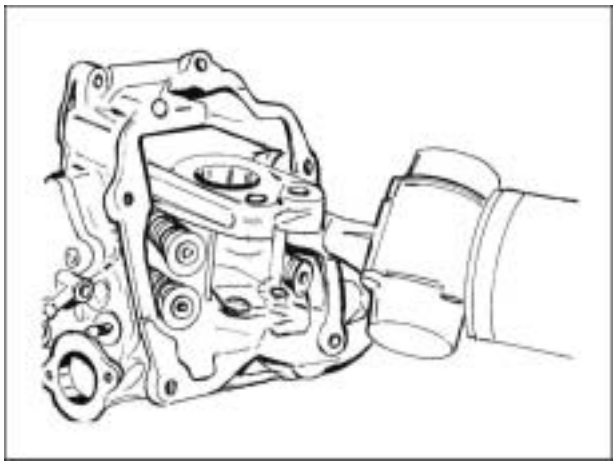
Max. allowed clearance
Intake: 0.062 mm
Exhaust: 0.072 mm

- Check the surface mating the shim joint terminal for wear.

Valve standard length (L – l)
L (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)=Intake: 94.6 mm
L (Engine M191M) (150 cc)=Intake: 80.6 mm
l (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)=Exhaust: 94.4 mm
l (Engine M191M) (150 cc)=Exhaust: 79.6 mm

- If after the above checks all the values are within the specified limits, use the same valves. To ensure perfect sealing, grind valves with fine emery cloth. When grinding, position the head with the valve axes in horizontal position to prevent emery cloth residues from entering the valve guide stem coupling (see figure).

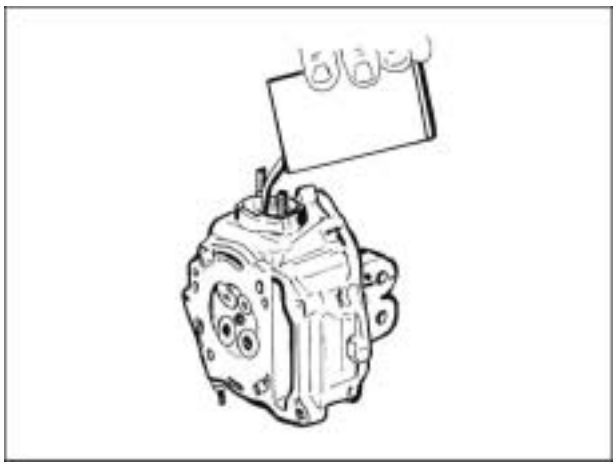




WARNING
To avoid scoring the mating surface, do not overturn valve when the emery cloth is finished. Thoroughly wash head and valves with a product suitable to the emery cloth used.

NOTE *Do not confuse valve-assembling position.*

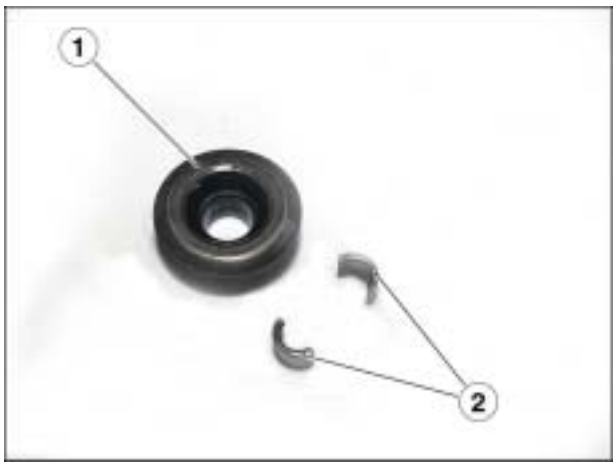
3.6.25. CHECKING VALVE SEALING



- Install valves into head.
- Alternatively test intake and exhaust valves.
- To carry out this test, fill manifold with fuel and check that head does not leak at the valves (keep valves pressed with your fingers).

3.6.26. CHECKING COLLETS AND SPRING PLATES

- Check that springs upper bearing plates (1) and collets (2) are not excessively worn.



3.6.27. ASSEMBLING VALVES

- Install valves, springs and plates. Use the special tool with adapter to compress springs and install cotters into seats.

NOTE *Do not confuse valve-assembling position. Fit valve springs with the reference color facing the cotters (longer turns).*

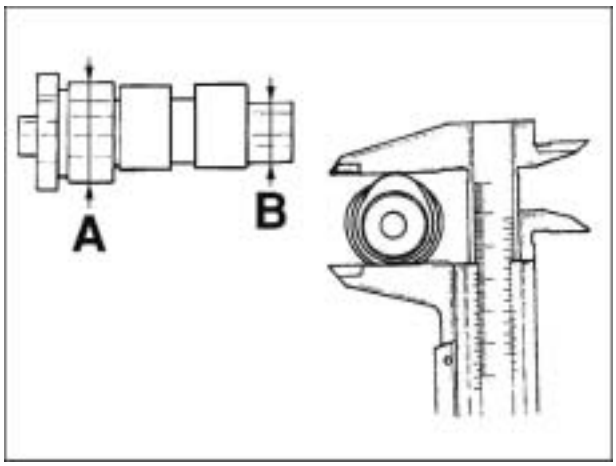
3.6.28. CHECKING THE TIMING SYSTEM PARTS

- Make sure the chain is not worn.
- Check that guide sliding shoe and tensioner sliding shoe are not excessively worn.
- Check that camshaft drive belt roller chain unit and sprocket are not worn.
- In case of wear, change the parts. If chain, sprocket and belt rollers are worn, change the whole unit.

- Remove center screw with washer and tensioner spring. Make sure that the one-way mechanism is not worn.
- Check tensioner spring.
- In case of wear, change the whole unit.
- Use the stop to check the travel of the tensioner.

3.6.29. CHECKING THE CAMSHAFT

- Check that camshaft thrust surfaces are not excessively worn and measure their diameters.



Standard diameter
Thrust surface A (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc) Ø: 36.95 ÷ 36.975 mm
Thrust surface A (Engine M191M) (150 cc) Ø: 32,459 ÷ 32,475 mm
Thrust surface B (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc) Ø: 19.959 ÷ 19.98 mm
Thrust surface B (Engine M191M) (150 cc) Ø: 19,967 ÷ 19,980 mm

Min. allowed diameter
Thrust surface A (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc) Ø: 36.94 mm
Thrust surface A (Engine M191M) (150 cc) Ø: 32,44 mm
Thrust surface B Ø: 19.950 mm

- Check cam (C and D) heights.

Standard height
C (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)=Intake: 30.285 mm
D (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)=Exhaust: 29.209 mm
C and D (Engine M191M) (150 cc) = Intake and Exhaust: 27,8 mm

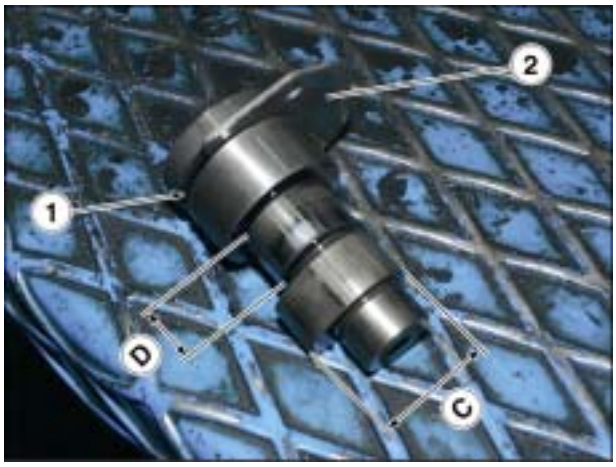
- Check rocker arm pins for wear and scoring and measure their diameter.

E (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)=Standard diameter: Ø 11,977 ÷ 11,985 mm
E (Engine M191M) (150 cc)= Min. allowed: Ø 11,970 mm

- Check that the sliding shoe (3) in contact with cam and shim joint plate (4) are not worn.
- Check inside diameter (F) of all rocker arms.

F (Engines M192M / M245M / M281M / M234M / M282M) (125 - 200 cc)= Standard diameter: Ø 12,015 ÷ 12,035 mm
F (Engine M191M) (150 cc)= Min. allowed: Ø 12,030 mm

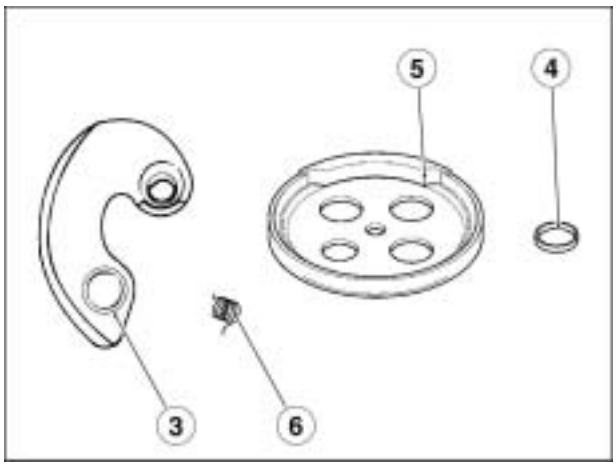
- Measure the clearance between the groove and the retaining plate.



Standard axial play: 0.11÷ 0.41 mm
Max. axial play allowed: 0.42 mm

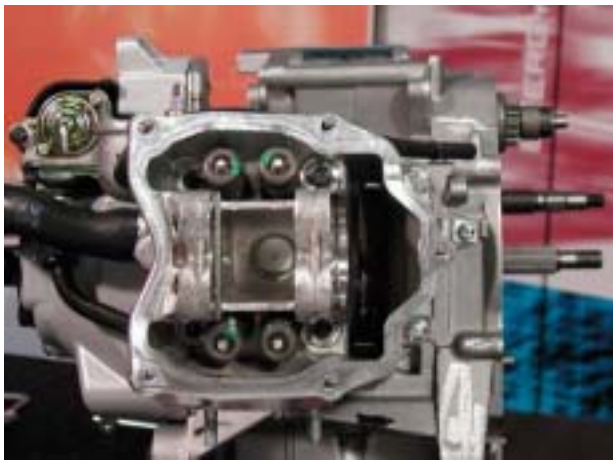
- Check the groove and the plate for signs of wear.
- In case of wear or if values are outside the permitted limit, change faulty parts.

- Check that the cam and the rubber stop on holding guard are not worn.
- Check that the automatic valve-lifter, end of travel roller and counterweight for signs of wear.
- Check that the valve lifter spring has not yielded.
- In case of wear, change the worn parts.



3.6.30. ASSEMBLING HEAD AND TIMING SYSTEM PARTS

- Fit the centering dowels.
- Fit the gasket with the word "ALTO" facing the cylinder head.
- Fit the retaining rings.
- Fit the chain guide-sliding shoe.



NOTE *Before assembling the head, make sure that the lubrication duct is perfectly clean. Blow with compressed air.*

- Mount the cylinder head.
- Tighten the timing chain side nuts and bolts crosswise to the specified torque values in a 2 or 3 steps.

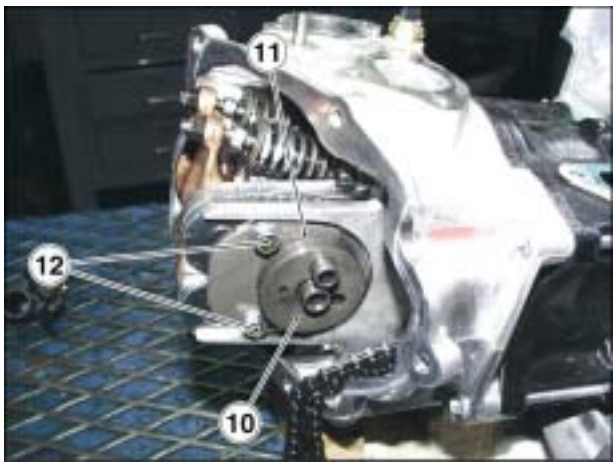
TIGHTENING TORQUE VALUES
Nuts: 28 ÷ 30 Nm
Screws: 11 ÷ 13 Nm

- Connect the SAS pipe to the head with a new gasket.
- Tighten the screws.

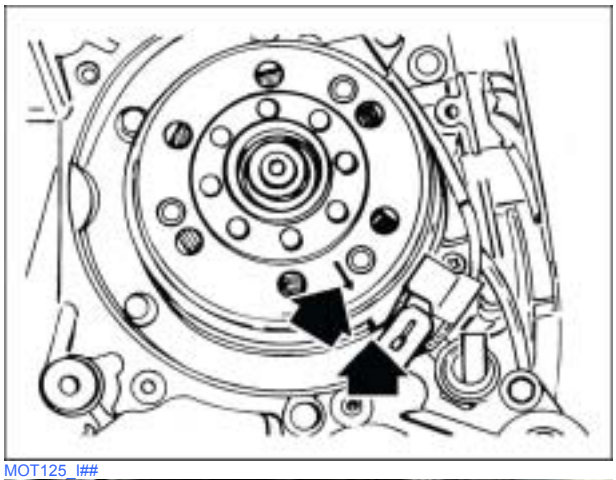
3.6.31. ASSEMBLING TIMING SYSTEM PARTS

- Install the rocker arms and pins.
- Lubricate the rocker arms through the upper holes.
- Mount the camshaft
- Insert the bracket and tighten the screws to the specified torque value.

TIGHTENING TORQUE VALUES
Screw: 4 ÷ 6 Nm



- Turn the flywheel to bring its reference mark in line with the TDE on the crankcase.


MOT125_I##

- Fit the timing chain in the turning direction indicated when disassembling and the drive pinion.

- Fit the tensioner shoe and spacer, and tighten the screw to the specified torque value.

TIGHTENING TORQUE VALUES
Screw: 10 ÷ 14 Nm

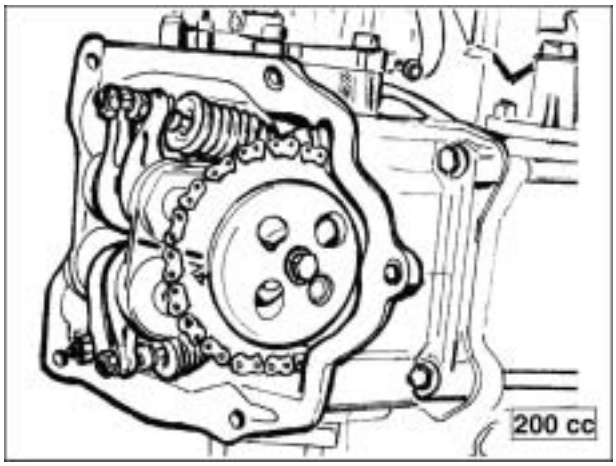
- Fit the camshaft drive pulley and its washer.
- Make sure the 4v mark on the on the pulley is in line with the reference mark on the head. If it is opposite to the head, turn the crankshaft once.

ENGINES M234M / M282M (200 CC)

- Fit the counterweight and tighten its screw to the specified torque value.

TIGHTENING TORQUE VALUES

Screw: 7 ÷ 8,5 Nm



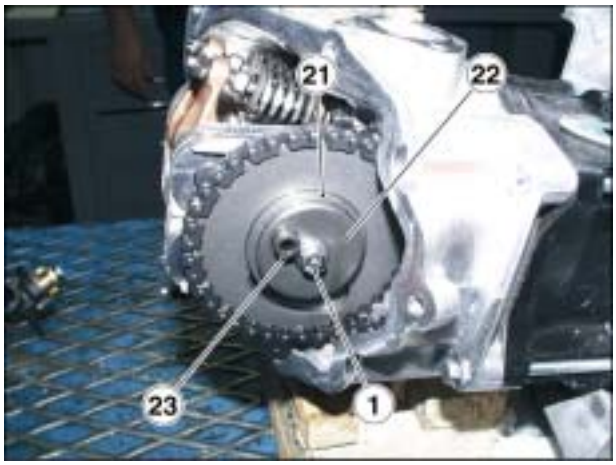
- Fit the automatic valve lifter with end of travel washer and restrain the return spring.
- Fit the valve lifter holder and tighten its screw to the specified torque value.

TIGHTENING TORQUE VALUES

Screw: 11 ÷ 15 Nm

ENGINES M245M / M281M (125 CC)

- Install the two washers
- Insert and tighten the side screw and centre screw.



- Remove the centre screw, washer and tensioner spring and check one-way mechanism for wear
- Check the soundness of the spring
- In the event of wear, change the entire unit
- Press the locking tooth to bring back the tensioner.
- Fit a new washer. Mount tensioner lighten and block its screws to the specified torque value.

TIGHTENING TORQUE VALUES

Screw: 11 ÷ 13 Nm

- Position the spring and washer and tighten the centre screw to the specified torque value.

TIGHTENING TORQUE VALUES
Screw: 5 ÷ 6 Nm

- Mount the tappet cover
- Fit the pinions separation washer and O-ring on the crankshaft, the oil pump, pulley cover, the sump with spring and by-pass piston, the starting pinion, the driving pulley and belt, and the transmission cover.

3.6.32. ASSEMBLING THE THERMOSTAT

- Position thermostat with the bleed hole in the highest position.
- Make sure that rubber seal is correctly positioned.
- Fit thermostat cover with the union for carburetor heating tube facing the flywheel.
- Tighten the screws to the specified torque values.

TIGHTENING TORQUE VALUES
Screws: 3 ÷ 4 Nm

3.6.33. ASSEMBLING THE INDUCTION MANIFOLD

- Fit manifold and tighten its three bolts.
- Fit the carburettor, connect the petrol drainpipe to the bowl and clamp the carburetor.
- Connect the carburetor cooling circuit pipes and clamp them.

3.7. SECONDARY AIR

3.7.1. DESCRIPTION

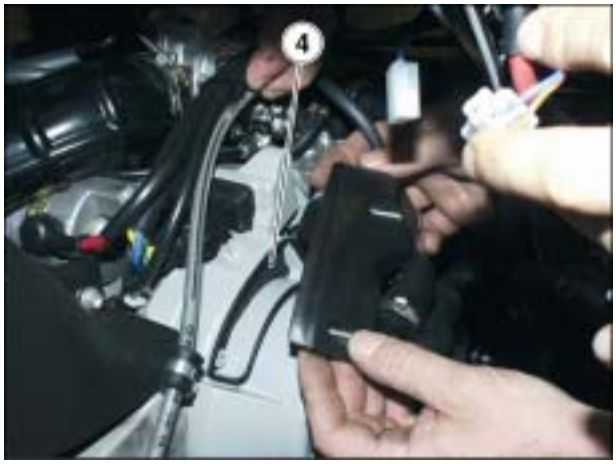
General notes

The SAS operating system for Euro 2 200cc leader engine is almost identical to the SAS system.
The only difference is that:
secondary air, instead of entering the muffler, enters directly head exhaust duct.

The unit indicated with an arrow in the figure is equipped with a cut-off connected to the vacuum port of the intake manifold to cut air infeed during deceleration so as to avoid any burst inside muffler.

System description

- Air is sucked through hole (1), and then it passes through the first filter (2) and hole (3), under rubber gasket.



- Through the hole indicated in the figure, air reaches the second filter (4).
- Filtered air enters the reed-mechanism, from where it will be directed to the head.

- Through a rigid, flanged duct connected to the head, air reaches the exhaust connector so as to release oxygen to the unburnt gases before the catalyzer, by thus favoring a better reaction of this last component.

3.7.2. TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	ACTION	REFERENCE
The exhaust noise level is too high	The reed valve on the secondary air device does not close correctly and causes damage to the rubber hose between this device and the head tube	Change device and hose	Disassembling the secondary air device
	No rubber seal on the first filter	Install the missing seal	
Bursts at the muffler when throttle control is released	The vacuum port tube from the secondary air device is disconnected or cracked	Change tube	
	Cut-off valve on secondary air device	Change secondary air device	Disassembling the secondary air device

UPDATING ENGINES M192M / M191M 4

SUMMARY

4.1. SPECIFICATIONS

4.1.1. TECHNICAL DATA: 125 CC, FOUR-STROKE, TWO-VALVE AIR

ENGINE

Type	Single-cylinder, 4-stroke, 2-valve
Bore	57 mm
Stroke	48,6 mm
Capacity	124,01 cm^3
Compression ratio	10,5:1
Carburettor	Walbro WVF-6E
Lubrication	Chain-driven lobe pump inside crankcase with a wire mesh and a paper filter
Fuel system	Petrol (minimum 95 octane, unleaded) carburettor with vacuum pump
Cooling	Forced air
Max. power output	6.5 kw a 7500 rpm
Spark advance	By microprocessor from 10°±1 at 1650 rpm to 26°±1 at 6000 rpm
Plug	Champion RG6YC /NGK CR7EB
Transmission	Automatic variator with expandable pulleys, Vee belt, automatic clutch, reduction gear, transmission housing with forced circulation cooling
Valve clearances (cold)	Intake: 0.13mm Exhaust: 0.23mm
Recommended engine oil:	Selenia HI Scooter 4 Tech SAE 5W-40
Quantity	1000 cc
Sump oil	TUTELA ZC 90
Quantity	100 cc
Final drive	15/46x15/42

4.1.2. TECHNICAL DATA: 150 CC, FOUR-STROKE, TWO-VALVE AIR

ENGINE

Type	Single-cylinder, 4-stroke, *1
Bore	62,6 mm
Stroke	48,6 mm
Capacity	149,58 cm^3
Compression ratio	10,1÷11,1:1
Carburettor	WALBRO WVF6
Lubrication	Chain-driven lobe pump inside crankcase with a wire mesh and a paper filter
Fuel supply	Petrol (minimum 95 octane, unleaded) carburettor with vacuum pump
Cooling	Forced air
Max. power output	9 kw a 7500 rpm
Spark advance	By microprocessor from 10°±1 at 1650 rpm to 26°±1 at 6000 rpm
Plug	Champion RG 4 HC
Transmission	Automatic variator with expandable pulleys, Vee belt, automatic clutch, reduction gear, transmission housing with forced circulation cooling
Valve clearances (cold)	Intake: 0,10 mm Exhaust: 0,15 mm
Recommended engine oil:	Selenia HI Scooter 4 Tech SAE 5W-40
Quantity	1000 cc
Sump oil	TUTELA ZC 90
Quantity	100 cc
Final drive	1/21,23

4.2. ENGINE

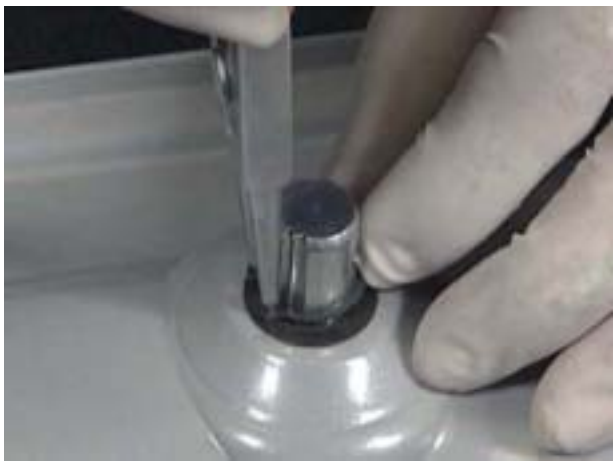
4.2.1. KICK-START COVER

- Unscrew the starter sector gear housing attachment bolts.

4.2.2. DIASSEMBLY OF SECTOR GEAR AND PINION

- Press the drive lever to remove the starter pinion.
- Unscrew the kick-start bolt and remove the lever.
- Remove the circlip and washer.
- Slide off the sector gear.

WARNING
The sector gear loads the spring. Prevent accidents!



4.2.3. ASSEMBLY OF SECTOR GEAR AND PINION

- Grease the spring with JOTA 3 FS.
- Mount the spring.
- Replace the sector gear and load the spring with the specific tool.

Spring compression tool: 8140264.

- Refit the washer and circlip and tighten the kick-start lever to the specified torque value.

TIGHTENING TORQUE VALUES

Bolt: 12-13 Nm (1.2 - 1.3 kgm)

- Use the lever to load the spring and insert the pinion.
- Refit the kick-start cover and tighten its attachment bolts.

4.2.4. DISASSEMBLY OF THE CLUTCH

- Mount the clutch on the specific tool.

Universal clutch tool: 8140259

WARNING
The tool must be firmly held in the vice with the middle screw in contact with it. Over tightening will damage the tool.

- Insert the lever pin in one hole of the clutch.
- Remove the nut, open the tool and remove the clutch, spring and driven pulley assembly.

4.2.5. ASSEMBLY OF THE CLUTCH

- Assemble the spring, clutch and driven pulley.
- Mount the clutch on the specific tool.

Universal clutch tool: 8140259

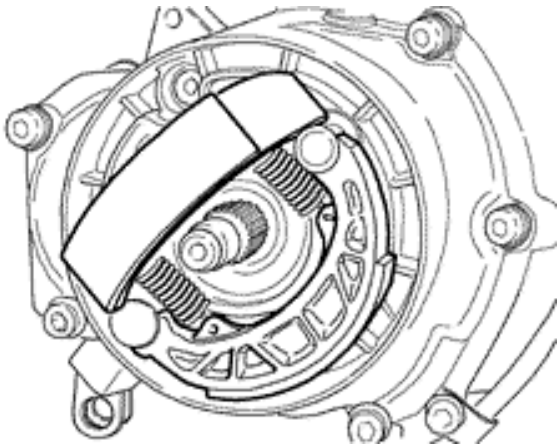
- Insert the lever pin in one hole of the clutch.
- Tighten the nut to the specified torque value.

TIGHTENING TORQUE VALUES

Nut: 55 - 60 Nm (5.5 - 6.0 kgm)

4.2.6. DISASSEMBLY REAR BRAKE SHOES GANASCE

- Turn one of the two rear brake shoes to remove them both.



4.2.7. DISASSEMBLY OF THE BRAKE LEVER AND CAM

- Remove the rear brake shoes.
- Unscrew the attachment holt, extract the cam and remove the linkage.

4.2.8. REAR HUB

- Remove the dipstick.
- Drain the hub oil through the drain hole.
- Remove the rear brake shoes.
- Unscrew the attachment bolt, extract the cam and remove the linkage.

- Remove the rubber plug.
- Unscrew the attachment bolts.
- Remove the hub cover complete with wheel shaft and gasket.

4.2.9. REMOVING THE WHEEL SHAFT

- Remove the driven pulley shaft.
- Remove the idler gear.
- Remove the shaft complete with gear.

4.2.10. ASSEMBLY OF THE HUB GEARS

- Refit the wheel shaft complete with gear.
- Refit the idler gear.
- Refit the driven pulley shaft.

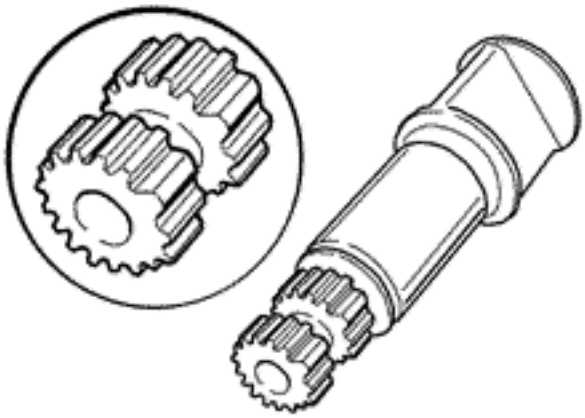
4.2.11. REASSEMBLY OF HUB COVER

- Fit a new gasket on the hub cover centring dowels.
- Refit the cover. Make sure the vent hole is properly positioned.
- Insert the screws and the two vent pipe support plates.
- Tighten the screws to the specified torque values.

TIGHTENING TORQUE VALUES
Screws: 24 ÷ 27 Nm

4.2.12. ASSEMBLY OF THE BRAKE LEVER AND CAM

- Check the cam and rear brake stem for signs of wear.
- If necessary, change the cam.
- Mount two new O-rings and lubricate them with Fiat Z2 grease.
- Assemble the cam and the lever on the engine casing. Use the double tooth to align the two profiles.
- Tighten the screw to the specified torque value.



TIGHTENING TORQUE VALUES

Screw: 11 ÷ 13 Nm

4.2.13. ASSEMBLY OF THE BRAKE SHOES

- Check the thickness of the linings.

Minimum thickness: 1 mm

- Check the cam and pinion supports for signs of wear.
- Make sure the springs are not worn or damaged.
- If necessary, change the shoes.
- Mount the shoes and springs.

NOTE: *If the rear brake is noisy, check that the shoes are properly supported on the pinion. For the same reason, the springs may become curved and rest on the supports on the hub cover.*

4.2.14. DISASSEMBLY OF THE FAN MUFF

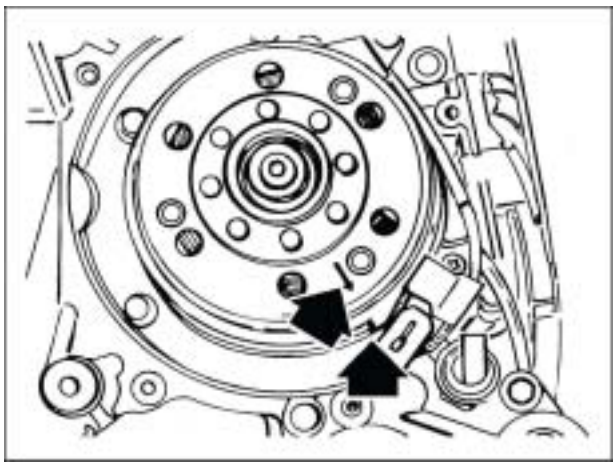
- Remove the attachment screws.
- Remove the muff by slipping off the connector lodged inside it.

4.2.15. DISASSEMBLY OF THE FAN MUFF

- Remove the attachment screws.
- Remove the muff by slipping off the connector lodged inside it.

4.2.16. CHECKING THE TIMING SYSTEM

- Turn the flywheel to align the case mark with the TDC mark.



- Ensure that the 2V mark on the camshaft pulley is in line with the mark on the head. If the mark on the camshaft is opposite the mark on the head, turn the drive shaft once.

4.2.17. DISASSEMBLY OF THE TIMING GEAR

- Remove the transmission cover, the driving belt roller, the sprocket, the oil sump with spring and by-pass piston, the oil pump pulley cover, the O-ring on the drive shaft and the washer between the sprockets.
- Remove the tappets cover.
- Unscrew the bolts and take off the cylinder guard.

- Slacken the central bolt of the tensioner.
- Remove the attachments.
- Remove the tightener with its gasket.

- Remove the screw and valve-lifter holder.

- Remove the automatic valve-lifter return spring, and the valve-lifter with its stop washer.
- Remove the inside hex nut and counterweight.

- Remove the camshaft drive pulley and its washer.

- Remove the screw, spacer and tensioner shoe.
- Remove the chain and the sprocket.

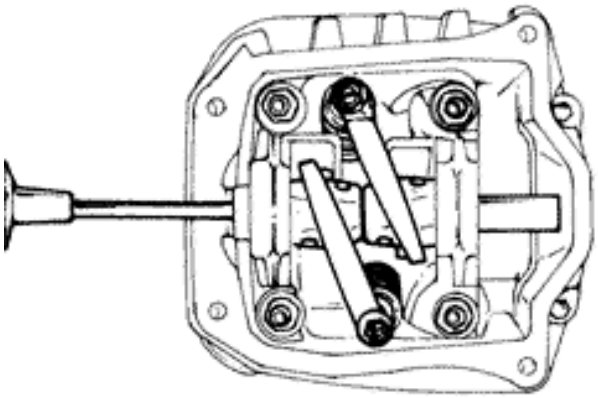
NOTE It is advisable to mark the chain to ensure that its original turning direction is maintained. The tensioner shoe must be removed from the transmission side. The lower chain guide shoe can only be removed after the head is disassembled.

4.2.18. DISASSEMBLY OF THE CAMSHAFT AND ROCKER ARMS

- Remove the two bolts and the camshaft attachment bracket.

- Remove the camshaft.

- Remove the pinion and rocker arms through the hole on the flywheel side.
- Save the metal ring.



4.2.19. HEAD DISASSEMBLY

- Remove the spark plug.
- Remove the two side fasteners.
- Working crossways, loosen cylinder head fastening nuts. Loosen in two or three steps.

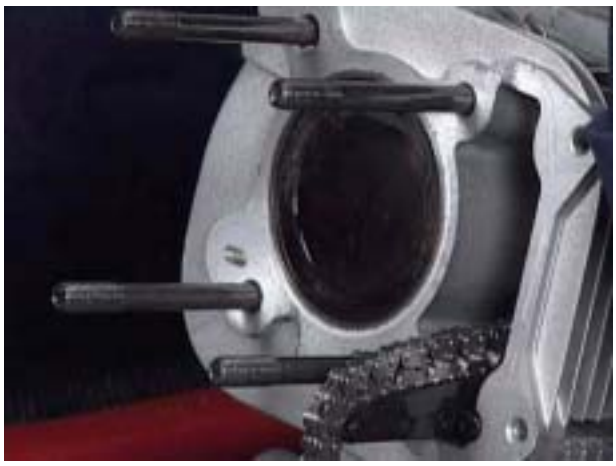
- Remove the head, the two centering dowels and gasket.

NOTE *If needed, head can be removed with camshaft, rocker arm shafts and fastening bracket. It can also be removed without disassembling the chain and drive shaft chain tensioner.*

4.2.20. CYLINDER AND PISTON DISASSEMBLY

- Remove the timing chain.
- Remove chain-sliding shoe.
- Slide out cylinder.

WARNING
Support the piston, so as not to damage it.



- Remove cylinder base gasket and centering dowels.

- Protect the crankshaft seat before removing.
- Remove the two snap rings, gudgeon pin and piston.
- Remove the two piston rings from piston.

NOTE *During disassembly, take care not to damage piston rings.*

4.2.21. ASSEMBLING PISTON

- Fit piston and gudgeon pin to on rod by setting the position piston with the arrow facing the exhaust side.

- Protect the crankshaft sent.
- Install snap ring on piston.
- Fit a ring on each side.

WARNING
Be careful not to score or damage ring seats or piston inner surface.

4.2.22. ASSEMBLING THE CYLINDER

- Blow through the lubrication duct and oil the cylinder liner.
- Fit the centring dowels.
- Install cylinder base gasket according to the previously calculated thickness.
- Take the following tools:

Engine M192M (125 cc): 8140658
Engine M191M (150 cc): 8140660

- Use the piston ring tool to fit the cylinder.

4.2.23. ASSEMBLING HEAD AND TIMING SYSTEM PARTS

- Fit the centring dowels.
- Fit the gasket with the word "ALTO" facing the cylinder head.
- Fit the chain guide-sliding shoe.

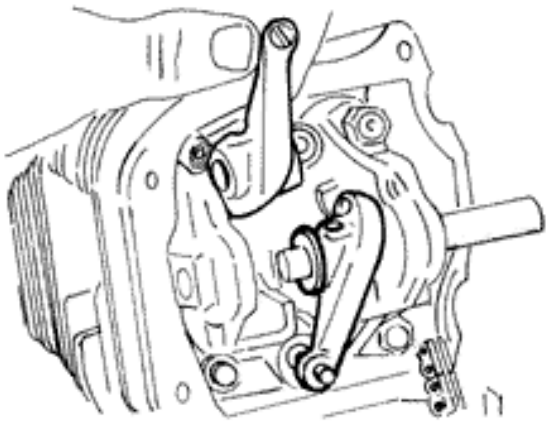
NOTE *Before assembling the head, make sure that the lubrication duct is perfectly clean. Blow with compressed air.*

- Mount the cylinder head.
- Tighten the timing chain side nuts and bolts crosswise to the specified torque values in a 2 or 3 steps.

TIGHTENING TORQUE VALUES
Nuts: 28 ÷ 30 Nm
Screws: 11 ÷ 13 Nm

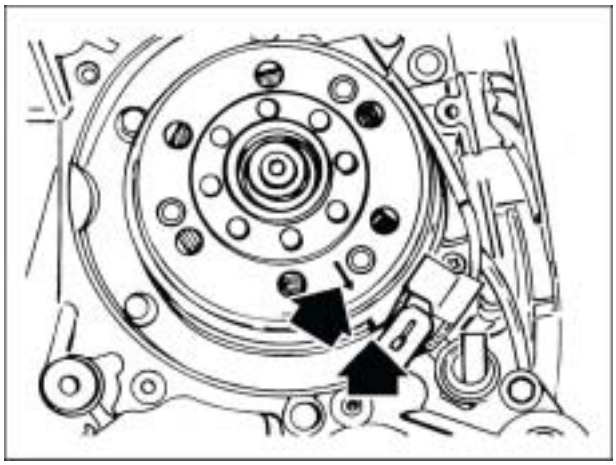
4.2.24. ASSEMBLING TIMING SYSTEM PARTS

- Mount the rocker arms, the metal ring and the pinion.
- Lubricate the rocker arms through the upper holes.
- Mount the camshaft.
- Position the camshaft attachment bracket and tighten the bolts to the specified torque value.



TIGHTENING TORQUE VALUE
Screws: 4 ÷ 6 Nm

- Turn the flywheel to align the case mark with the TDC mark.



- Mount the timing chain in the turning direction marked during the disassembly, together with the drive pinion.

- Mount the tightener shoe and spacer and tighten the attachment screw to the specified torque value.

TIGHTENING TORQUE VALUE
Screw: 10 ÷ 14 Nm

- Mount the camshaft drive pulley with its washer.
- Ensure that the 2V mark on the camshaft pulley is in line with the mark on the head. If the mark on the camshaft is opposite the mark on the head, turn the drive shaft once.

- Mount the counterweight. Tighten the attachment screw to the specified torque value.

TIGHTENING TORQUE VALUE
Screw: 7 ÷ 8,5 Nm

- Mount the automatic valve-lifter body with its end-of-travel washer and restrain the return spring.
- Mount the valve-lifter body stop cup and tighten the screw to the specified torque value.

TIGHTENING TORQUE VALUE
Screw: 11 ÷ 15 Nm

- Remove the central screw with the washer and tightener spring. Check the one-way mechanism for signs of wear.
- Check the soundness of the tightener spring.
- If necessary, change the entire unit.
- Press the locking tooth and bring the tightener block fully home.
- Mount a new gasket and the chain stretcher. Tighten the attachment screws to the specified torque value.

TIGHTENING TORQUE VALUE
Screws: 11 ÷ 13 Nm

- Position the spring and the washer. Tighten the central screw to the specified torque value.

TIGHTENING TORQUE VALUE
Screw: 5 ÷ 6 Nm

- Mount the tappets cover.
- Mount the washer separating the pinions, the O-ring on the drive shaft, the oil pump pulley cover, the oil sump with spring and by-pass piston, the starter pinion, the driving pulley with belt, and the transmission cover.