TECHNICAL INFORMATION 2

TECHNICAL INFORMATION

2

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2.1 IDENTIFICATION DATA

Please supply the frame number when you purchase spare parts.

NOTE Do not obliterate or alter the identification numbers under any circumstance.

This is illegal in all countries.

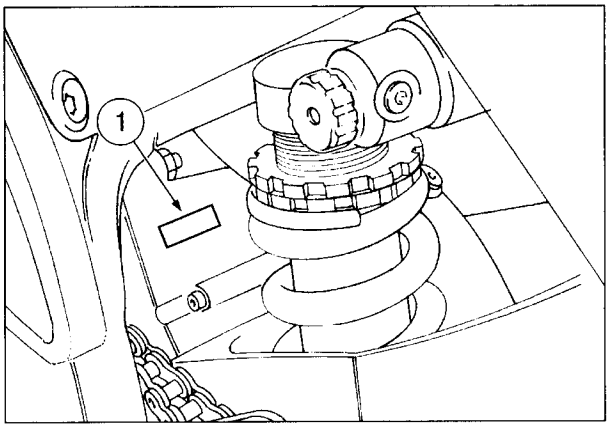
In addition, alteration of the identification numbers invalidates the warranty.

2.1.1 FRAME NUMBER

Consult the corresponding paragraph of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

2.1.2 ENGINE NUMBER

The engine number (1) is stamped on the rear part of the left engine crankcase.



2.2 REGULAR SERVICE INTERVAL CHART

Consult the corresponding chapter in the section 2 (SERVICE AND SETTING UP) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

2.3 SPARE PARTS

For any replacement, use **aprilia** Genuine Spare Parts only.
aprilia Genuine Spare Parts are high-quality parts, expressly designed and manufactured for **aprilia** vehicles.

⚠ CAUTION

Failure to use aprilia Genuine Spare Parts may result in poor performance and damage to your vehicle.

2.4 TECHNICAL DATA

DIMENSIONS
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

ENGINE	
Model	V990
Type	60° longitudinal V-type, two-cylinder, 4-stroke, with 4 valves per cylinder, DOHC.
Number of cylinders	2
Total displacement RSV RSV R (vehicles up to year 2000)	60.88 cu in (997.60 cm³)
Total displacement RSV RSV R (vehicles year 2001 and later)	60.90 cu in (998.00 cm³)
Total displacement SL (vehicles up to year 2000)	60.88 cu in (997.60 cm³)
Total displacement SL (vehicles year 2001 and later)	60.90 cu in (998.00 cm³)
Total displacement RST	60.88 cu in (997.62 cm³)
Total displacement ETV	60.90 cu in (998.00 cm³)
Max. rated power (to crankshaft)	86.5 kW (116 HP) at 9,250 rpm
Max. torque	67.3 ftlb (93 Nm) at 7,000 rpm
Bore/stroke	3.82 in/2.66 in (97.00 mm/67.50 mm)
Compression ratio RSV RSV R (vehicles up to year 2000)	11.4 ± 0.5 : 1
Compression ratio RSV RSV R (vehicles year 2001 and later)	11.8 ± 0.5 : 1
Compression ratio SL (vehicles up to year 2000)	11.4 ± 0.5 : 1
Compression ratio SL (vehicles year 2001 and later)	11.8 ± 0.5 : 1
Compression ratio RST	11.8 ± 0.5 : 1
Compression ratio ETV	10.4 ± 0.5 : 1
Average piston speed	22.5 m/s at 10000 rpm
Camshaft during intake stroke RSV RSV R (vehicles up to year 2000)	262°, valve lifting: 0.42 in (10.60 mm)
Camshaft during exhaust stroke RSV RSV R (vehicles up to year 2000)	259°, valve lifting: 0.42 in (10.60 mm)
Camshaft during intake stroke RSV RSV R (vehicles year 2001 and later)	262°, valve lifting: 0.45 in (11.40 mm)
Camshaft during exhaust stroke RSV RSV R (vehicles year 2001 and later)	259°, valve lifting: 0.42 in (10.60 mm)
Camshaft during intake stroke SL (vehicles up to year 2000)	262°, valve lifting: 0.42 in (10.60 mm)
Camshaft during exhaust stroke SL (vehicles up to year 2000)	259°, valve lifting: 0.42 in (10.60 mm)
Camshaft during intake stroke SL (vehicles year 2001 and later)	262°, valve lifting: 0.45 in (11.40 mm)
Camshaft during exhaust stroke SL (vehicles year 2001 and later)	259°, valve lifting: 0.42 in (10.60 mm)
Camshaft during intake stroke RST	259°, valve lifting: 0.42 in (10.60 mm)
Camshaft during exhaust stroke RST	259°, valve lifting: 0.42 in (10.60 mm)
Camshaft during intake stroke ETV	242°, valve lifting: 0.37 in (9.50 mm)

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ENGINE	
Camshaft during exhaust stroke ETV	242°, valve lifting: 0.37 in (9.50 mm)
Valve advance (with valve clearance 1 mm) RSV RSV R	– opening during intake stroke: 20° before **TDC** – closing during intake stroke: 62° after **BDC** – opening during exhaust stroke: 64° before **TDC** – closing during exhaust stroke: 15° after **BDC**
Valve advance (with valve clearance 1 mm) SL	– opening during intake stroke: 20° before **TDC** – closing during intake stroke: 62° after **BDC** – opening during exhaust stroke: 64° before **TDC** – closing during exhaust stroke: 15° after **BDC**
Valve advance (with valve clearance 1 mm) RST	– opening during intake stroke: 20° before **TDC** – closing during intake stroke: 59° after **BDC** – opening during exhaust stroke: 64° before **TDC** – closing during exhaust stroke: 15° after **BDC**
Valve advance (with valve clearance 1 mm) ETV	– opening during intake stroke: 25° before **TDC** – closing during intake stroke: 37° after **BDC** – opening during exhaust stroke: 57° before **TDC** – closing during exhaust stroke: 5° after **BDC**
Valve clearance (with engine cold)	0.005 – 0.006 in (0.12 – 0.17 mm) [intake] - 0.009 – 0.011 in (0.23 – 0.28 mm) [exhaust]
Diameter of the inlet valve plate RSV RSV R (vehicles up to year 2000)	1.42 in (36.0 mm)
Diameter of the exhaust valve plate RSV RSV R (vehicles up to year 2000)	1.22 in (31.0 mm)
Diameter of the inlet valve plate RSV RSV R (vehicles year 2001 and later)	1.50 in (38.0 mm)
Diameter of the exhaust valve plate RSV RSV R (vehicles year 2001 and later)	1.22 in (31.0 mm)
Diameter of the inlet valve plate SL (vehicles up to year 2000)	1.42 in (36.0 mm)
Diameter of the exhaust valve plate SL (vehicles up to year 2000)	1.22 in (31.0 mm)
Diameter of the inlet valve plate SL (vehicles year 2001 and later)	1.50 in (38.0 mm)
Diameter of the exhaust valve plate SL (vehicles year 2001 and later)	1.22 in (31.0 mm)
Diameter of the inlet valve plate RST	1.42 in (36.0 mm)
Diameter of the exhaust valve plate RST	1.22 in (31.0 mm)
Diameter of the inlet valve plate ETV	1.42 in (36.0 mm)
Diameter of the exhaust valve plate ETV	1.22 in (31.0 mm)
Engine idling rpm RSV RSV R	1,250 ± 100 rpm CO 1% [+1% – 0.5% (total range from 0.5% to 2%)]
Engine idling rpm SL	1,250 ± 100 rpm CO 1% [+1% – 0.5% (total range from 0.5% to 2%)]
Engine idling rpm RST	1,250 ± 100 rpm CO 1% [+1% – 0.5% (total range from 0.5% to 2%)]
Engine idling rpm ETV	1,340 ± 100 rpm CO 1% [+1% – 0.5% (total range from 0.5% to 2%)]
Engine revolutions at peak rpm RSV RSV R (vehicles up to year 2000)	10,250 ± 100 rpm
Engine revolutions at peak rpm RSV RSV R (vehicles year 2001 and later)	10,500 ± 100 rpm
Engine revolutions at peak rpm SL (vehicles up to year 2000)	10,250 ± 100 rpm

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ENGINE	
Engine revolutions at peak rpm SL (vehicles year 2001 and later)	10,500 ± 100 rpm
Engine revolutions at peak rpm RST	10,500 ± 100 rpm
Engine revolutions at peak rpm ETV	8,750 ± 100 rpm
Ignition	electronically controlled
Ignition timing	21.8° ± 2° at 2,800 rpm
Starting	electric
Spark advance	At start: 5° before **TDC**, additional advance depending on specific consumption levels
Starter motor gear ratio	i= 49/9 * 30/11 * 64/30 = 31.677
Clutch	multidisc in oil bath, with hydraulic control on the left side of the handlebar and PPC device - # 9 lined discs; thick 0.14 in (3.5 mm) - # 10 internal discs; thick 0.06 in (1.5 mm)
Gear	mechanical, 6 gears with foot control on the left side of the engine
Lubrication system	dry pan with separate oil tank, 2 trochoidal pumps and cooling radiator
Lubrication pressure	min 72.5 in (500 kP) (5 bar) at max 80 °C (176 °F) and 6,000 rpm
Air cleaner	with dry filter cartridge
Cooling	liquid-cooled
Coolant pump gear ratio	i_{wp}= 28/27 * 28/28 = 1.037
Coolant pump delivery (with thermal expansion valve open)	23.8 Us gal/min (90 ℓ/min) and 9,000 rpm
Thermal expansion valve opening start temperature	65 ± 2 °C (149 ± 5 °F)
Engine dry weight	~ 143 lb (65 kg)

CAPACITY	
Engine oil	oil renew 3.91 US qt (3,700 cm³) – oil and oil filter renew 4.12 US qt (3,900 cm³)
For further technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).	

DRIVE RSV RSV R					
GEAR RATIOS	Ratio	Primary	Secondary	Final ratio	Total ratio
	1 st	31/60 = 1 : 1.935	14/35 = 1 : 2.500	17/42 = 1 : 2.470	11.948
	2 nd		16/28 = 1 : 1. 750		8.368
	3 rd		19/26 = 1 : 1. 368		6.543
	4 th		22/24 = 1 : 1. 091		5.216
	5 th		23/22 = 1 : 0. 957		4.573
	6 th		27/23 = 1 : 0. 852		4.073
For further technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).					

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DRIVE SL

GEAR RATIOS	Ratio	Primary	Secondary	Final ratio	Total ratio
	1 st	31/60 = 1 : 1.935	14/35 = 1 : 2.500	16/41 = 1 : 2.563	12.399
	2 nd		16/28 = 1 : 1.750		8.679
	3 rd		19/26 = 1 : 1.368		6.787
	4 th		22/24 = 1 : 1.091		5.411
	5 th		23/22 = 1 : 0.957		4.744
	6 th		27/23 = 1 : 0.852		4.225

For further technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

DRIVE RST

GEAR RATIOS	Ratio	Primary	Secondary	Final ratio	Total ratio
	1 st	31/60 = 1 : 1.935	14/35 = 1 : 2.500	16/43 =1 : 2.687	13.000
	2 nd		16/28 = 1 : 1.750		9.102
	3 rd		19/26 = 1 : 1.368		7.117
	4 th		22/24 = 1 : 1.091		5.674
	5 th		23/22 = 1 : 0.957		4.975
	6 th		27/23 = 1 : 0.852		4.431

For further technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

DRIVE ETV

GEAR RATIOS	Ratio	Primary	Secondary	Final ratio	Total ratio
	1 st	31/60 = 1 : 1.935	14/35 = 1 : 2.500	17/45 = 1 : 2.647	12.804
	2 nd		16/28 = 1 : 1.750		9.041
	3 rd		19/26 = 1 : 1.368		7.006
	4 th		22/24 = 1 : 1.091		5.582
	5 th		23/22 = 1 : 0.957		4.896
	6 th		27/23 = 1 : 0.852		4.358

For further technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FUEL SYSTEM

For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FRAME

For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

SUSPENSIONS

For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

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BRAKES
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

WHEEL RIMS
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FRONT TIRE
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

REAR TIRE
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

SPARK PLUGS	
Number per cylinder	2
Standard	NGK R DCPR9E
Spark plug gap	0.024 – 0.028 in (0.6 – 0.7 mm)
Resistance	5 kΩ

ELECTRIC SYSTEM
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

BULBS
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

WARNING LIGHTS
For this technical data consult the corresponding voice in the chapter (TECHNICAL DATA) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

2.5 LUBRICANT CHART

Consult the corresponding chapter of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL) or the specific use and maintenance book, see 0.4.4 (USE AND MAINTENANCE BOOK).

2.6 CONSUMABLES

Only use the products given below for any maintenance work. The materials mentioned have been tested for many years and are suitable for all the application conditions indicated by the manufacturer.

NOTE The consumables, which are coded, are available on application, see 2.6.2 (USE OF CONSUMABLES).

2.6.1 PRODUCT PROPERTIES

aprilia part# (product)	Use and properties
– **aprilia** part# 0897651 [LOCTITE® 243 blue 0.34 fl oz (10 cm³)] 	Thread locker for screws and nuts up to M36, and to seal connections for fluids, medium strength. It can be used on parts which have not been completely degreased. The hardening time depends on the temperature and the material (maximum one hour). Resistance to temperatures in the range -55 to 150 °C (-131 °F to 302 °F).
– **aprilia** part# 0898011 (fluorescent green LOCTITE® 275). 	It prevents the loosening of the threaded components and the fluid leakages due to vibrations. It must be used on clean,degreased and non-oxidized components. Apply a quantity sufficient to cover all the threaded part.
– **aprilia** part# 0899788 [LOCTITE® 648 green 0.17 oz (5 g)] 	High strength thread locker for screw threads. The hardening time depends on the temperature and the material (maximum twelve hours). Resistance to temperatures in the range -55 to 175 °C (-131 °F to 347 °F). To remove nuts that have been fastened with Loctite 648, it may be necessary to heat the assembled parts to a temperature of 250 °C (482 °F).
– **aprilia** part# 0899784 (LOCTITE® 574 orange) 	Solvent-free joint cement, to be used instead of gaskets where components are held firmly together, and where a precise distance is required between the two components. Applied in its liquid state, it hardens after assembly on contact with the metal within a few hours. A seal is created whose surface structure adapts to the surfaces to be sealed. Resistance to temperatures in the range -55 to 200 °C (-131 °F to 392 °F); where applied, it seals the surfaces against corrosion.
– **aprilia** part# 8116067 (LOCTITE® 8150) 	Paste to be used on components subjected to high temperature.
– **aprilia** part# 0297434 (LOCTITE® 767 Anti Seize 15378) 	Lubricant and anti-corrosive, resistant to high temperatures. Sprayed on both components, it ensures low sliding friction and maintenance-free operation for a long period. It also prevents corrosion.
– **aprilia** part# 0297433 [MOLYKOTE® G-N 1.76 oz (50 g)] 	Lubricating grease, used on connections and bearings subject to heavy loads, and to lubricate threads and connections which are heavily torqued, in order to prevent corrosion, which would prevent subsequent disassembly. To be applied to both joining surfaces.
– **aprilia** part# 0297386 [SILASTIC 732 RTV 3.53 oz (100 g)] 	Silicone rubber sealant, used to prevent water from getting inside the alternator cover.

2.6.2 USE OF CONSUMABLES

For the description of use unintentionally omitted in these tables, and for further information refer to the use of consumables, see 0.4.2 (SPARE PARTS CATALOGUE).

aprilia part# (product)	Description of use
– **aprilia** part# 8116050 (engine oil) (*)	– On timing intermediate gear roller bearings. – On lower balanceshaft thrust washer. – Clutch disengaging shaft. – On valve stems and valve lifter buckets. – On valve guide oil seals. – On camshaft housings. – On the timing chain tightener. – On double starter gear and idler gear pins. – On the sprag clutch gear/sprag clutch contact surface. – On the sprag clutch inner contact surface. – On piston, piston rings and piston rings grooves. **For the description of use referred to vehicle components consult the corresponding voice in the chapter (USE OF CONSUMABLES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).**
– **aprilia** part# 0897651 [LOCTITE® 243 blue 0.34 fl oz (10 cm³)] (**)	– On coolant pump center fastening screw. – On cylinder joining bracket fastening screws. – On engine half-case bearing lock screws. – On cylinder fastening stud bolts (engine half-case side). – RSV RSV R SL On crankshaft position sensor fastening screws. – On camshaft position sensor fastening screws. – RST ETV On crankshaft position sensor fastening screw. – On index lever and plate fastening screws. – On crankshaft fastening nut. – On timing gear fastening screws. – On upper balanceshaft balanceweight fastening nut. – On intermediate timing gear bearing support lower fastening screw. – On thread of coolant manifold plug, on rear cylinder "2". – On thread of engine oil pressure sensor. – On stator fastening screws. **For the description of use referred to vehicle components consult the corresponding voice in the chapter (USE OF CONSUMABLES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).**
– **aprilia** part# 0898011 (fluorescent green LOCTITE® 275) (**)	– On thread of coolant union coupling, on cylinders.
– **aprilia** part# 0899784 (LOCTITE® 574 orange) (**)	– On neutral gear switch contact screw. – On both surfaces of the engine oil pump. – On cylinder base where it contacts the engine case. – On thread of the engine oil union coupling, on the rear cylinder "2". **For the description of use referred to vehicle components consult the corresponding voice in the chapter (USE OF CONSUMABLES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).**

(*) = see 2.5 (LUBRICANT CHART).

(**) = see 2.6.1 (PRODUCT PROPERTIES).

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aprilia part# (product)	Description of use
– **aprilia** part# 0899788 [LOCTITE® 648 green 0.17 oz (5 g)] (**)	– On coolant pump idler gear pin. – On engine oil pump cap. – On spring-support plate/clutch gear/clutch housing fastening screws. – On clutch gear metal slip fastening screws. – Assembly sprag clutch flange/alternator rotor. – On clutch housing fastening nut. – On lower balanceshaft balanceweight fastening screw. – On sprag clutch flange/alternator rotor fastening screws. – On alternator rotor inner taper. – On flywheel fastening screw. – On the flat surface of the sprag clutch flange before to place it in the center of the alternator rotor. – On thread (side cylinder) of exhaust pipes studs.
– **aprilia** part# 8116067 (LOCTITE® 8150) (**)	**For the description of use referred to vehicle components consult the corresponding voice in the chapter (USE OF CONSUMABLES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).**
– **aprilia** part# 0897330 (multi-purpose grease bp lz.)	– On the thrust washer of the oil pump intermediate drive gear. – On the oil seal of the upper balanceshaft bearing. **For the description of use referred to vehicle components consult the corresponding voice in the chapter (USE OF CONSUMABLES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).**
– **aprilia** part# 0297434 (LOCTITE® 767 Anti Seize 15378) (**)	– On main shaft and countershaft. – On main shaft and countershaft housings. – On crankshaft and lower balanceshaft. – On the main shaft housing and spline.
– **aprilia** part# 0297433 [MOLYKOTE® G-N 1.76 oz (50 g)] (**)	– On main bushing housings. – On main bushings. – On engine case bearing housings. – On coolant pump shaft. – On valve guide recesses in the head. – On valve guide edges. – Valve lifter buckets/camshaft cams contact surface. – On crankshaft and lower balanceshaft bushing housings. – On crankshaft and lower balanceshaft housings. – On connecting rod/piston pin bores. – On camshafts cams. – On starter motor fastening housing.
– **aprilia** part# 0297386 [SILASTIC 732 RTV 3.53 oz (100 g)] (**)	– On cable bracket on alternator cover. – On camshaft sensor cable guide. – RST On contact surfaces of plastic plug with the front cylinder "1".
– **aprilia** part# 8116053 (Bimol Grease 481)	– On intermediate timing gear thrust washer. – Lower balanceshaft oil seal. – Starter motor gear. **For the description of use referred to vehicle components consult the corresponding voice in the chapter (USE OF CONSUMABLES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).**

(**) = see 2.6.1 (PRODUCT PROPERTIES).

2.7 SPECIAL TOOLS OPT

In order to perform assembly, reassembly and settings correctly, special tools suitable for the task must be used. The use of special tools avoids the potential risk of damage as a result of inappropriate tools and/or improvised methods.
Below is a list of the special tools designed especially for this specific engine.
When ordering generic special tools, refer to the special tools manual.

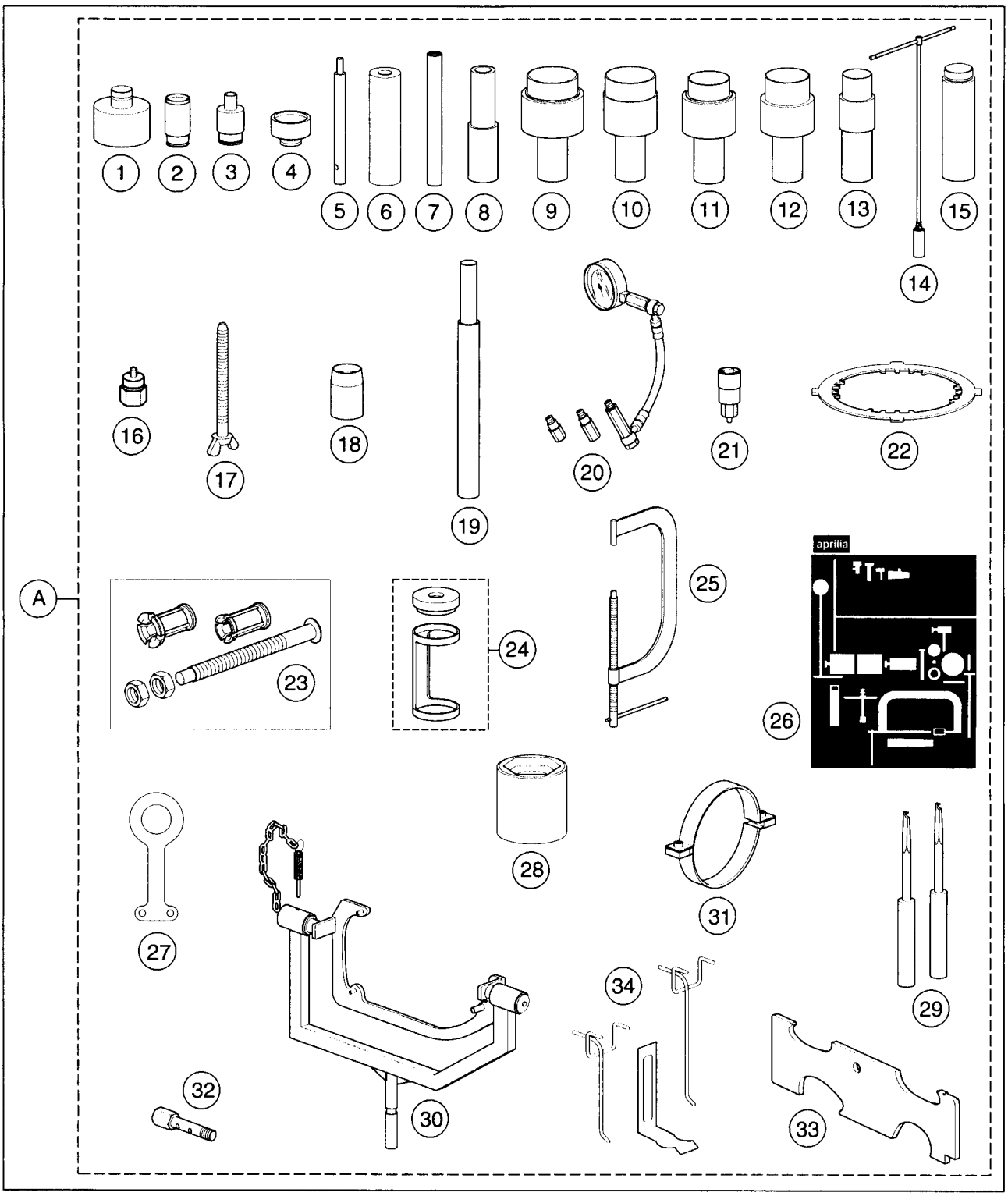
⚠ CAUTION

Before using the special tools, consult any documents attached.

⚠ WARNING

Do not attempt to use makeshift tools to work on this engine. To do so will not only ensure that you damage the engine, sometimes irreparably, but you will also hurt yourself. Failure to use special tools will certainly lead to injury to the mechanic.

2.7.1 ENGINE TOOLS OPT



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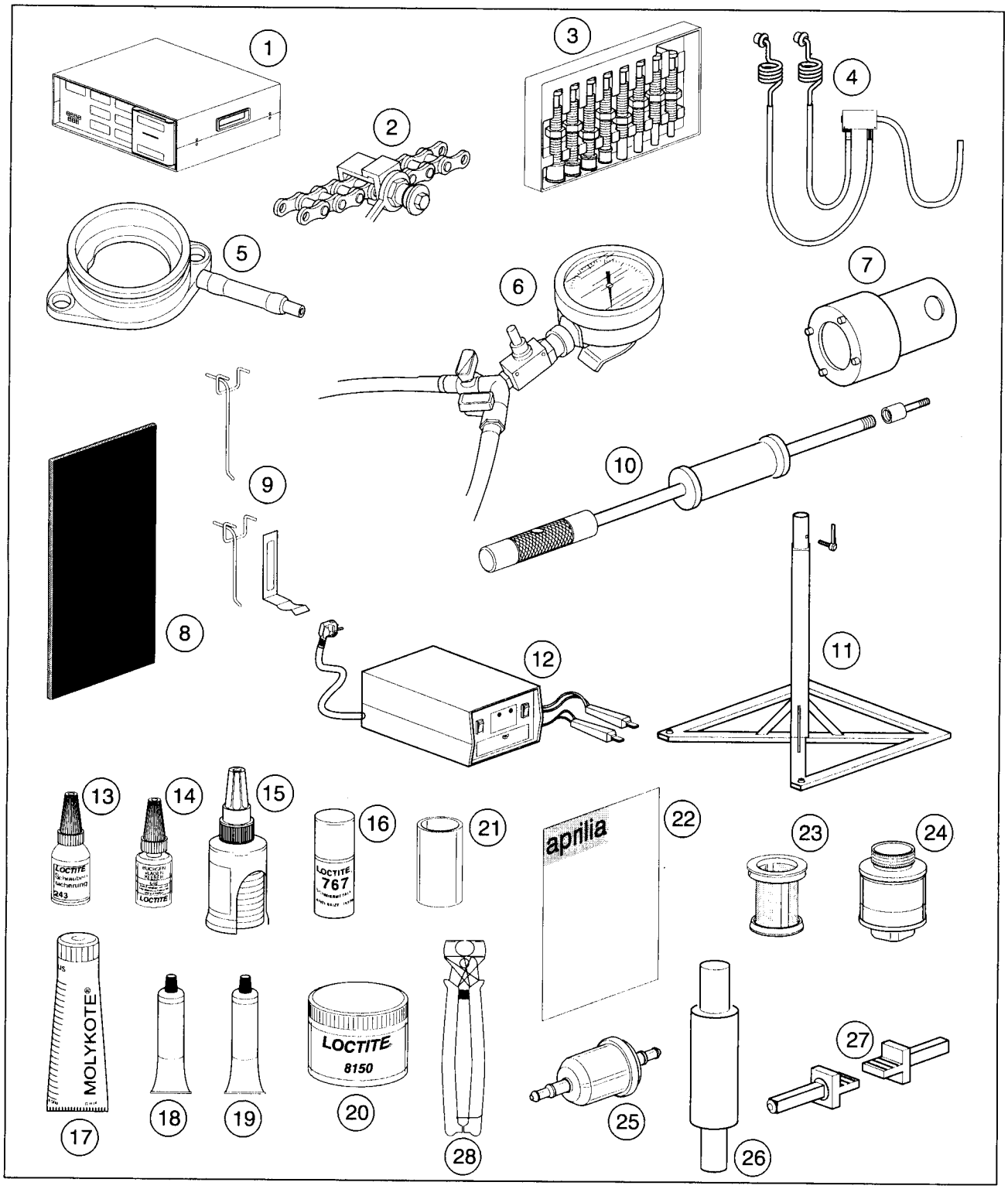
Pos.	– aprilia part# (tool description and function)	Note
A	– **8140175** (complete tool kit for engine)	–
1	– **0277680** (countershaft oil seal assembly drift)	✕
2	– **0277660** (upper balanceshaft oil seal assembly drift)	✕
3	– **0277670** (coolant pump shaft housing oil seal assembly drift)	✕
4	– **0877257** (coolant pump shaft housing sliding ring assembly drift)	✕
5	– **0277510** (valve guide disassembly drift)	✕
6	– **0277210** (valve guide assembly drift)	✕
7	– **0277695** (valve guide oil seal assembly drift)	✕
8	– **8140155** (main shaft oil seal-clutch shaft oil seal assembly drift)	✕
9	– **0277725** (crankshaft bushing inserter drift)	✕
10	– **0277720** (crankshaft sleeve puller drift)	✕
11	– **0277537** (upper balanceshaft bushing inserter drift)	✕
12	– **0277727** (crankshaft-clutch cover bushing inserter drift)	✕
13	– **0277729** (lower balanceshaft bushing inserter drift)	✕
14	– **8140177** (cap socket spanner)	●
15	– **0277252** (tool for removal alternator cover)	✕
16	– **0277730** (alternator rotor removal hexagonal bolt)	✕
17	– **0240880** (threaded bolt for retaining the crankshaft at **TDC**)	✕
18	– **0277308** (countershaft guide bushing)	✕
19	– **8140178** (piston pin disassembly and reassembly drift)	✕
20	– **8140181** (fuel-oil pressure gauge)	●
21	– **8140182** (alternator rotor bolt removal bushing)	✕
22	– **0277881** (clutch locking tool)	✕
23	– **8140156 + 8140157 + 0276377** (clutch cover sleeve puller)	✕
24	– **0276479** (valves spring-pusher tool)	✕
25	– **8140179** (valves disassembly and reassembly clamp)	✕
26	– **8157143** (adhesive for tool holder panel)	–
27	– **8140183** (engine lifting eye hook)	●
28	– **8140184** (primary transmission nut disassembly bushing)	✕
29	– **8140185** (clutch disc extraction hook lever)	✕
30	– **8140188** (engine support)	●
31	– **8140186** (piston ring compression tool)	✕
32	– **8140197** (banjo screw for fuel pressure test)	●
33	– **8140205** (camshaft template tool)	✕
34	– **8140426** (panel hooks)	–

✕ = Special tools required in order to perform some operations described in this manual.
● = Special tools required to perform some operations described in the specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

2.7.2 MISCELLANEOUS TOOLS OPT



Pos.	– **aprilia part# (tool description and function)**	Note
1	– **8140196** (exhaust gas analyzer)	●
2	– **8140192** (chain disassembly/reassembly tool)	●
3	– **8140180** (kit for installing and removing bearings)	●
4	– **8140202** (exhaust gas analyzer tube kit)	●
5	– **8140267** (intake manifold for vacuum gauge)	●
6	– **8140256** (vacuum gauge)	●
7	– **8140424** (key for Ohlins fork)	●
8	– **8140199** (tool holder panel)	–

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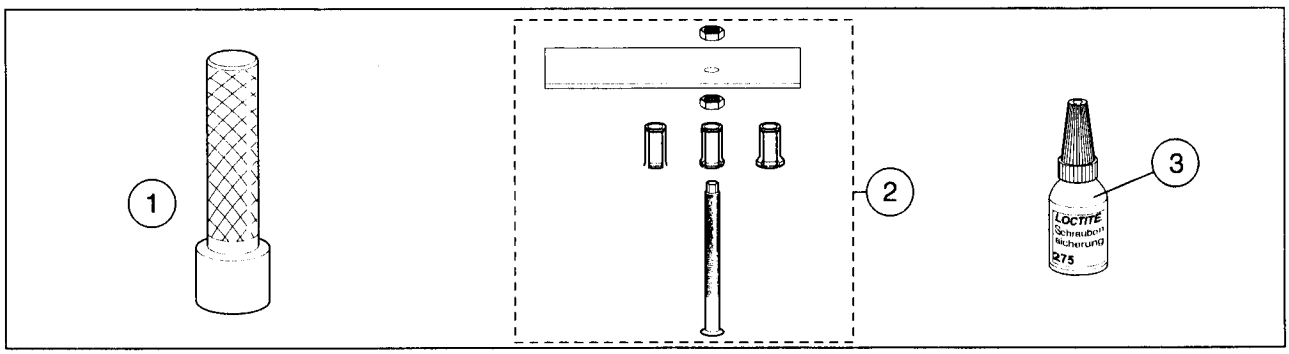
Pos.	– aprilia part# (tool description and function)	Note
9	– **8140426** (panel hooks)	–
10	– **8140432** (head extractor)	●
11	– **8140187** (engine support stand)	●
12	– **8124838** (battery charger M.F.)	●
13	– **0897651** [LOCTITE® 243 blue 0.34 fl oz (10 cm³)]	●
14	– **0899788** [LOCTITE® 648 green 0.17 oz (5 g)]	✕
15	– **0899784** (LOCTITE® 574 orange)	●
16	– **0297434** (LOCTITE® 767 Anti Seize 15378)	✕
17	– **0297433** [MOLYKOTE® G-N 1.76 oz (50 g)]	✕
18	– **0897330** (multi-purpose grease bp lz.)	●
19	– **0297386** [SILASTIC 732 RTV 3.53 oz (100 g)]	✕
20	– **8116067** (LOCTITE® 8150)	●
21	– **8140395** [particulate filter for: **aprilia** part# 8140196 (exhaust gas analyzer)]	●
22	– **8202222** (generic panel sticker)	–
23	– **8140396** (tabular net filter for: **aprilia** part# 8140196 (exhaust gas analyzer)]	●
24	– **8140397** (oxygen sensor for: **aprilia** part# 8140196 (exhaust gas analyzer)]	●
25	– **8140398** (air intake net filter for: **aprilia** part# 8140196 (exhaust gas analyzer)]	●
26	– **8140074** (lower balanceshaft bushing extractor drift)	✕
27	– **8140204** (support for rear stand)	–
28	– **0277295** (click clamp installation pliers)	●

✕ = Special tools required in order to perform some operations described in this manual.
● = Special tools required to perform some operations described in the specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

2.7.3 FURTHER aprilia VEHICLES TOOLS OPT



Pos.	– aprilia part# (tool description and function)	Note
1	– **0877650** (handle for drift)	✕
2	– **0277265** (balanceshaft bearings - main shaft bearings - countershaft bearings, puller)	✕
3	– **0898011** (fluorescent green LOCTITE® 275)	✕
–	– **8116050** (engine oil)	●
–	– **8116053** (MP Bimol Grease 481)	●
–	– **8116038** (LUBERING ST grease)	●
–	– **xxxxxxx N.A.** (AP-LUBE temporary lubricant)	●
–	– **xxxxxxx N.A.** (DID CHAIN LUBE grease)	●
–	– **8116031** ("Biosolvent" frame detergent)	●
–	– **8116945** ("ACRILON 28" cyanoacrylic glue)	●
–	– **xxxxxxx N.A.** (MOTUL MOTOWASH degreaser)	●
–	– **8116043** (ANTI-SEIZE MOTAGEPASTE AS 1800 antiscuff paste)	●
–	– **xxxxxxx N.A.** (Alcohol)	●

xxxxxxx N.A. = Not available
✕ = Special tools required in order to perform some operations described in this manual.
● = Special tools required to perform some operations described in the specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

2.8 FASTENERS

Carefully read 1.3.10 (FASTENERS TIGHTENING TORQUES).

2.8.1 JOINTS WITH CLICK CLAMPS AND WITH SCREW-TYPE CLAMPS

⚠ CAUTION

Remove ONLY the clamps indicated in the maintenance procedures.
The following text does not authorize the arbitrary removal of the clamps present on the engine.

⚠ WARNING

Before removing a clamp, make sure that the removal does not cause any fluid leakage; if so, provide for preventing such leakages and protect the parts placed around the joint.

CLICK CLAMPS

For the removal it is sufficient to use simple pliers, while for the installation a special tool is required (see below).

Before removing a clamp, prepare the material necessary for the correct installation of the new clamp.

NOTE Have the appropriate special tool OPT available:
– **aprilia** part# 0277295 (click clamp installation pliers).

⚠ CAUTION

Upon installation, replace the click clamp that has been removed with a new click clamp having the same dimensions, see 0.4.2 (SPARE PARTS CATALOGUE).

Do not attempt to reinstall the removed click clamp, since it is unusable.
Do not replace the removed click clamp with a screw-type clamp or with other types of clamps.

⚠ CAUTION

Proceed with care, in order not to damage the joint components.

- Work with the pliers on the head of the click clamp, forcing until you release it.

SCREW-TYPE CLAMPS

For the removal and installation it is sufficient to use a simple screwdriver.

⚠ CAUTION

Check the conditions of the screw-type clamp and if necessary replace it with a new screw-type clamp of the same dimensions, see 0.4.2 (SPARE PARTS CATALOGUE).
When fastening the screw-type clamp, make sure that the joint is sufficiently stable.

2.8.2 GENERAL VALUES OF TIGHTENING TORQUES

The following table shows tightening torques for screws and bolts with metric ISO threads, as is used in this engine. These are general values to be used if no specific value is given in this manual or other **aprilia** service literature.

Screw or bolt thread	Wrench	Tightening torque	
		ftlb	(Nm)
M 6	10	4.34	6
M 8	12	10.84	15
M 10	14	21.70	30
M 12	17	39.79	55
M 14	19	61.49	85
M 16	22	94.03	130

If not otherwise indicated, the tightening torques shown should be used for clean and dry threads, at room temperature.

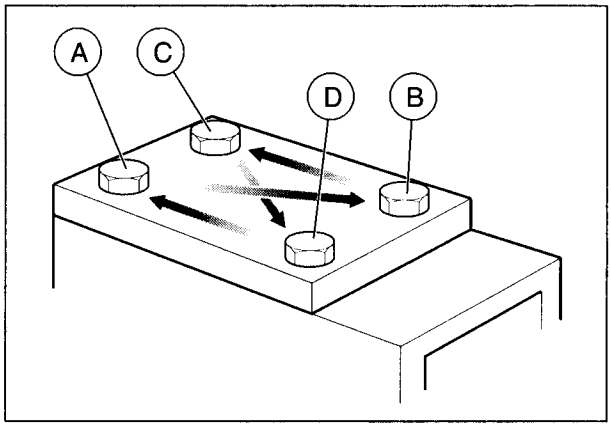
NOTE To avoid damage to the threads, tighten screws and bolts as follows:

- Run up the fasteners finger tight.
- Applying half the prescribed tightening torque, tighten the fasteners that are diametrically opposite each other: (A) and (B); (C) and (D).
- Repeat, applying the prescribed tightening torque.

NOTE In this way the pressure exerted by the fasteners will be uniformly distributed on the joint surface.

Steel/aluminum fastening screws with similar coefficient of elasticity:

Screw	ftlb	Nm
M4	2.2	3
M5	4.4	6
M6	8.7	12
M8	18	25
M10	36	50
M12	58	80



2.8.3 SPECIFIC VALUES OF TIGHTENING TORQUES

⚠ CAUTION

The fasteners featured in the table must be torqued to specification using a torque spanner and LOCTITE® applied, where indicated.

Notes:
L243 = fasten with LOCTITE® 243
L572 = fasten with LOCTITE® 572
L574 = fasten with LOCTITE® 574
L648 = fasten with LOCTITE® 648

ENGINE
Engine/Frame Fasteners
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

Engine Fasteners					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Engine oil inlet flange	2	M6	8.7	12	–
For further fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).					

Crankcase					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Grooved ball bearings for selector roller/[alternator side (MS)] case	1	Flat-head screw M6x13	8	11	L243
Grooved ball bearings for selector roller/[clutch side (KS)] case	1	Flat-head screw M6x13	8	11	L243
Grooved ball bearings for propeller shaft/[clutch side (KS)] case	2	Flat-head screw M6x13	8	11	L243
Coolant pump idler gear/[clutch side (KS)] case	1	Pin 10	–	–	L648
Gasket [flywheel side (MS)] case/[clutch side (KS)] case	1	–	–	–	On both sides in the engine oil "labyrinth" seal area.
[alternator side (MS)] case/[clutch side (KS)] case	13	Allen screw M6x65	8	11	–
[alternator side (MS)] case/[clutch side (KS)] case	1	Allen screw M6x80	8	11	–
[alternator side (MS)] case/[clutch side (KS)] case	5	Allen screw M6x45	8	11	–
[alternator side (MS)] case/[clutch side (KS)] case	1	Allen screw M6x25	8	11	–
Case	1	Magnetic screw M12x1.5	14.5	20	–
Case	1	Contact screw M10	2.9	4	L574
Case/nozzle 75	1	Allen screw M6x10	4.4	6	–
Bearing flange [clutch side (KS)]/[alternator side (MS)]	2	Screw M8x45	18	25	–
Bearing flange [clutch side (KS)]	2	Screw M8x25	18	25	–
Bearing flange [alternator side (MS)]	1	Allen screw M8x20	18	25	–
Bearing flange [alternator side (MS)]	1	Allen screw M6x20	8	11	L243
For further fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).					

Crankshaft, balanceshaft, gearshift					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Shifting lever/positioning disc	2	Allen screw M6x20	8	11	L243
Balanceshaft [clutch side (KS)]	1	Nut M22x1.5	108	150	–
Crankshaft [clutch side (KS)]	1	Nut M33x1.5	166	230	L243
Balanceshaft [alternator side (MS)]	1	Allen screw M10x20	36	50	L648

Oil pump					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Oil pump	1	Without head screw with double diameter M12x1.5	–	–	Upper and lower surfaces: L574

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Oil pump					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Oil pump cover	1	–	–	–	Upper and lower surfaces: L574
Oil pump lid	4	Allen screw M6x45	8	11	–

Clutch					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Countershaft [clutch side (KS)]	1	Nut M24x1.5	123	170	L648
Clutch spring	6	Screw M6x25	8	11	–
Disengagement rod	1	Locking nut M12	21.7	30	–
Complete diaphragm ring	8	Allen screw M5x20	3.6	5	–
Primary drive (spring-support plate/clutch gear/clutch housing fastening screws)	3	Screw M8x16	21.7	30	L648
Primary drive (spring-support plate/clutch gear/clutch housing fastening screws)	3	Screw M8x25/ nut M8	21.7	30	L648

Head, cylinders					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Camshaft support/head "1" (front)	8	Allen screw M6x30	8	11	–
Head "1" (front)	2	Exhaust pipe M18x1.5	9.4	13	L275
ETV Head "1" (front)	1	Breather nipple	20	2.0	L243
Head "2" (rear)	1	Exhaust pipe M18x1.5	9.4	13	L275
Camshaft support/head "2" (rear)	4	Allen screw M6x30	8	11	–
Camshaft support/head "2" (rear)	2	Allen screw M6x45	8	11	–
Camshaft support/head "2" (rear)	2	Allen screw M6x55	8	11	–
Head "2" (rear)	1	Cap screw M18x1.5	14.4	20	L243
Head/exhaust	6	Stud bolt M8x16/20	7.2	10	L648
Head "2" (rear)	1	Angular union	–	–	L574
Head/case	8	Stud bolt M10x171	4.4	6	L243
Cylinder/head	8	Screws with shoulder M8x45	Not varnished cylinder version 20.3-21.7 ftlb (28-30 Nm) Varnished cylinder version 18-20.3 ftlb (25-28 Nm)		–
Head/stud bolt	8	Nut M10	Not varnished head version 42 ftlb (58 Nm) Varnished head version 36.2-39.8 ftlb (50-55 Nm) Varnished head version (with nut on outer side) 42 ftlb (58 Nm)		Grease the nut support surface
Head/chain compartment	4	Allen screw M6x100	8	11	–
Head "2" (rear)/bearing flange	2	Screw M6x35	8	11	–
Head "2" (rear)/bearing flange	2	Screw M6x20	8	11	–

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Head, cylinders					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Head "1" (front)/Timing gear - exhaust camshaft	3	Allen screw M6x14	8	11	L243
Head "1" (front)/Timing gear - intake camshaft	3	Allen screw M6x14	8	11	L243
Head "1" (front)/Timing chain - guide bracket	1	Spacer screw M6x16	8	11	–
Head "2" (rear)/Timing gear - intake camshaft	3	Allen screw M6x11.5	8	11	L243
Head "2" (rear)/Drive gear (upper balanceshaft gearing) + timing gear - exhaust camshaft	3	Allen screw M6x14	8	11	L243
Head "2" (rear)/Balance weight + driven gear (upper balance-shaft gearing) - intake camshaft	1	Nut M14x1	36	50	L243
Head "2" (rear)/Timing chain guide	2	Screw M6x35	8	11	–
Valve cover	10	Spacer screw M6x23	6.6	9	–
Head	4	Spark cap	13	18	–
Induction flange	4	Allen screw M8x25	13.7	19	–
Cylinder/chain tightener	2	Cap screw M16x1.5	21.7	30	–
Head "1" (front)	1	Coolant tempera-ture thermistor	14.5	20	–
Head "2" (rear)	1	Coolant tempera-ture thermistor	14.5	20	–
Cylinder bracket support shoe	2	Screw Allen M10x40	29	40	–
Cylinder bracket support shoe	2	Nut M10	29	40	L243

Ignition system, starter motor					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
RSV RSV R SL Crankshaft position sensor/alternator cover	2	Taptite screw M6x16	8	11	–
RST ETV Crankshaft position sensor/alternator cover	1	Taptite screw M6x12	7.2	10	L243
Alternator cover/alternator	3	Allen screw M6x40	8	11	L243
Alternator rotor/sprag clutch case/alternator ring	–	–	–	–	L648
RST ETV Alternator rotor/sprag clutch case/alternator ring	3	Allen screw M8x18	21.7	30	L648
Sprag clutch case	3	Allen screw M8x16	21.7	30	L648
Alternator rotor taper	–	–	–	–	L648
Alternator rotor/crankshaft	1	Allen screw M16x30	94	130	L648
Alternator cover/[alternator side (MS)] case	12	Allen screw M6x35	8	11	–
Alternator cover	1	Cap screw M24x1.5	Man-ual tight-ening	–	Alternator cover
RST ETV Alternator cover/cable-lock bracket	1	Allen screw M6x10	5	7	L243
Camshaft position sensor/head "1" (front)	2	Taptite screw M5x12	2.9	4	L243
For further fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).					

Clutch cover, coolant pump					
Description	**Q.ty**	**Screw/nut**	**ftlb**	**Nm**	**Note**
Coolant pump	1	Impeller	Manual tighten-ing, min. 5 ftlb (7 Nm)		–
Clutch cover	1	Oil pressure switch M10x1	10.8	15	L243
Coolant pump case	1	Allen screw M6x25	8	11	–

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Clutch cover, coolant pump					
Coolant pump case	3	Allen screw M6x55	8	11	L243 only for left central screw
Clutch cover	11	Allen screw M6x35	8	11	–
Clutch cover	3	Allen screw M8x40	13.7	19	–
Clutch cover	1	Allen screw M8x65	13.7	19	–

SWINGING ARM

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

SIDE STAND

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FRONT SUSPENSION

Front fork

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

Steering damper

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

REAR SUSPENSION

Damper absorber

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

Linkage

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

ELECTRICAL SYSTEM

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

AIR FILTER CASE

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FRONT WHEEL

For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

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REAR WHEEL
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

COOLING SYSTEM
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

BRAKE SYSTEMS
Front system
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).
Rear system
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

CLUTCH CONTROL SYSTEM
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

EXHAUST SYSTEM
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FUEL SYSTEM
Fuel pump flange
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).
Fuel tank
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

ENGINE OIL TANK AND RADIATOR
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

FRAME/FAIRINGS
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

RIGHT/LEFT HANDLEBARS AND CONTROLS
For this fasteners consult the corresponding voice in the paragraph (SPECIFIC VALUES OF TIGHTENING TORQUES) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

NOTE

NOTE

REMOVING/REFITTING THE COMPLETE ENGINE FROM/TO THE VEHICLE FRAME

3

REMOVING/REFITTING THE COMPLETE ENGINE FROM/TO THE VEHICLE FRAME

TABLE OF CONTENTS

3

3.1 PREFACE

This section contains the information and data required by the professional mechanic to remove and refit the engine, from and to, the frame of the specific **aprilia** vehicle; it also indicates the engine parts which can be removed and refitted without removing the engine from the frame.

3.2 ENGINE PARTS WHICH CAN BE DISASSEMBLED WITHOUT REMOVING THE ENGINE FROM THE FRAME

Consult the corresponding chapter in the section 3 (ENGINE) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

3.3 REMOVING THE COMPLETE ENGINE FROM THE FRAME

Consult the corresponding chapter in the section 3 (ENGINE) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

3.4 REFITTING THE ENGINE TO THE FRAME

Consult the corresponding chapter in the section 3 (ENGINE) of specific vehicle workshop manual, see 0.4.1 (VEHICLE WORKSHOP MANUAL).

NOTE