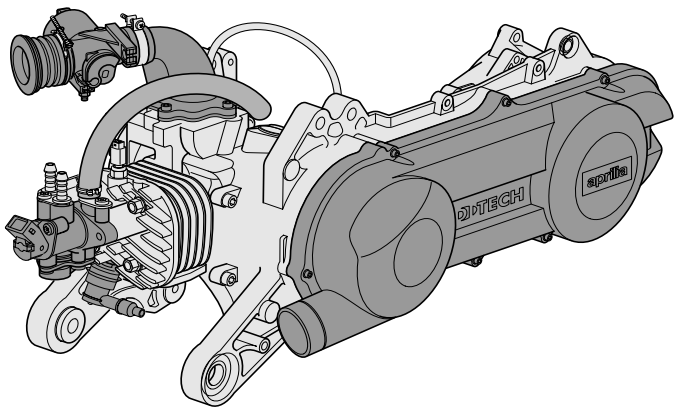
aprilia

QUICK WORKSHOP HANDBOOK

Electronic air injection
Aprilia Ditech Engine



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INTRODUCTION

- This manual contains all the essential information for carrying out routine vehicle procedures.
- The information and diagrams in the manual are up-to-date at the time of publication.
- This publication is intended for use by **Aprilia** dealers and their trained mechanics. A large number of procedures do not require explanation and therefore have been omitted. It has not been possible to give detailed mechanical data for every procedure. All personnel consulting this manual must therefore possess the basis skills of a mechanic and be thoroughly familiar with the most common motor cycle repair procedures. Without these skills and the necessary familiarity any repair or routine maintenance operation may be ineffective or even dangerous.

Given the fact that it is not possible to provide detailed descriptions of all procedures, special care must be taken for whatever repair or maintenance work is done, in order to prevent damage to the vehicle and injury to persons.

In order to provide the best level of customer satisfaction, **Aprilia s.p.a.** constantly improves its products and relevant documentation. All important technical changes and alterations to procedures are notified to all **Aprilia** dealers, branches and points of sale throughout the world. All changes will be included in later editions of this manual.

If you have any doubts or queries about the procedures described in this manual, please contact the **Aprilia** Training and Documentation Department, who will be pleased to give you all the information and explanations you require, and to bring you up-to-date with any changes.

For further information see:
- SPARE PARTS CATALOGUE no. 5601

Without alteration to the basic features of its models as described and illustrated in this manual, **Aprilia s.p.a.** may carry out modifications to any of the models without notice.

First edition. September 2002.

GENERAL SAFETY NORMS

CARBON MONOXIDE

If the engine must be switched on to carry out certain operations make sure the room is well ventilated or open to the outside. Never switch on the engine in a closed room, unless there is a smoke and fume removal system installed
and the operating.

⚠ DANGER

Exhaust fumes contain carbon monoxide, a poisonous gas which make cause loss of consciousness and can be lethal.
Switch on the engine only in an open space or in a closed room if fitted with a fully operating smoke and fume removal system.

FUEL

Make sure the room is well ventilated. Extinguish all cigarettes, keep fuel containers away from flames and possible sources of sparks.

⚠ DANGER

Fuel is highly flammable and may explode.
Take special care to check the air and fuel injection plant hoses; the operating pressure should not exceed about 750 KPa (7.5 bar).
Any fuel hoses which are cut or cracked should be replaced.
KEEP OUT OF THE REACH OF CHILDREN

HIGH TEMPERATURE COMPONENTS

⚠ DANGER

The engine and parts of the exhaust system reach very high temperatures and remain hot for a certain period after switching off the engine. Handle these components only after putting on protective gloves or waiting for the engine and parts to fully cool down.

WASTE TRANSMISSION OIL

⚠ DANGER

Use latex gloves for maintenance operations involving contact with oil. If left in contact with the skin for long periods, used engine oil can cause skin cancer. Although this is unlikely, unless handled every day, wash your hands with soap and water after handling used engine oil.
KEEP OUT OF THE REACH OF CHILDREN

GENERAL PRECAUTIONS AND INFORMATION

For repair and disassembly and reassembly operations follow the instructions.

⚠ DANGER

Do not carry out any operation in the presence of naked flames.
Before starting any maintenance or inspection operation, switch off the engine and remove the ignition key. Wait for the engine and exhaust system to cool down. Place the motor cycle, if possible, in a raised position on a level, even surface. Take special care of heated parts (engine and the exhaust) in order to avoid burns.
The vehicle is made with parts which cannot be swallowed. Do not bite, chew, suck or otherwise attempt to carry out operations using the teeth or mouth.
Unless otherwise specified, to reassemble parts, reverse the order for disassembly operations. Some operations may involve disassembling parts previously disassembled for other operations to be carried out. Consult the various pages of the manual where each operation is described in order to avoid unnecessary work. Never use fuel as a solvent for cleaning the vehicle.
If welding operations are to be carried out, disconnect the negative pole (-) of the battery and take special care with all electrical components used for the injection system.
If more than one person is working on the vehicle make sure both are in a safe position whatever the work being done.

BEFORE DISASSEMBLY

- Remove dirt, mud, dust and foreign bodies from the vehicle before disassembling the components.
- Use all the tools specifically designed for the vehicle.

DISASSEMBLY

- Before separating pipes or wires etc. (joints and junctions) mark each part with a unique marking.
Each piece should be clearly marked for reassembly purposes.
-Clean and wash the disassembled components with close to non-inflammable detergent.
-Keep paired parts together, because normal wear and tear create a natural pairing. In some cases, where one part is replaced the other must also be replaced.
Keep away from sources of heat.

REASSEMBLY

⚠ DANGER

Never re-use a snap ring. If removed, replace it with a new ring. If a new ring is fitted, do not stretch more than necessary when fitting it to the shaft. Afterwards, check that the ring is properly fitted to the housing.

Do not clean bearings with compressed air.

IMPORTANT Bearings must rotate freely, without sticking or noise. Replace if necessary.

- Use only ORIGINAL **Aprilia** SPARE PARTS.
- Stick to the oil chart and recommended wearing parts.
- Wherever possible, lubricate parts before reassembling them.
- When tightening screws and nuts begin with the largest diameters, or inner nuts and screws, and tighten diagonally. Tighten each before finally tightening to the specified torque.
- Always replace gaskets, gasket rings, snap rings, O-rings and split pins with new ones.
- Clean all joint surfaces, oil seal edges and gaskets before reassembling.
- Lightly smear the edges of oil seals with lithium based grease.
- Refit the oil seals and bearings with the trademark or manufacturer's serial number facing outwards (so it is visible).
- Grease the bearings fully before fitting.
- Check that all components have been reassembled properly.
After a maintenance or repair operation, carry out preliminary checks and commission the vehicle on private property or in a low traffic area.

TECHNICAL DATA

ENGINE

Type	air/injection
Engine type	air-injection with direct petrol injection
Number of valves	-
Number of cylinders	mono-cylindrical horizontal
Piston displacement	49.38 cm^3
Bore/Stroke	41.0 mm / 37.4 mm
Corrected compression ratio	r_c = 10.7 ± 0.1
Idle rpm	1650 ± 50 r/min
Starter system	electric
Clutch	centrifuge
Gearbox	automatic stepless variator
Lubrication system	Electric oil pump
Cooling system	forced air

TRANSMISSION

Variator	automatic stepless
Primary	V- belt
Gears	minimum for stepless change: 2.9
	maximum for stepless change: 0.75
Secondary	with gears

CAPACITY

Transmission oil	130 cm^3

THROTTLE BODY

Type	BING
Diffuser	Ø18 mm

FUEL SUPPLY

Fuel injector	SIEMENS DEKA
Air injector	SYNERJECT

IGNITION UNIT

Type of ignition	Inductive
Ign advance	Variable: 20° at 3000 rpm 17° at 7500 rpm.

SPARK PLUG

Standard	NGK R CPR8-E
Electrode-spark plug distance	0.55 - 0.65 mm

ELECTRICAL INSTALLATION

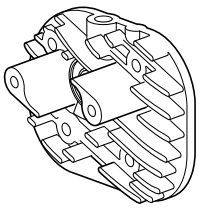
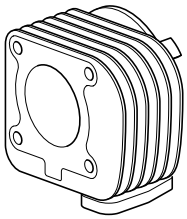
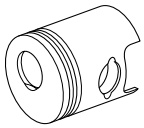
Battery	12 V - 4 Ah
Fuse	7.5 A
Generator (magneto)	12 V - 140 W

TIGHTENING TORQUE 50 cc AIR INJECTION ENGINE

Application	Screw	TIGHTENING TORQUE		Sealant
		Nm	Kgm	
Pick-up locking	M5 x 12	4 - 6	0.4 - 0.6	not
Stator locking	M5 x 25	4 - 6	0.4 - 0.6	not
Transmission steel plate locking	M6 x 12	8 - 12	0.8 - 1.2	Loctite 270
Throttle body (with roller) hose clamp locking		end stop	end stop	not
Suction manifold (built-in, hexagonal) locking	M6 x 20	8 - 12	0.8 - 1.2	not
Screws and pin securing intake manifold		9 - 11	0.9 - 1.1	not
Transmission cover	M6 x 25	8 - 12	0.8 - 1.2	not
Variator cover	M6 x 25	8 - 12	0.8 - 1.2	not
Bendix support locking	M6 x 30	8 - 12	0.8 - 1.2	not
Starter motor	M6 x 25	8 - 12	0.8 - 1.2	not
L/r carter locking	M6 x 55 M6 x 75 M6 x 100	8 - 12	0.8 - 1.2	not
Wheel bearing retaining plate locking	M6 x 16	6 - 10	0.6 - 1.0	Loctite 243
Oil load plug (flanged)	M8 x 12	10 - 14	1.0 - 1.4	not
Oil unload (Ch. 8)	M6 x 12	5 - 6	0.5 - 0.6	not
Variator sliding pulley cover locking	M4 x 8	2	0.2	not
Head locking (nut)	M6 h=9	11 - 13	1.1 - 1.3	not
Clutch locking (nut)	M10x1.5	45 - 55	4.5 - 5.5	not
Flywheel locking (nut)	M10x1.25	35 - 45	3.5 - 4.5	not
Exhaust stud		4 - 5	0.4 - 0.5	Loctite 270
Cylinder stud		4 - 5	0.4 - 0.5	not
Spark plug (thread)	M10x1.0	13 - 15	1.3 - 1.5	/
Compressor screw locking	M5 x 20	4 - 5	0.4 - 0.5	not
Fuel rail screw locking (flanged TE)	M5 x 25	6 - 7	0.6 - 0.7	not
Variator fixed pulley locking (nut)	M12x1.25	35 - 45	3.5 - 4.5	not
Cylinder head temperature probe	6 - 9	6 - 9	0.6 - 0.9	

TECHNICAL DATA

CYLINDER + PISTON + RINGS

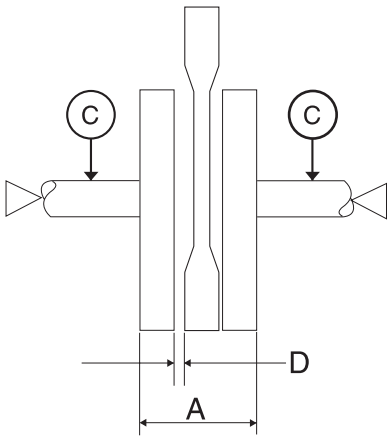
Item:			Standard: mm (in)		Limit: mm (in)
Piston to cylinder clearance		Air-injection	0.028-0.040 (0.0011-0.0016)		0.100 (0.0039)
Piston diam.	 	Air-injection	Selection A (*)	40.966-40.972 (1.6128-1.6131)	40.912 (1.6107)
			Selection B (*)	40.972-40.978 (1.6131-1.6133)	40.918 (1.6109)
			Selection C (*)	40.978-40.984 (1.6133-1.6135)	40.924 (1.6112)
			Measure 18 mm (0.7) from the outer edge		
Cylinder bore		Air-injection	Selection A	41.000-41.006 (1.6141-1.6144)	41.050 (1.6161)
			Selection B	41.006-41.012 (1.6144-1.6146)	41.056 (1.6164)
			Selection C	41.012-41.018 (1.6146-1.6149)	41.066 (1.6168)
			Measure 15 mm (0.59) from the outer edge		
Cylinder distortion			0.005 (0.0002)		0.03 (0.0012)
Cylinder head distortion			0.02 (0.0008)		0.05 (0.0020)

(*) N.B. During disassembly selections A,B, C may not be visible. In this case, refer to limit values.

CYLINDER + PISTON + RINGS

Item:		Standard: mm (in)			Limit: mm (in)
Port at the end of the unassembled segment	**Air-injection**	1°-2°	T	Approx. 4.5 (0.18)	3.6 (0.14)
Port at the end of the segment fitted into the cylinder	**Air-injection**	1°-2°	T	0.25 - 0.40 (0.0098 - 0.0157)	0.70 (0.027)
Segment/slot clearance	**Air-injection**	1°-2°		0.036 - 0.076 (0.0014 - 0.0030)	- -
Piston pin housing bore on piston	**Air-injection**	12.002 - 12.010 (0.4725 - 0.4728)			12.030 (0.4736)
Piston pin outer diameter	**Air-injection**	11.996 - 12.000 (0.4723 - 0.4724)			11.980 (0.4717)

CONROD + CRANKSHAFT

Item:		Standard: mm (in)	Limite: mm (in)
Connecting rod small end diameter	**Air-injection**	16.003 - 16.011 (0.6300 - 0.6304) 36.0 ± 0.05	16.040 (0.6315)
Width from crank arm to arm **(A)**	**Air-injection**	37.95 - 38.10 (1.494 - 1.5)	- -
Misalignment limit **(C)**	Measured between two opposite points		0.03 (0.001)
Side clearance of connecting rod big end **(D)**	**Air-injection**	0.15 - 0.75 (0.0059 - 0.029)	-
Standard crank width 			

CLUTCH

Item:	Standard: mm (in)	Limit:mm (in)
Clutch wheel inner diameter	110.00 - 110.15 (4.331 - 4.337)	110.50 (4.350)
Clutch shoe thickness	3.0 (0.12)	2.0 (0.08)
Clutch engagement	3200 ± 200 rpm	-
Clutch lock-up	6700 ± 300 rpm	-

OIL PUMP

Item:	Specification:
Inner coil	R_i = 26.3 ± 2.6 Ω a 20° C

TRANSMISSION

Item:		Standard: mm (in)	Limit: mm (in)
Reduction ratio		Variable 2.9 - 0.75	-
Final reduction ratio	**Air-injection**	51/15 x 67 x 14	-
Drive belt width		18.4 (0.724)	17.4 (0.685)
Driven face spring free	**Air-injection**	110 (4.33)	104.5 (4.114)
Guide roller for variator		17 (0.669)	16.5 (0.650)
Drum diameter		107 - 107.2 (4.213 - 4.220)	107.5 (4.232)

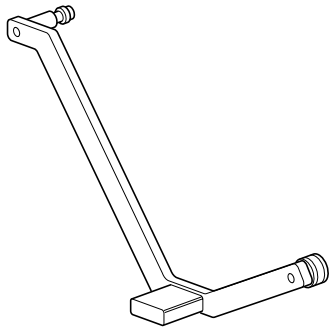
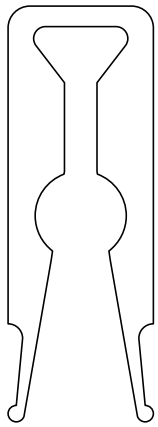
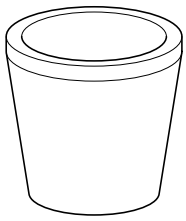
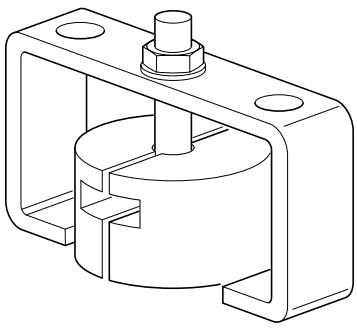
OIL CHART

Transmission oil (recommended): F.C.,SAE 75W - 90 or Agip GEAR SYNTH, SAE 75W - 90.
Or alternatively branded oils with equivalent or better performance than A.P.I. GL-4.

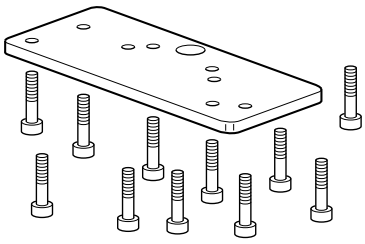
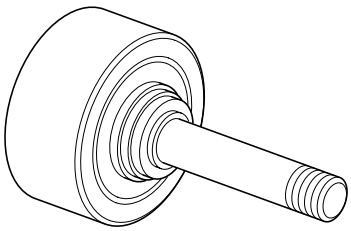
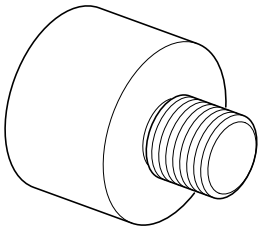
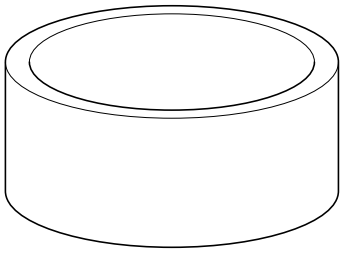
Mixer oil (recommended): GREEN HIT 2 or Agip CITY 2T.
Or alternatively branded oils with equivalent or better performance than ISO-L-ETC++,A.P.I. TC++

Bearings and other grease points (recommended): AUTOGREASE MP or Agip GREASE 30
Or alternatively branded grease for revolving bearings with temperature range of -30 °C to+140 °C, dripping point 150 °C + 230 °C, with high protection and anti corrosion properties, good resistance to water and oxidation.

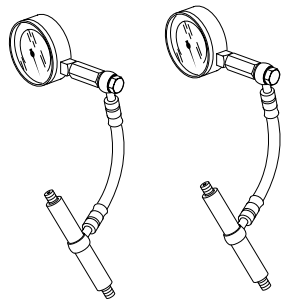
SPECIAL ENGINE TOOLS

UK Illustration	Tool code	Name/function or use
	**8140229**	Engine support.
	**8140429**	Tool for fitting the teflon ring onto the air injector.
	**8140430**	Tool for fitting the teflon ring onto the air injector.
	**8140431**	Air injector extractor.

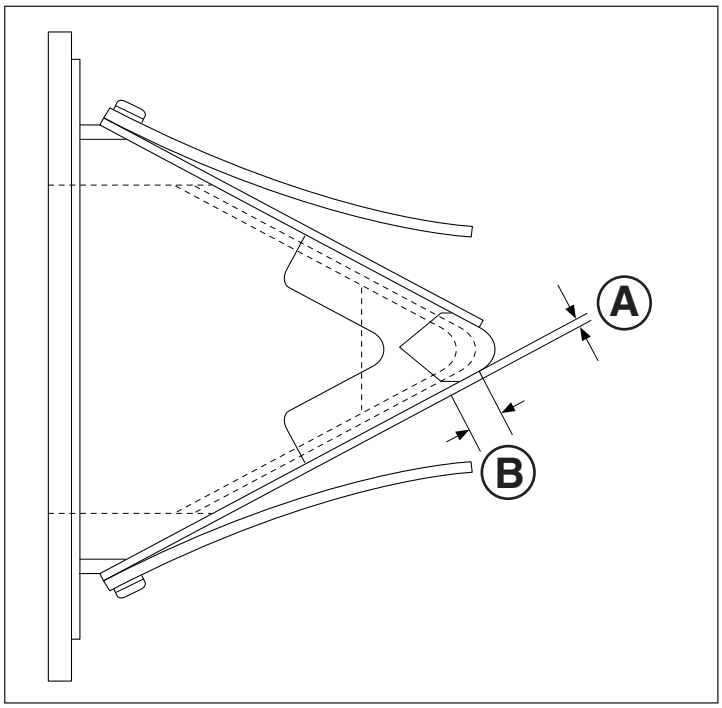
SPECIAL ENGINE TOOLS

UK Illustration	Tool code	Name/function or use
	**8140228**	Adapter plate for flywheel and crankcase extraction.
	**8140227**	Reduction gear for bearing assembly.
	**8140225**	Reduction gear for crankcase traction.
	**8140226**	Spacer for crankcase centering.

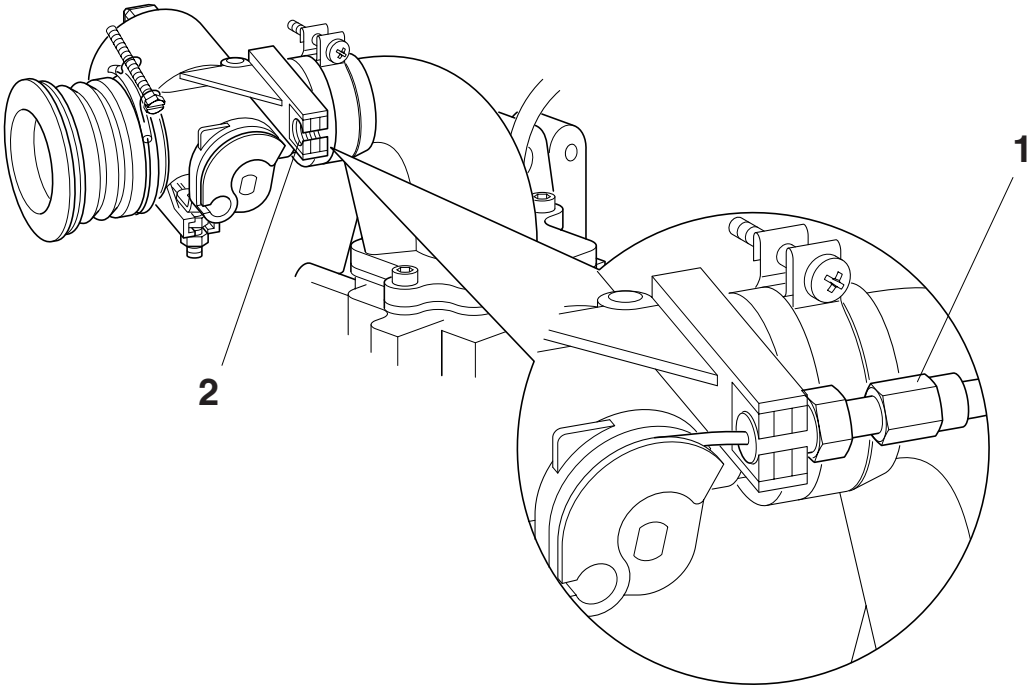
SPECIAL ENGINE TOOLS

UK Illustration	Tool code	Name/function or use
	**8140488**	Fuel-air pressure gauge.

LAMINAR VALVE



Measure clearance (**A**) between laminar valve and its housing and size (**B**).
If clearance (**A**) is in excess of 0.2 mm (0.008 in), replace the laminar valve.
(**B**) size is at least 1 mm (0.04 in).



Tighten the gas-wire adjuster and the return-nut (**1**) carefully.
If the nut is tightened to quickly, the threaded pawl plastic housing may break (**2**).

INJECTION TROUBLESHOOTING

TROUBLESHOOTING SHAFT

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

FUNCTIONAL PHASE

1 - Turn the key to the “ON” position

2 - Does the control LED stay on?

NO

When the start button is pressed, does the engine turn over?

NO

- Make sure the battery is charged
- Check the battery terminals
- Check the 15 A fuse
- Make sure the fuse connector is properly inserted into its housing
- Check between the 15 A connector and the positive pole of the battery
- See the SR 50 water-cooled (injection relay) workshop manual to check the wiring

YES

With the key in the “ON” position, is there power (12 Volt) between the two terminals of the injection control connector led?

YES

Replace the bulb

NO

Is there power between the red/ black cables of the led and the negative pole of the battery?

YES

- Check the continuity between the black wire and the ECU connector
- Check the ECU. See **‘ECU CONTROL”**

NO

- Make sure the led connector and fuse are properly connected.
- Make sure the black wire between the led and CDI connector is continuous
- Check the general electrical wiring (battery, fuses, main switch)

YES

3 - After turning the key does the fuel pump run for a few seconds?

NO

Turn to the “OFF” then to the “ON” position.
Did the pump work?

NO

- Make sure the battery is charged
- Check the battery connections
- Check the voltage at the pump connector ends

YES

YES

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

4 - Does the starter motor work properly when you press the starter button?

NO → If the starter motor does not start or turns slowly →
- Make sure the battery is charged
- Check battery connections
- Check the electric plant against the workshop drawing for the SR 50 water-cooled model (starter motor)
- (Check the earth connection to the starter motor)

YES ↓

5 - Does the engine start up normally?

NO ↓

Engine flooded: open the throttle crank engine for 10 seconds, then re-start.

↓

Make sure the spark plug is clean; clean or replace if necessary
Make sure it produces a spark on ignition.

NO ↓
- General diagnostics with Game-boy
- Check battery voltage
- Replace the spark plug
- Check Plug lead
- Check the ECU. See **"ECU CONTROL"**

YES ↓
Check mechanical parts
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

NO ↓

See **"AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE"**

YES ↓

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

6 - Does the engine idle normally?

NO

Has the pre-delivery procedure been followed for a new vehicle?

1- Prime the petrol pump (each time it is replaced) by:
   a) switching to “ON”
   b) during the 5 seconds that the petrol pump is working press and release the tank/pump hose repeatedly
   c) switch to “OFF” as soon as the petrol pump stops running
   d) switch back to “ON”
   e) repeat the sequence 8-10 times.

2- Check the spark plug. It may be covered with oil and need cleaning. This will improve engine performance. Stay on high revs for about 5 minutes.

YES

- General diagnostics with Game-boy
- Check battery voltage
- Replace the spark plug
- Check Plug lead
- Check the ECU. See **‘ECU CONTROL”**

YES

Check mechanical parts
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

NO

See **“AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE”**

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

7 - Does the vehicle accelerate normally (minimum acceleration)?

NO

- General check-up with Game-Boy and reset errors (butterfly valve at “O” if required)
- Check the battery voltage
- Replace the spark plug
- Check Plug lead
- Check the pick-up wiring
- Check ECU. See **‘ECU CONTROL”**
- Is the variator working properly?

NO

Check mechanical parts
- Are all transmission parts (clutch, belt, rollers, variator) working properly?
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

NO

See **“AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE”**

YES

YES

YES

8 - Does the vehicle accelerate normally (maximum acceleration)?

NO

- General check-up with Game-Boy and reset errors (butterfly valve at “O” if required)
- Check the battery voltage
- Replace the spark plug
- Check Plug lead
- Check the pick-up wiring
- Check ECU. See **‘ECU CONTROL”**
- Is the variator working properly?

NO

Check mechanical parts
- Are all transmission parts (belt, variator) in good condition?
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

NO

See **“AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE”**

YES

YES

YES

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

9 - Half-open the throttle: does the vehicle maintain speed?

NO

- General check-up with Game-Boy and reset errors (butterfly valve at “O” if required)
- Check the battery voltage
- Replace the spark plug
- Check Plug lead
- Check the pick-up wiring
- Check ECU. See **‘ECU CONTROL”**
- Is the variator working properly?

NO

Check mechanical parts
- Are all transmission parts (belt, variator) working properly?
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

YES

YES

YES

NO

See **“AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE”**

10 - Is top speed normal?

NO

- Is the variator working properly?
- General diagnostics by Game-boy
- Check the battery voltage
- Replace the spark plug
- Check Plug lead
- Check the pick-up wiring
- Check ECU. See **‘ECU CONTROL”**

NO

Check mechanical parts
- Are all transmission parts (belt, variator) working properly?
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

YES

YES

YES

NO

See **“AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE”**

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

11 - Does the engine work properly ticking over at minimum?

NO

- General diagnostics by Game-boy
- Check the battery voltage
- Replace the spark plug
- Check Plug lead
- Check the pick-up wiring
- Check ECU. See "**ECU CONTROL**"

NO

Check mechanical parts
- Is the compression ratio right? (piston rings, piston and cylinder)
- Check the Teflon gasket for the air injector to see if there are any traces of carbon above the teflon ring and injector casing
- Does the engine sound strange?
- Are the oil guards and bearings in good condition?
- Has the reed pack been damaged?
- Is the petrol filter clogged? Is it in place?
- Has the exhaust been damaged? Is it clogged?

YES

YES

YES

NO

See "**AIR/FUEL CIRCUIT PRESSURE CONTROL PROCEDURE**"

12 - Are noise and vibrations normal?

NO

Check mechanical parts
- Compression ration (piston rings, piston, cylinder)
- Unusual engine noise (seizure) Crankshaft main bearings, crank case and connecting rods.

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

CHECKING THE PRESSURE OF THE AIR AND FUEL CIRCUITS

Fit the pressure gauge to the petrol circuit, between fuel pump and fuel rail

To discharge air from the circuit:
- switch to “ON”
- nudge the starter motor so it switches on momentarily
- the pressure of the fuel circuit should be **2.5 ± 2.0** bar
- switch off
- now the pressure gauge can be fitted

Switch to “OFF”
Is the pressure **2.5 bar**?

NO

Does the starter motor for the pump start up? Can you hear the characteristic buzz when you switch on?

NO

Check the power at the pump connector. If the voltage is correct, replace the petrol pump.
N.B. After replacing the pump, start up as specified above (point 6 of Troubleshooting the Injection)

YES

YES

Does the pressure stay at **2.5 ± 2.0** bar?

NO

Check:
- the tank breather
- the petrol filter and tank delivery flange
- the fuel feed hose
- **Start up as specified above (point 6 of Troubleshooting the Injection)**

YES

YES

Check the pump pressure blocking the delivery hose below the pressure gauge. Is the pressure **7** bar?
N.B. Do not exceed 7.5 bar, or the pump will be damaged.

NO

Replace the fuel pump

Does the pressure stay at **7.5** bar on “OFF”?

YES

NO

Blocking the delivery hose above the pump, does the pressure remain?
N.B. Do not exceed 7.5 bar, or the pump will be damaged.

NO

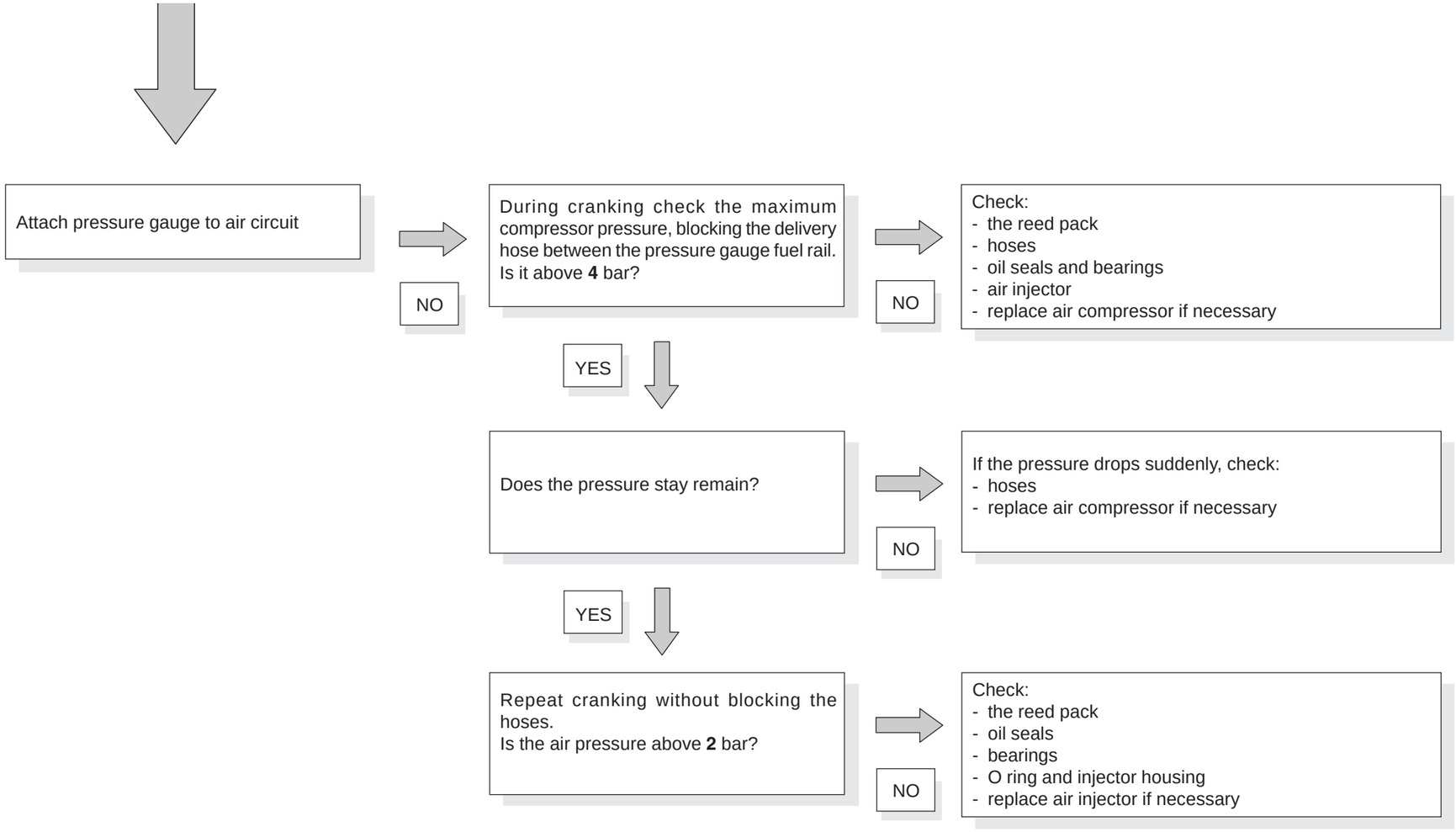
Check the hoses and replace the Fuel Rail if necessary

YES

Replace the petrol pump

INJECTION TROUBLESHOOTING

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)



PRESSURE VALUES (BAR) FOR THE AIR AND FUEL CIRCUITS

IN OPERATION	AIR CIRCUIT	FUEL CIRCUIT
OFF	2 - 5	+ 2.5 ± 0.2 bar
MINIMUM	4.2 ÷ 6	+ 2.5 ± 0.2 bar
MAXIMUM	< 6.2	+ 2.5 ± 0.2 bar

N.B. Petrol pressure is above 2.5 bar

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

INJECTION TROUBLESHOOTING — TABLE OF FAULT CODES

FLASHING NUMBER	DESCRIPTION OF FAULTS	FAULT PRIORITY	ENGINE CHECK	POSSIBLE CAUSE	CHECKS AND REMEDIES
1	Overheated engine	1	-	Damaged thermostat	Check thermostat
				Damaged radiator	Check radiator
				Damaged hose	Check hose
2	Fault in the phonic wheel	2	-	Inverted pickup wires	Check wiring
				Damaged pickup wires	Check the continuity (R=0 Ohm) between the transducer and ECU (blue wire – white wire - blue/yellow wire –white/yellow wire). Check opening of the circuit (R=infinite) between the pickup and earth
				Connectors	Check connectors
				Transducers	Check resistance (R=385 +/- 20% Ohm) between the positive and negative poles of the pickup
3	Twin error of alignment, throttle sensor (TPS)	2	-	Throttle control sealing screw out of place	Check the end screw (which shouldn't be tampered with)
				Throttle wire improperly set (on the handlebar)	Adjust throttle cable
4	Error of alignment, primary throttle sensor (TPS)			Inverted throttle sensor connector wires	Check connector wires
				Connectors	Check connectors
5	Error of alignment, secondary throttle sensor (TPS)			Damaged wires	Check continuity (R=0 Ohm) between the sensor and ECU (yellow/brown wire - pink wire - white wire - yellow wire)
				Damaged throttle sensor	Replace throttle body
6	Primary throttle sensor (TPS) fault	2	-	Inverted throttle sensor wiring	Check sensor wiring
				Connectors	Check connectors
7	Secondary throttle sensor (TPS) fault	2		Damaged wires	Check the continuity (R=0 Ohm) between the sensor and ECU (brown/yellow wire - pink wire - white wire - yellow wire)
				Sensor races worn	Replace throttle body
8	Twin fault, throttle sensor (TPS)	1	Set ticking over speed	Water in the sensor	Remove traces of water and try again. If necessary, replace the butterfly casing.
				Damaged throttle sensor	Replace throttle body

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

FLASHING NUMBER	DESCRIPTION OF FAULTS	FAULT PRIORITY	ENGINE CHECK	POSSIBLE CAUSE		CHECKS AND REMEDIES
9	Inadequate battery voltage or ECU disconnected Low voltage	1	-	Battery voltage too low	→	Check the battery charge. Check and restore battery connections if necessary.
				Red/brown wire connector 15 wire to the ECU not connected or connected to earth	→	Check the continuity (R=0 Ohm) of the red/brown wire.
				Voltage regulation wires and/or connectors not wired up	→	Check the wires/connectors (see SR 50 WATER HANDBOOK)
				Wires and/or connectors of the injector system relay not connected	→	Check connectors. Fit the relay between the blue wire and red/black wire. If the relay closes, check the continuity (R=0 Ohm) between the red/brown wire and orange wire. If the values are correct: check the general feed plant (battery, fuse, main switch).
				Magnet flywheel	→	Check the magnet flywheel (see SR 50 WATER HANDBOOK)
10	Faulty oil pump	1	-	Connectors	→	Check connectors
				Damaged wires	→	Check the continuity (R=0 Ohm) of the brown wire between the pump and ECU. Check the voltage (12V) between the red/black wire and negative battery pole. Control the general electrical feed plant (battery, fuse, main switch)
				Pompa dell'olio danneggiata	→	Check the resistance value of the oil pump (26.3 Ohm at 25°C) between the positive and negative pole.
				Damaged ECU	→	See ECU CONTROL
11	Air injector fault	2	-	Connectors	→	Check connectors
				Damaged wires	→	Check the continuity (R=0 Ohm) of the white/red wire between the air injector and ECU. Check the voltage (12V) between the red/black wire and the negative pole of the battery.
				Damaged air injector	→	Check the resistance inside the air injector between the negative and positive poles (R= 1.3 Ohm)
				Damaged injection plant relay	→	Check connectors. Fit the relay between the red and blue wire. If the relay closes check the continuity (R=0 Ohm) between the red/brown wire and the orange wire. If values are correct: check the general feed circuit (battery, fuse, main switch).
				Damaged ECU	→	See ECU CONTROL

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

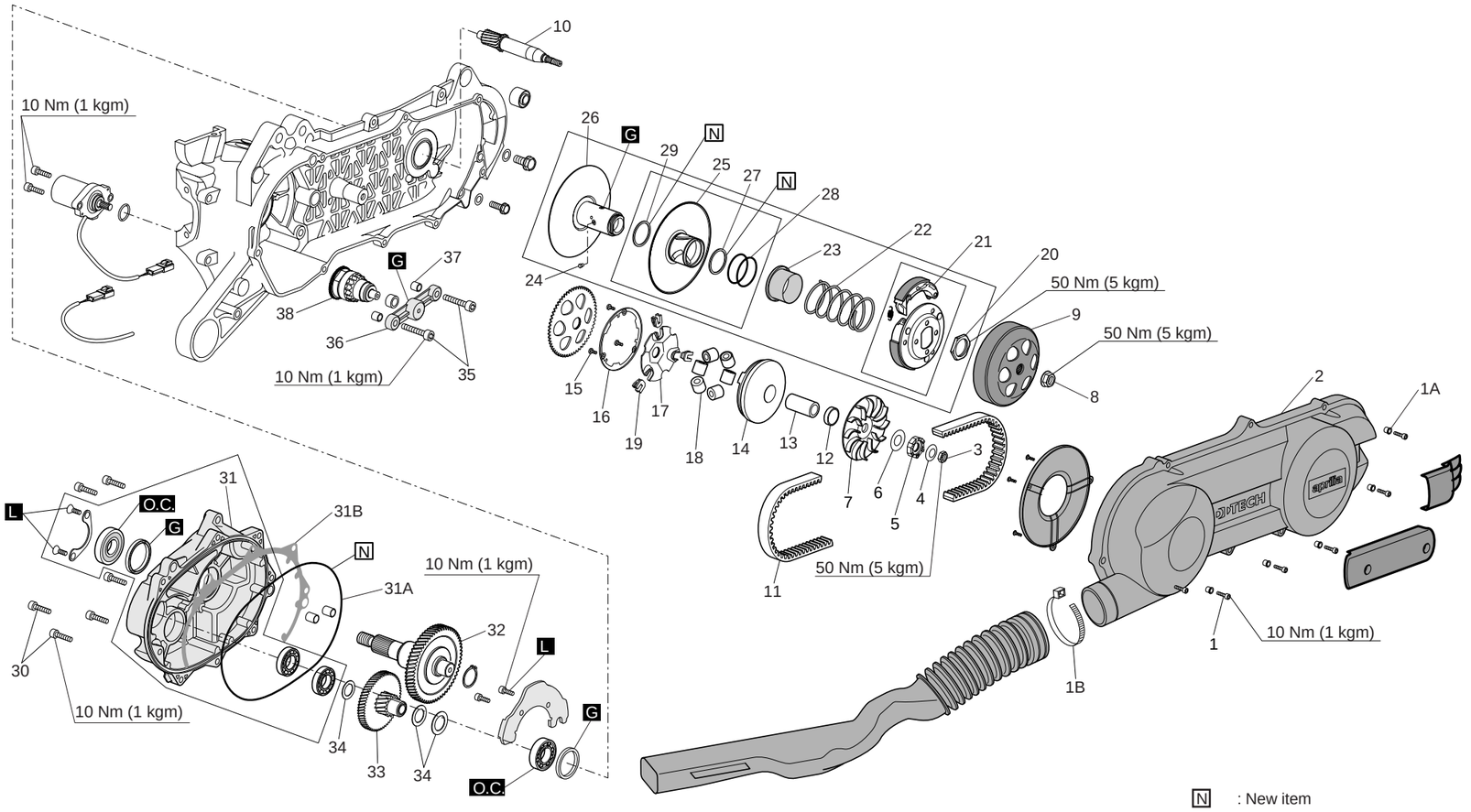
FLASHING NUMBER	DESCRIPTION OF FAULTS	FAULT PRIORITY	ENGINE CHECK	POSSIBLE CAUSE		CHECKS AND REMEDIES
12	Fuel injector fault	2	-	Connectors	→	Check connectors
				Damaged wires	→	Check the continuity (R=0 Ohm) of the yellow/red wire between the fuel injector and ECU. Check the voltage (12V) between the red/black wire and the negative pole of the battery.
				Damaged fuel injector	→	Check the resistance inside the air injector between the negative and positive poles (R= 1.8 Ohm)
				Damaged injection plant relay	→	Check connectors. Fit the relay between the blue and red/black wires. If the relay closes, check the continuity (R=0 Ohm) between the red/brown wire and orange wire. If values are correct: check the general feed circuit (battery, fuse, main switch).
				Damaged ECU	→	See ECU CONTROL
13	Ignition system fault	2	-	Connectors	→	Check connectors
				High voltage wire spark plug / spark plug	→	Check the spark plug (R= 5 Ohm). Check the continuity of the High Voltage wire of the spark plug.
				Damaged wires	→	Check the continuity (R=0 Ohm) of the white/violet wire between the High Voltage wire and ECU. Check the voltage (12V) between the red/black wire and negative pole of the battery.
				Damaged high voltage cable.	→	Check the general feed circuit (battery, fuse, main switch).
				Damaged injection plant relay	→	Check connectors. Fit the relay between the blue and red/black wires. If the relay closes check the continuity (R=0 Ohm) between the red/brown wire and orange wire. If values are correct: check the general feed circuit (battery, fuse, main switch).
				Damaged ECU	→	See ECU CONTROL
14	Fuel pump fault	3	-	Connectors	→	Check connectors
				Damaged wires	→	Check the continuity (R=0 Ohm) of the green wire between the fuel pump and ECU. Check the voltage (12V) between the red/black wire and the negative pole of the battery.
				Main switch circuit	→	Check the general feed circuit (battery, fuse, main switch).
				Damaged fuel pump	→	Replace the fuel pump
				Damaged ECU	→	See ECU CONTROL

(DOUBLE CHECK THE MALFUNCTION BEFORE REPLACING ANY PART)

FLASHING NUMBER	DESCRIPTION OF FAULTS	FAULT PRIORITY	ENGINE CHECK	POSSIBLE CAUSE		CHECKS AND REMEDIES
15	Rev limit switch triggered	2	Maximum speed limit	Led for rev limit switch (if on, does not indicate a fault)		
16	Fault to sensor feed circuit ECU Low voltage	3	-	Damaged ECU	→	See ECU CONTROL
17	Variator threshold exceeded	3	Rev limit	High revs on start-up	→	Examine the cause of the high revs at start-up
18	Temperature sensor fault (feed with current too low) -	3	-	Connectors	→	Check connectors
				Damaged wires	→	Check the continuity (R=0 Ohm) of the pink wire between the sensor and ECU, and of the green/red wire between the sensor and ECU.
19	Temperature sensor fault (feed with current too high) -	3	-	Damaged temperature sensor	→	Check the resistance of the temperature sensor: 21430 - 24750 Ohm at 15 °C / 2613 - 2795 Ohm at 25 °C / 99.9 – 106.9 Ohm at 120 °C
				Damaged ECU	→	See ECU CONTROL
20	Cooling liquid temperature fault	3	-	Connectors	→	Check the connection between the temperature sensor and dashboard connection.
				Temperature reader wires	→	Check the voltage (12V) between the green/red wire and negative pole of the battery. Check the continuity (R=0 Ohm) of the white/blue wire between the temperature reader and ECU. Check the continuity (R=0 Ohm) of the pink wire between the temperature sensor and ECU and of the green/red wire between the temperature reader and ECU.
				Damaged temperature reader	→	Replace the temperature reader
				Damaged ECU	→	See ECU CONTROL
21	Injection system – faulty bulb	3	-	Can be read using external control instruments	→	Check the voltage (12V) between the two terminals of the injection control led connector. If the voltage is normal: replace the injector control led. If there is no voltage reading: check the led connector and/or red/black wire between the led and ECU.
22	ECU Low voltage sensor feed circuit fault	2	Set ticking over speed	Damaged ECU	→	See ECU CONTROL

CONTROL ECU

1	Check continuity (R=0 Ohm) between the blue wire (PIN no. 1) and the battery negative	3	Check the voltage (12V) between the red/black wire (PIN no. 17) and battery negative
2	Check voltage (12V) between the red/brown wire (PIN no. 15) and battery negative	4	Replace the ECU with one that functions properly.



DISASSEMBLY SEQUENCE

V-BELT - CLUTCH - PRIMARY AND SECONDARY PULLEY

- Remove the 8 screws (**1**) retaining the T sleeves (**1A**), loosen the clamp (**1B**) and remove the variator cover (**2**).
- Remove the 6-sided nut (**3**), spacer **4**), toothed cup (**5**) spacer (**6**).
- Remove the primary fixed pulley (**7**).
- Remove the 6-sided nut (**8**), remove clutch bell (**9**).
- Remove the clutch assembly from the shaft (**10**).
- Remove the trapezoid belt (**11**)**.**
- Remove shim (**12**) , bush (**13**) and mobile primary pulley (**14**).
- Remove the three locking screws (**15**) of the cap (**16**) and of mobile pulley and remove the ramp-plate (**17**) and the six slide pieces (**18**).
- Remove slide pieces (**19**).

CLUTCH

- Remove the 6-sided nut (**20**).
- Remove the centrifugal clutch assy. (**21**), Limit spring (**22**), and spring holder cup (**23**).
- Remove guide dowels (**24**).
- Slide sliding secondary pulley (**25**) off fixed pulley (**26**).
- Remove the oil seal (**27**) O-rings (**28**) and oil seal (**29**).

TRANSMISSION

- Remove the 8 screws (**30**), the transmission cover (**31**), O ring (**31A**) or paper gasket (**31B**).
- Remove transmission shaft (**10**) from the variator half-crank case.
- Remove drive shaft (**32**), double intermediate gear (**33**) and related shims (**34**) from transmission cover.

STARTER PINION

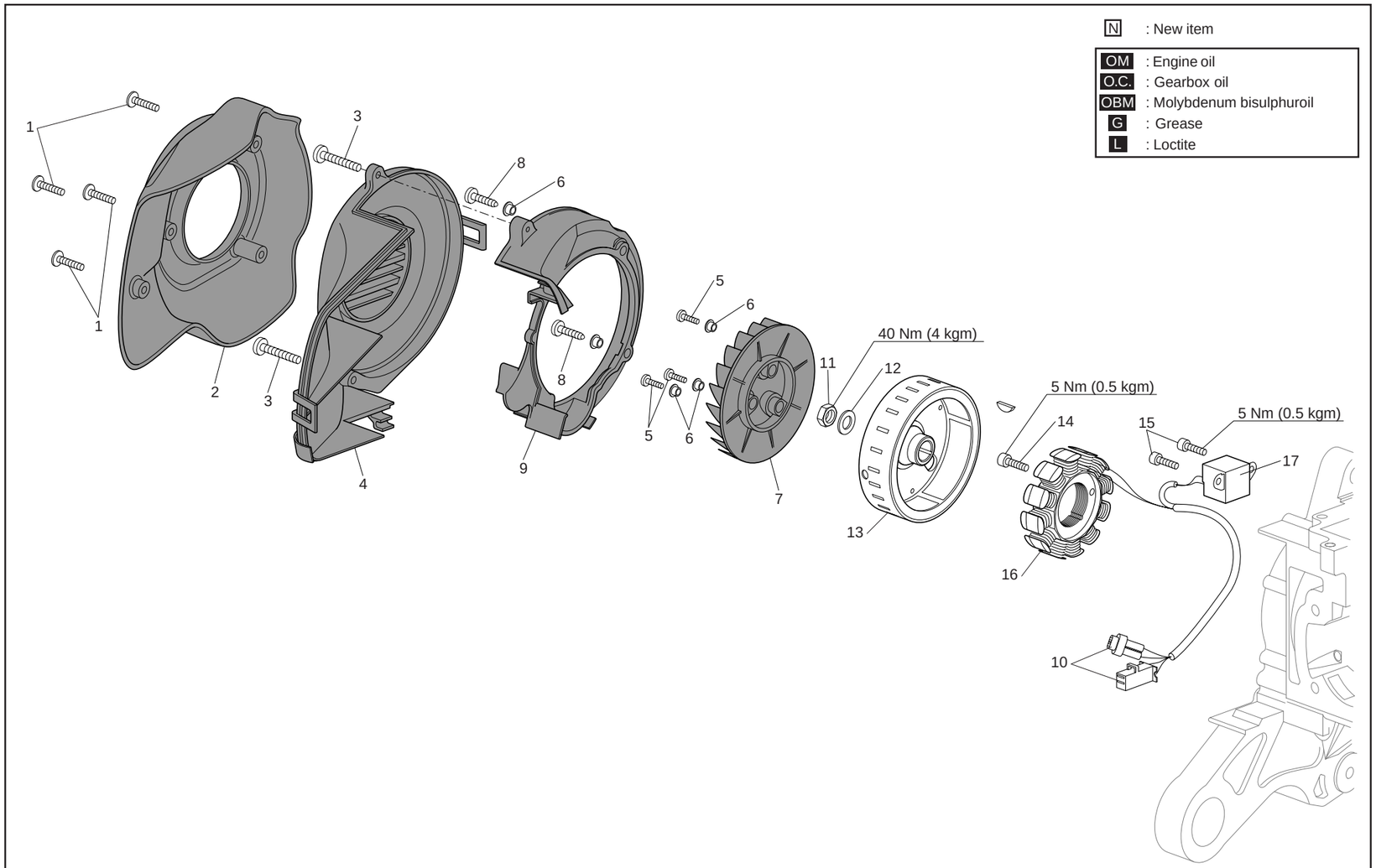
- Remove the 2 locking screw (**35**), the bendix support (**36**) and the bushes (**37**).
- Remove bendix (**38**).

CHECKING WEAR LIMITS

Chart references	Component	Wear limit
9	Drum diameter	Max. diameter: 107.5 mm (original diameter: 107 - 107.2 mm)
11	V-belt	Min. width: 17.4 mm (original width: 18.4 mm)
18	Variator roller	Outer diameter: 16.5 (original diameter: 17 mm)
21	Clutch shoe	Min. thickness: 1 mm (original thickness: 1.8 - 2 mm) measured at the centre of the friction area
22	Limit spring	Min. length: 105 mm (original length: 110 mm)
N.B. 31A - 31B		Items **31A** and **31B** are not interchangeable: each has a separate transmission cover.

REASSEMBLY

Reverse the order of disassembly instructions, making sure tightening torques are correct, and all components requiring grease are greased or, if necessary, replaced with components specified in the table.



DISASSEMBLY SEQUENCE

COOLING UNIT

- Remove the 4 screws (**1**) and aeration cover (**2**).
- Remove the 2 screws (**3**) and fan conveyor (**4**).
- Remove the 3 screws (**5**), retain the T sleeves (**6**) and remove the fan (**7**).
- Remove the 3 screws (**8**) and the base of the fan (**9**).

C.A. GENERATOR

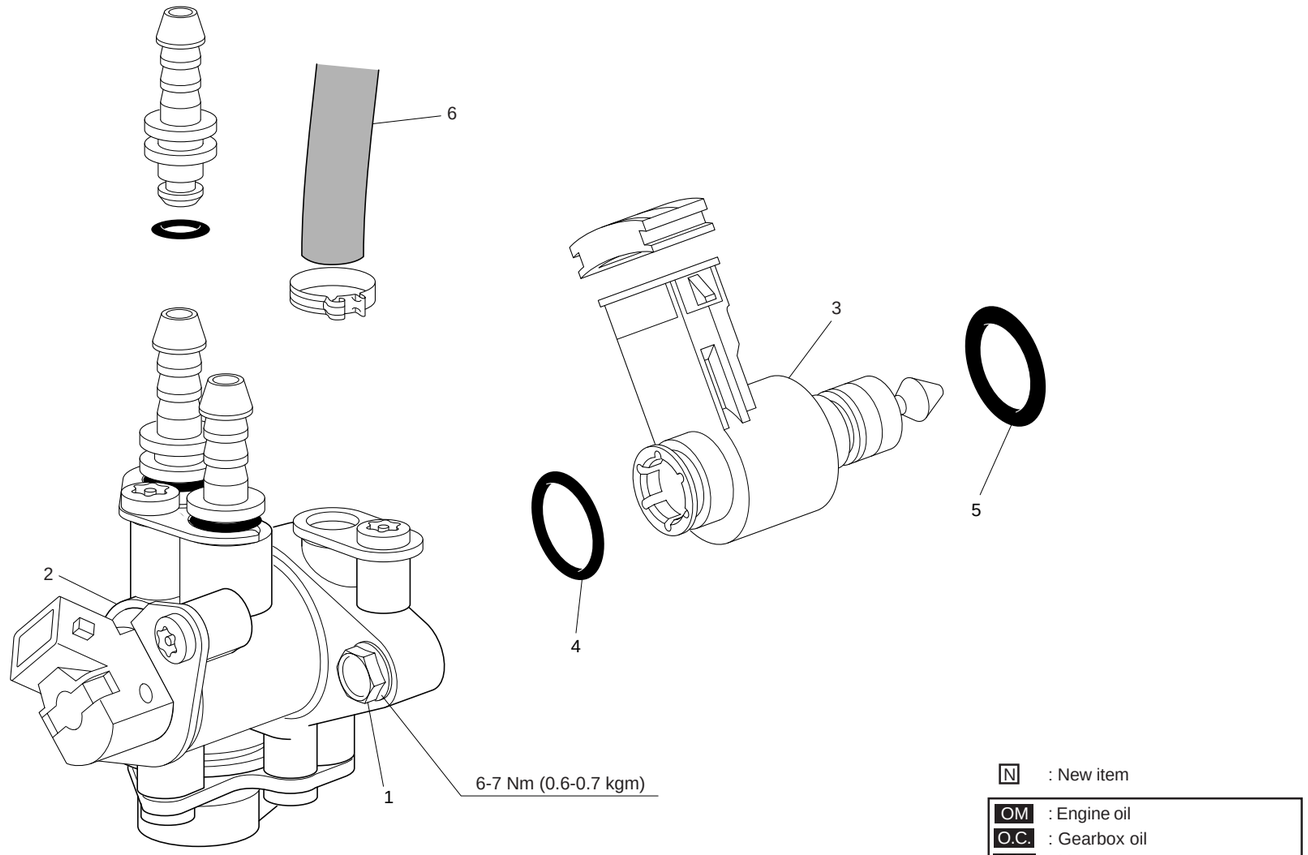
- Disconnect connectors (**10**).
- Remove the rotor nut (**11**) without losing the washer (**12**).
- Remove rotor (**13**).
- Remove the two locking screws of stator plate (**14**) and pick-up (**15**).
- Remove stator (**16**) and pick-up (**17**).

CHECKING WEAR LIMITS

Chart references	Component	Rated values
16	Stator	Yellow-Orange wire R = 265 Ohm ± 20 % at 20° C
		Orange-Earth wire R = 395 Ohm ± 20 % at 20° C
17	Pick-up	Blue-Brown wire R = 385 Ohm ± 20 % at 20° C

REASSEMBLY

Reverse the order of disassembly instructions, making sure tightening torques are correct, and all components requiring grease are greased or, if necessary, replaced with components specified in the table.



N : New item

OM : Engine oil
O.C. : Gearbox oil
OBM : Molybdenum bisulphuroil
G : Grease
L : Loctite

DISASSEMBLY SEQUENCE

INJECTION UNIT

- Empty the fuel tank
- Disconnect the wires
- Remove the 2 flanged screws (**1**).
- Remove the input valve (**2**).
- Remove the air injector using the proper tool (**3**).
- Slide off the O rings (**4**), (**5**).

⚠ **DANGER** ⚠

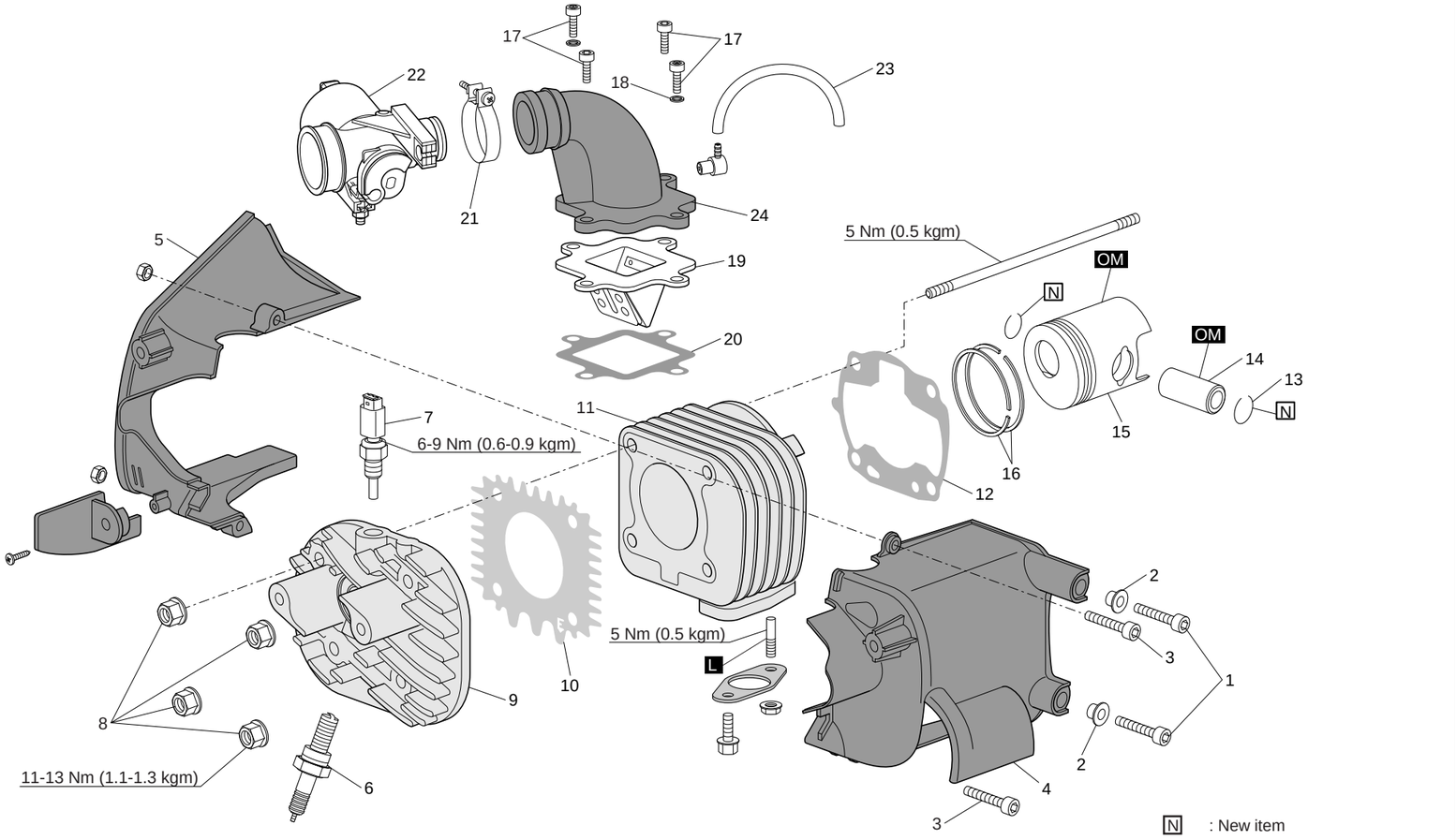
If connector hoses are removed (after removing the clamps), be very careful when refitting the high pressure hose (6) (maximum pressure 8-10 bar).

CHECKING WEAR LIMITS

Chart references	Component	Rated values

REASSEMBLY

Reverse the order of disassembly instructions, making sure tightening torques are correct, and all components requiring grease are greased or, if necessary, replaced with components specified in the table.



DISASSEMBLY SEQUENCE

HEAD - CYLINDER - PISTON

- Remove the 2 screws (**1**), retain the 2 T sleeves (**2**).
- Remove the 2 screws (**3**).
- Remove the LH cylinder cover (**4**) and RH cover (**5**).
- Remove spark plug (**6**) and thermostat (**7**).
- Remove the four tightening head nuts (**8**).
- Remove head (**9**), head gasket (**10**), cylinder (**11**), base gas ket (**12**).
- Remove the pin stop (**13**).
- Slide out pin (**14**) and piston (**15**).
- Remove rings (**16**).

THROTTLE BODY - LAMINAR PACK

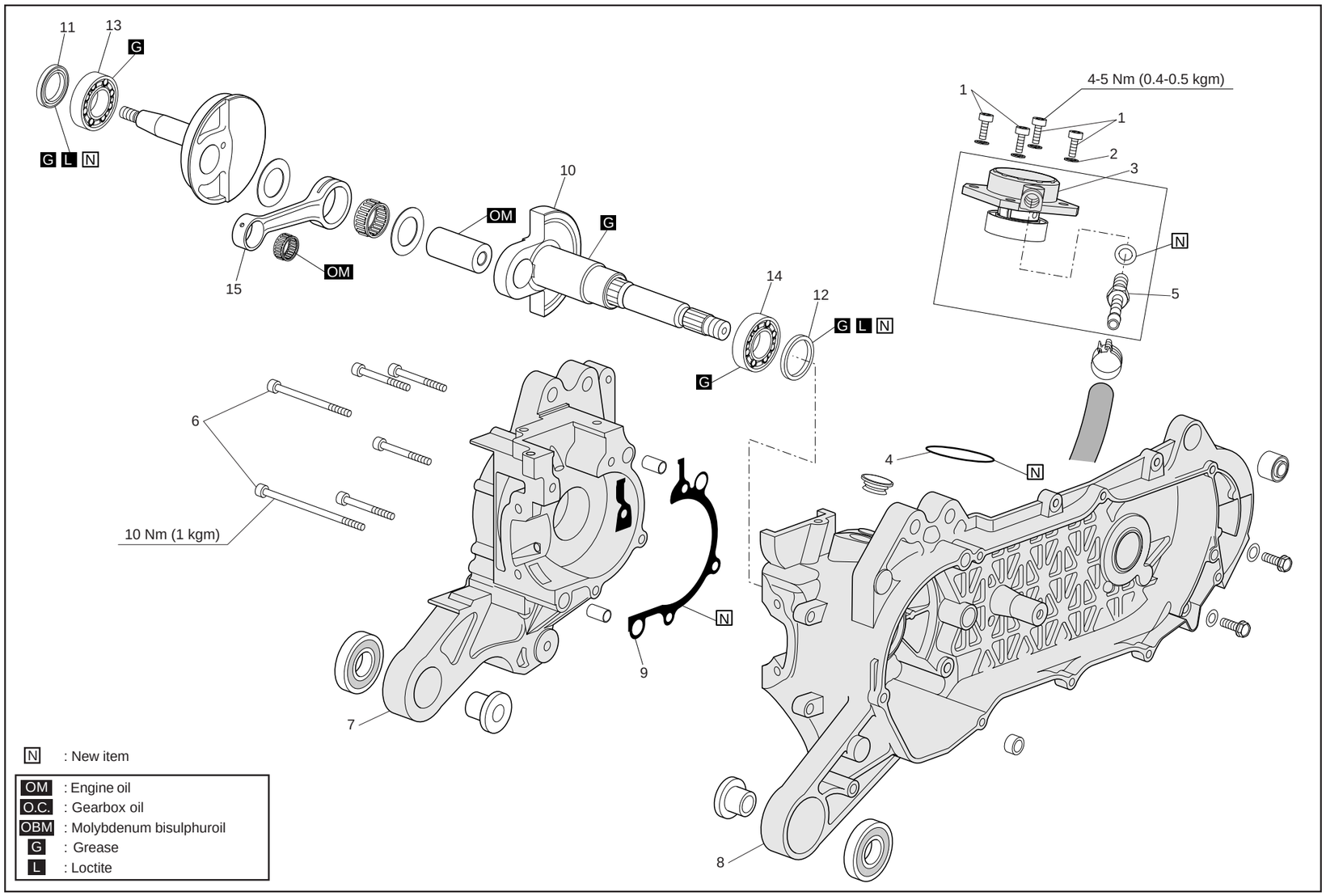
- Remove the 4 screws (**17**) securing the manifold and retain the washers (**18**).
- Slide off the mill pack (**19**) and gaskets (**20**).
- Remove the throttle body hose clamp (**21**).
- Remove the throttle body (**22**).
- Disconnect the oil pump hose (**23**).
- Do not lose the intake manifold (**24**).

CHECKING WEAR LIMITS

Chart references	Component	Wear limit
9	Head	Flatness limit: 0.05 mm
11	Cylinder	Max bore: 41.066 mm
		Min diameter: 40.912 mm
14	Piston pin	Min diameter: 11.98 mm
15	Piston	Piston-cylinder clearance: 0.100 mm
16	Upper ring	End space max: 0.7 mm
	Lower ring	End space max: 0.7 mm
19	Laminar valve	Valve body - laminar element space: 0.2 mm

REASSEMBLY

Reverse the order of disassembly instructions, making sure tightening torques are correct, and all components requiring grease are greased or, if necessary, replaced with components specified in the table.



DISASSEMBLY SEQUENCE

AIR COMPRESSOR

- Remove the 4 screws (**1**) without losing the washers (**2**).
- Remove the compressor (**3**) from the guard.
- Remove the OR (**4**).
- Unscrew the compressor connector (**5**).

COVER AND CRANKCASE

- Remove the six cover screws (**6**).
- Separate the RH half (**7**) from the LH half (**8**) of the cover.
- Remove the gasket (**9**).
- Remove the crankcase (**10**) from the RH half.
- Remove the RH oil guard (**11**) and LH oil guard (**12**).
- Remove the RH (**13**) and LH (**14**) bearing.

⚠ WARNING ⚠

N.B.: Grease the RH (**13**) and LH (**14**) crankshaft main bearings.

CHECKING WEAR LIMITS

Chart references	Component	Wear limit
10	Crankcase	Standard width: 37.95 - 38.10 mm
10	Crankcase	Off-line tolerance 0.03 mm (measured at two opposite points)
10	Crankcase	Connecting rod head side play: 0.85 mm (original: 0.75 mm)
15	Connecting rod	Max diameter connecting rod foot: 16.04 mm (original: 16.003 - 16.011 mm)

REASSEMBLY

Reverse the order of disassembly instructions, making sure tightening torques are correct, and all components requiring grease are greased or, if necessary, replaced with components specified in the table.

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