Mercedes-Benz

After-Sales

Workshop Manual
Engines
OM 449 OM 449 A OM 449 LA
OM 447 OM 447 A OM 447 LA

Mercedes-Benz do Brasil S.A.

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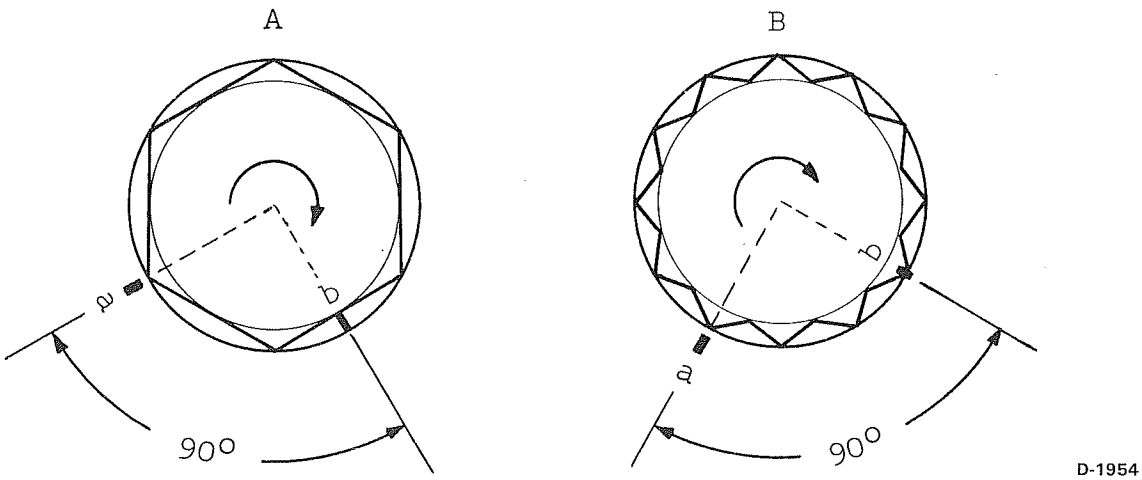
This manual is intended for use by mechanics as a guide to engine repairs.

For the practical use for the instructions contained herein, the use of the recomended special tools is indispensable.

The handling of this manual, as well as the system adopted for its use, are explained as follows:

- The content of this manual is divided into construction groups, and these in chapters. In this way the operations are individualized, this providing for easy and quick consultation.
- Each chapter starts on a new page.
- At the beginning of this manual, is a general index with the names of the chapters.
- Respective technical data is to be found at the beginning of each chapter, including moments of torque and special tools.
- Unless otherwise stated, all measurements contained in this manual, are in milimeters (mm).
- Mercedez-Benz reserves the right to introduce technical modifications to the product and consequently update the present edition whenever necessary.

Angular tightenings (torque)



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In the tightening tables in this manual, it is noted that some bolts must be tightened with a combined torque, i.e.: initial torque in Nm and final angular tightening.
To perform this type of tightening, proceed as follows:

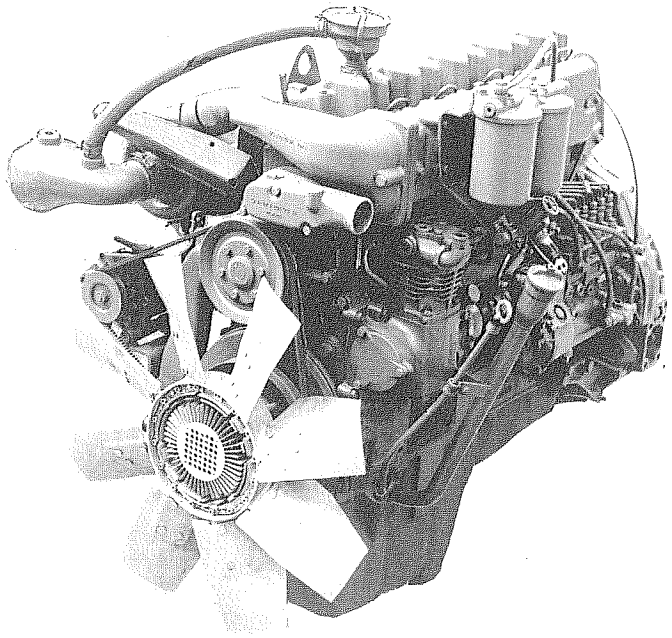
1. With a torque wrench, apply the initial specified torque.

2. In line with bolt head corner, make the marking "a" (indication a).

3. Make another mark on bolt head, in position b, in this way mark "b" is at 90 deg. in relation to mark "a".

4. With a conventional wrench tighten the bolt until mark "b" matches with mark "a", which corresponds to a turning angle of 90 deg. (1/4 of a turn).

OM 449 A



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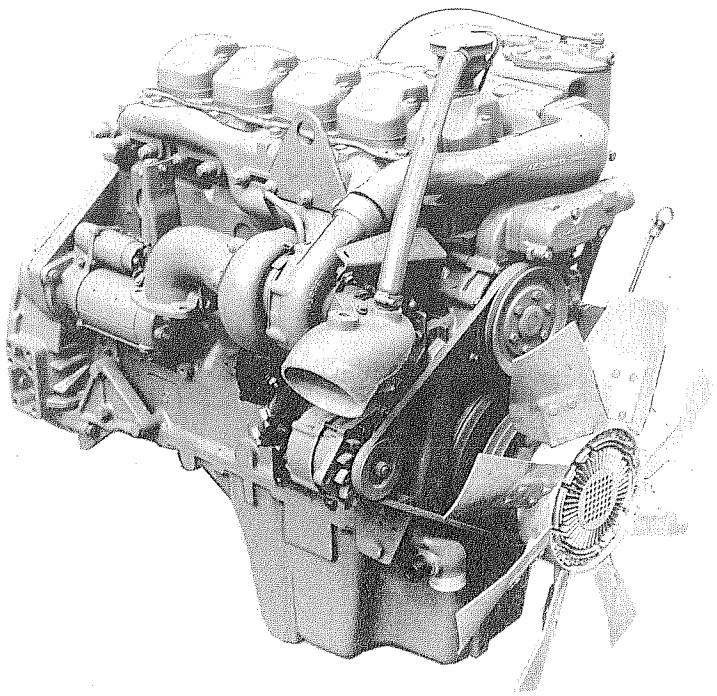
OM 449 A



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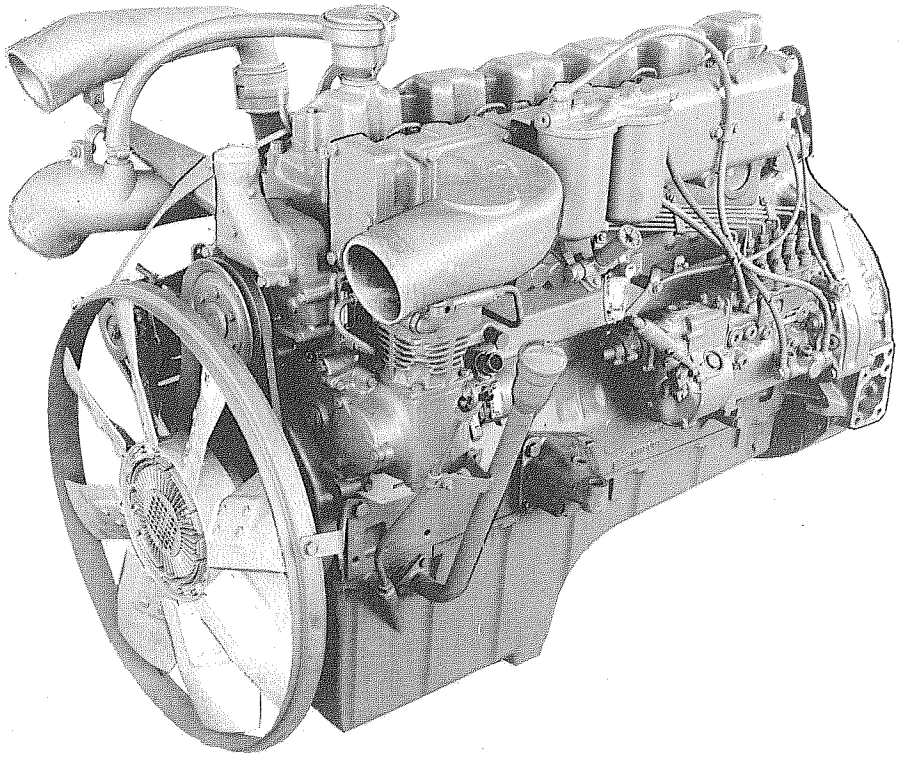
OM 447 LA



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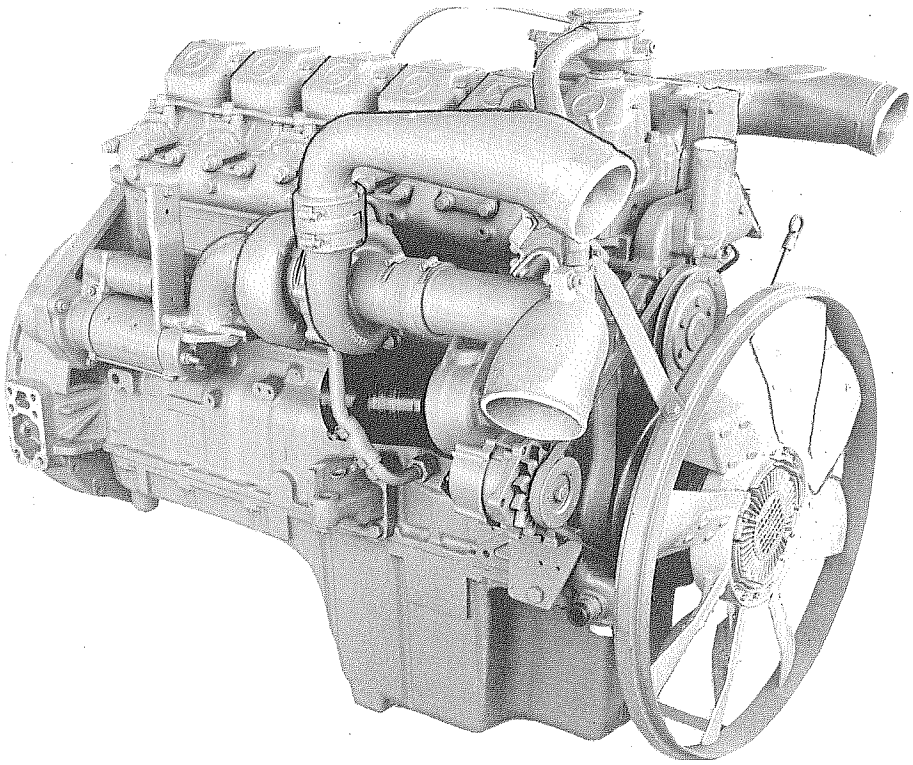

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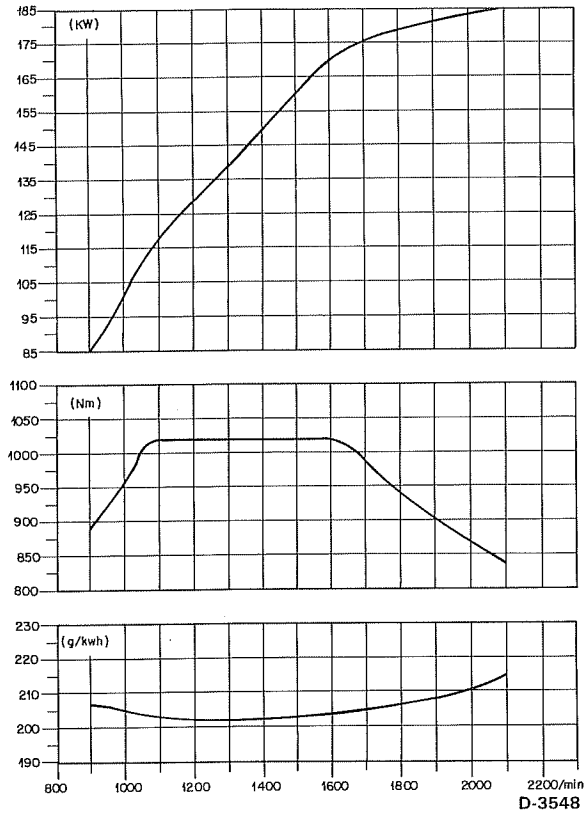

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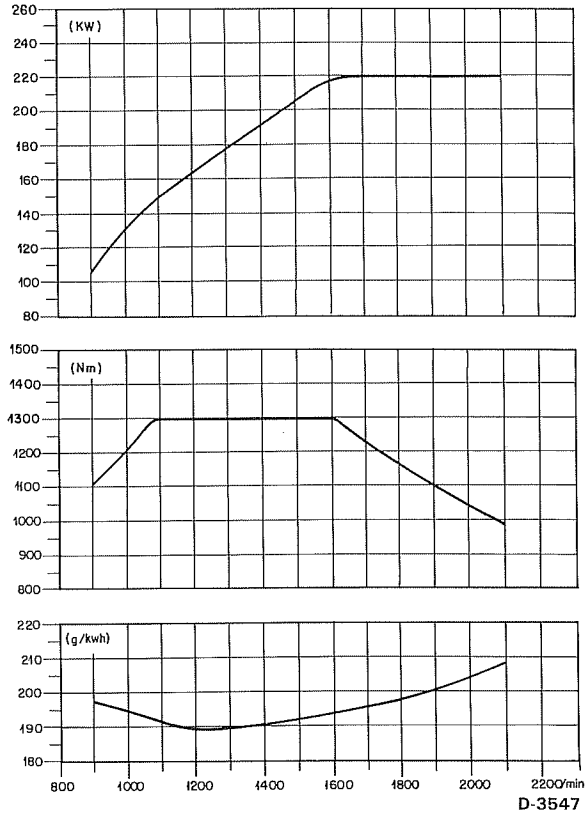

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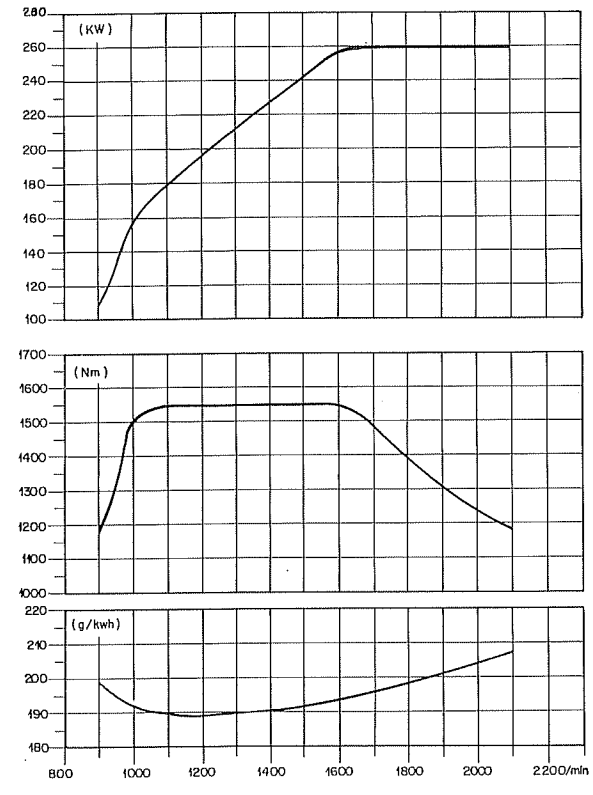

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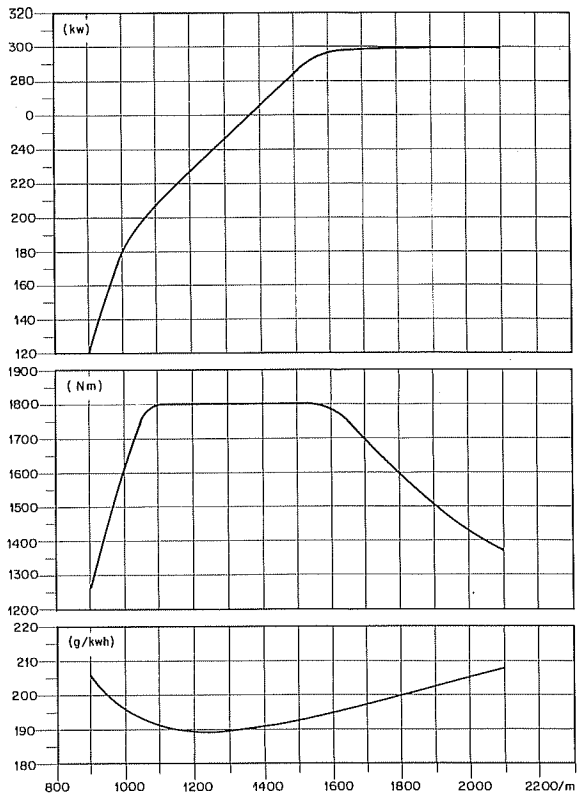

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1. General

The correct determination of consumption of engine lubrication oil, is made possible with a test route, performed together with a fuel consumption test. The dipstick method does not provide values with the required accuracy.

During the engine running in period (up to approx. 20.000 km) a greater oil consumption is normal. Consumption test should not be carried out during this period. Only after the 20.000 km limit should this problem receive any special attention, but even so, before any active action is taken on engine, the following test should be carried out.

2. When to consider excessive the consumption

Among the many factors that affect the accurate determination of "lube oil consumption" is the nature of the test route, for which reason we emphasize some of these points.

- Type of highway
- Engine Revs.
- Engine operating temperature
- Engine load
- Leakages
- Quality and grade of oil in use
- Engine condition

Type of highway

In order to reproduce as close as possible the normal operating conditions of the vehicle, a test route of at least 200 km preferably in a closed circuit should be selected.

At this lube oil consumption test the fuel consumption should also be determined, as, only with a comparison of lube oil and fuel consumption can the various normal operating conditions be accertained.

The test route should include 30 or 40 km of highway that could be covered at maximum normal operating speed.

Over the entire route, the vehicle should be operated in accordance with scheduled specifications.

The ideal would be the actual driver of the vehicle making the test drive over the different stretches of the route, with the assistance of a Receptionist at his side.

Preparation for tests

1. Before the test, the engine should be completely inspected for possible external leakages; as for example: at filters, rocker arm covers, heat exchanger pipings, etc.

2. Park vehicle on level ground mark down the place, so it can be parked again on the same spot after the test drive. Shut down engine and wait for 5 minutes.

3. Top up oil level to the top mark on dipstick.

4. Warm up engine to 80 to 90 deg. C. coolant temperature.

5. Set choke knob to engine stopped position. Next, check on injection pump, if control lever is really in the stop position.

6. Remove oil pan plug, drain hot oil into clean container for 15 mins.. After 15 mins. drainage, crank engine with starter only, (choke knob in stop position). Allow residual oil to drain for 5 minutes.

7. After drainage, install crankcase plug and tighten.

8. Weigh container with drained oil on scale graduated in grams (wt. of oil + wt. of container).

9. Carefully pour oil from weighed container into engine, avoiding spillage.

10. Top up fuel tank to 2 cm below the filling spout and mark the exact height of the fuel level.

00 Lube oil consumption test

Running the test

1. Drive the vehicle over the specified route under the conditions described above (a minimum of 200 km — driver and receptionist).

2. At end of run, drive vehicle immediately to the previously marked position.

3. Place the previously used container under the crankcase and drain the oil.

The draining time as previously stated, is 15 minutes. After 15 mins. draining time, crank engine for 10 seconds using only the starter motor. Allow oil to drain for further 5 minutes.

Attention: Follow item 6 of previous chapter. Reinstall and tighten crankcase plug.

4. Reweigh the container with the oil and determine the lube oil consumption. The oil consumed will be the difference between the two weighing operations, that is, between the weights before and after the test run.

The oil consumption (C) is generally given in litres and is calculatedd from the difference between the two weighing operations, the specific weight of the oil and the distance covered in the test run, as indicated on the Test Card.

5. Top up the fuel tank to the level marked prior to the test run and determine the quantity of fuel consumed during the run.

The fuel consumption (Cc) is given in km/l.

Example

- Weight of container with oil, before the test run, (P_1) 24,600 g.
- Weight of container with oil, after the test run, (P_2) 24,350 g.
- Weight of oil consumed
  (P) = (P_1) − (P_2) = 250 g.
- Distance covered (L) 200 km.
- Fuel consumed (D) 70 liters.
- Specific weight of lube oil 900 g/l.

- **Lube oil consumption**

$$C_1 = \frac{900 \times (L)}{(P)} = \frac{900 \times 200}{250} = 720 \text{ km/l}$$

- **Fuel consumption**

$$Cc = \frac{(L)}{(D)} = \frac{200}{70} = 2.85 \text{ km/l}$$

- **Consumption of oil as a percentage of fuel consumption**

- The relation, in percentage, between lube oil consumption and the fuel consumption can be calculated with the help of the following formula:

$$\% = 100 \times \frac{Cc}{C_1} = 100 \times \frac{2.85}{720} = 0.39\%$$

A lube oil consumption up to 0.5% in relation to fuel consumption is acceptable.

Important remarks

- Never remove the cylinder heads of an engine before measuring the compression of each cylinder.

  This data should be recorded to be included in reports and later furnished to MBB.

- After verifying an excessive consumption of lube oil, the cause should be determined and corrective action taken.

Test Sheet

The attached model test sheet is practical and assures an exact and easily made consumption test.

3. Probable causes

High lube oil consumption of an engine can be the result of various causes.

In the following table we analyze the evident symptoms of excessive lube oil consumption, their causes and the corrective action to be taken.

Evident Symptoms	Probable Cause	Corrective Action
Tail pipe shows signs of oil	Excessive clearance between exhaust valve stems and guides.	Check clearance. See shop Repair Manuals. Replace guides if necessary.
Signs of leakage (oily surfaces of engine).	Bolts not properly tightened. Deteriorated gaskets, oil seals and packing.	Locate cause and repair.
Excessive black smoke from exhaust. Engine operates as if straining and misfires.	Air filter dirty or air feed hose collapses when engine is run at high speed.	Clean filter. Check hoses with engine at high speed. If hoses collapse they should be replaced.
Excess of bluish smoke from tail pipe.	Pressure in crankcase due to clearance between rings and cylinders. Crankcase pressure regulating valve obstructed.	Check engine compression. Replace crankcase pressure regulating valve.
	Crankcase oil above recommended level.	Drain all oil and check existing volume compared with recommendations in our manuals. Fill engine again with the correct quantity. Check accuracy of dipstick which should mark the maximum level. Replace dipstick if correct level is not shown 5 minutes after filling the crankcase.
	Loss of lube oil due to oil getting passed the rings and into the compression chamber. Insufficient engine compression.	Measure engine compression. If low, remove cylinder heads, make the necessary measurements and correct as necessary.

"TEST SHEET"

Dealer:
Owner:
Engine n°:
License n°:
Tested by:

Vehicle type:
Chassis n°:
Km:

Date

A — Route: _____
_____ (km)

B — Conditions:
a - weather Good Cold Hot Rainy
b - highway _____

C — Temperature:
- oil _____ deg. C.
- ambient _____ deg. C.
- coolant _____ deg. C.

D — Mileage:
- after run _____ km
- before run _____ km
- distance covered (L): _____ km

E — Oil pressure, idling:
- at average temperature _____ kgf/cm²

F — Oil quantity: _____ litros
Make of oil: _____ Viscosity _____ SAE

G — Weights:
- container (empty) (R) _____ g
- with oil prior to test run (P_1) _____ g
- with oil after test run (P_2) _____ g
- oil consumption ($P = P_1 - P_2$) _____ g

H — Oil consumption:

$$C_1 = \text{consumption (km/l)} = \frac{900\ (L)}{(P)} = \_\_\_\_\_ \text{ km/l}$$

I — Fuel consumption:
- Quantity of fuel consumed (D) = _____ l

$$Cc = \frac{(L)}{(D)} = \_\_\_\_\_ \text{ km/l}$$

J — Oil consumption as a percentage of fuel consumption:

$$\% = 100 \times \frac{(Cc)}{(C_1)} = 100 \times \_\_\_\_\_ \%$$

Where:

P = Weight of oil consumed (g)
900 = Specific weight of oil (g/l)
L = Distance covered (km)

The causes of internal damages to engine and/or excessive lube oil consumption are not always perfectly identified. In order to determine if such troubles result from normal engine wear or from the penetration of dirt in engine's internal parts, some indications are given here which will make the identification of the causes of the respective troubles possible.

Clues that permit identification

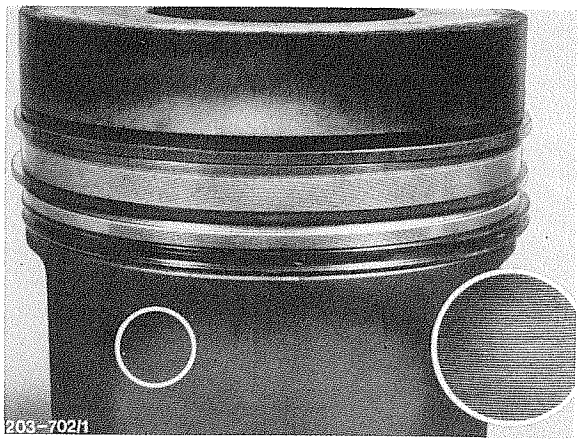
Considerable dust deposits accumulated in the corners of the intake piping (between the air cleaner and the engine) are signs of penetration of dirt into the engine.

Also the appearance of the highest pressure contact surface of the piston skirt as well as the appearance of the honed surfaces of the cylinder, will allow us to conclude if the damages are caused by suction of dust or not.

Appearance of piston without damages caused by dust

The streaked appearance of the higher pressure contact surface of the piston skirt should be clearly visible over a good portion of this area.

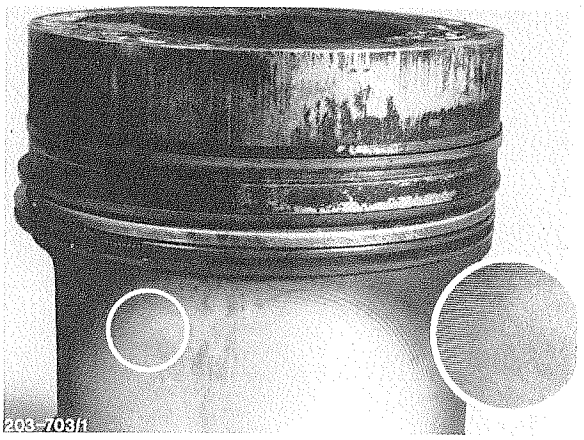
The machinig grooves on the piston surface are intended to retain oil and improve lubrication conditions.



Appearance of a piston with damages caused by dust

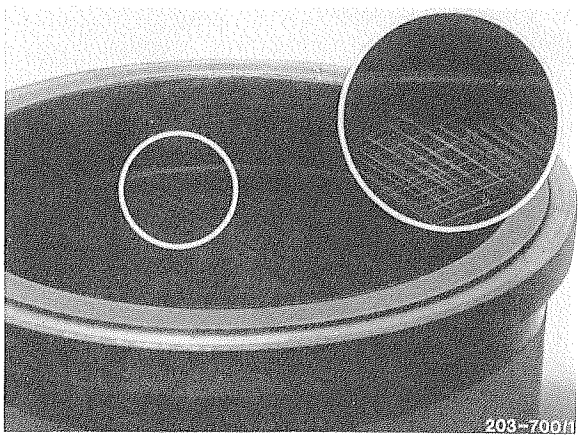
The satin appearance (mat-grey) as the complete vanishing of the machining grooves on higher pressure contact surface of the piston skirt, are indications of damages caused by dust.

At a more advanced stage small signs of seizing begin to appear on the piston as well as sharp edges on the piston rings.



Appearance of a cylinder without damages caused by dust

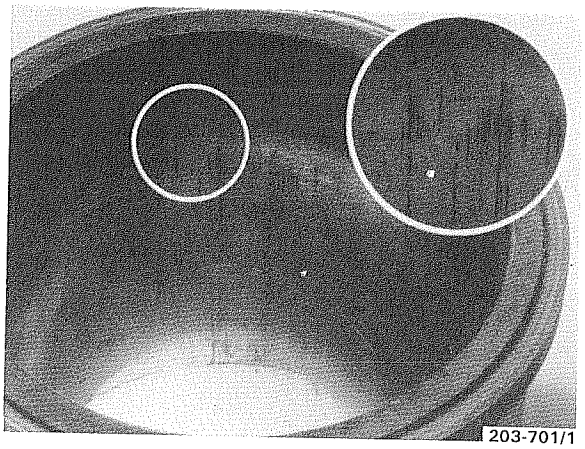
In a cylinder without damages caused by dust, the honing signs are visible over the whole internal surface, except at the point of reversal of the top piston ring, where the honing traces could be partially polished away.



Apearance of a cylinder with damages caused by dust

In the case of damages caused by dust, the honing signs on the cylinder wall are weak or no longer visible.

At a more advanced stage, considerable wear can be seen at the point of reversal of the top piston ring.



Attention

Air filtration defficiency, caused by intake tubing defective sealing, damages or cracks in the flexible tubing, insufficient air cleaner maintenance, the use of non-original filter elements, or still, the operation of the vehicle in high dust concentration environment, are the main causes of abrasive wear of pistons and cylinders.

Technical data

Minimum compression [1]	20 bar
Maximun difference of compression between cylinders	4 bar

[1] Engine cranked by starter motor (180 to 200 RPM) and coolant temperature between 80 and 95 degrees C.

Special tools

Compression gauge		000 598 17 21 00
Adapter		403 589 00 21 00

Note I: Compression measurement is made in order to check the condition of the engine. Insufficient compression can be due to:
- Excessive cylinder wear
- Damaged pistons or rings
- Valve leakage
- burnt cylinder head gasket

Note II: Before measuring the compression, check and adjust valve clearance.

1. Run engine until coolant attains an operating temperature of between 80 and 95 degrees C.

2. Remove all injector holders (see group 07).

3. Disconnect accelerator rod and move injector pump lever to "Stop" position.

4. Crank engine over for about 5 seconds, using starter motor, to expel any carbon residue from the cylinders.

5. Install the adapter in place of the injector holder and connect the compression gauge.

6. Crank engine over, using the starter motor, up to the point where the pressure indicated on the gauge fails to rise further.

Remark: Bleed the compression gauge after each measurement.

Note: If the compression is equal to or above 20 bar and the difference between cylinders is less than 4 bar, the engine can be considered to be in good condition.
If the compression is below 20 bar, proceed as follows:
Pour approx. 30 ml of engine oil into the cylinder. Then turn the engine over (3 to 5 rotations) and repeat the measurement. If the compression raises, it is to be concluded that the low compression is due to piston ring problems.
If the pressure does not increase, the cause is due to gasket problems, burnt valves or valve seats, or damages to the piston or cylinder.

7. Repeat measurements of other cylinders.

8. Install injector holders (see group 07).

Running-in engine installed in vehicle

1. Install engine in vehicle.

2. Fill engine crankcase with specified running-in oil.

3. Run the engine at a speed slightly higher than idling speed (800 to 900 RPM) for 10 to 15 minutes or until the temperature reaches 80 to 90 degrees C.

4. Drive the vehicle for one hour. Do not maintain speed constant on the route, but moderately accelerate and decelerate.

5. Run the engine at idling speed until the coolant in the cooling system reaches 90 degrees C, then shut down engine.

6. Check any water or oil leakage and correct as necessary.

7. Remove rocker arm covers.

8. Adjust valve clearances 30 minutes after stopping the engine.

9. Replace rocker arm covers.

10. Drain the oil used for running-in from the crankcase and filter.

11. Install new filter and fill crankcase with specified oil.

12. Run the engine at idling speed for 5 minutes and then check levels of both water and oil. Top up as necessary.

13. Test drive vehicle. Check engine suspension points. Retighten if necessary.

Running-in on a dynamometer

1. Fill engine crankcase with specified running-in oil.

2. Check length of dynamometer arm. If necessary, adjust length to 954 mm.

3. Run engine according to figures in table on following page.

4. Drain used running-in oil from the crankcase and filter.

5. Install new filter. Fill crankcase with specified oil.

6. Install engine in vehicle.

7. Run the engine at idling speed for 5 minutes and then check levels of both water and oil.
Top up as necessary.

8. Test drive vehicle. Check engine suspension points.
Retighten if necessary.

Running-in table for engine on dynamometer

RUNNING IN POINTS	RUNNING 1			RUNNING 2			RUNNING 3 (ALLOCATION ON TORQUE CURVES)		4		5		6		7						INSPECTION						CONTROL							
ENGINE SERIES	REVS	TIME (MINUTES)	LOAD N	REVS	TIME (MINUTES)	LOAD N	TIME (MINUTES)	LOAD N	TIME (MINUTES)	LOAD N	TIME (MINUTES)	LOAD N	TIME (MINUTES)	LOAD N	TIME (MINUTES)	LOAD N	TOTAL RUNNING IN TIME	NORMAL POWER BRAKING BAND	ENGINE STOPPED		REVS	LOAD N	REVS	LOAD N	REVS	LOAD N	REVS	LOAD N	REVS	INSPECTION	REVS	INSPECTION	TOTAL INSPECTION AND CONTROL TIME	GENERAL TOTAL TIME
OM 449 (475.930)	700	2	50				2	370	10	510	10	590	8	620	8	640	40	670/800N	Perofrm maintenance services as per attached list	Washing of engine	2200	Maximum load	1200	Maximum load	1000	Maximum load	Maximum revs	Control of governor		Control of governor		Check oil pressure. See approval values	15	55
OM 449 A (475.950)	100	10	160	2000	15	310			15	410	15	545	10	680	10	750	75	780/930N			2100		1600		1210									
OM 449 LA (475.982)			190			365				490		650		810		895		930/1100N																
OM 447 (476.950)	700	2	50				2	440	10	600	10	695	8	735	8	760	40	800/900N			2200		1300		1000								15	55
OM 447 A			190			365				490		650		810		895		930/1100N			2100		1600		1200								20	95
OM 447 LA (476.980)	1000	10	220	200	15	435			15	575	15	765	10	955	10	1055	75	1100/1300N																
OM 447 LA (476.982)			260			510				680		905		1125		1245		1300/1500N																

Attention: Loads valid for 954.9 mm brake arm

$$\text{Nominal load (N)} = \frac{P\ (kw \times 10000)}{\text{Nominal RPM}}$$

Maintenance services

- Retighten crankcase.
- Retighten crankcase oil feed tube.
- Valve: Inspect and adjust clearance.
- Air compressor: Retighten cylinder head cylinder and body on engine block.
- Retighten intake manifold on cylinder heads.
- Retighten exhaust manifold on cylinder heads.
- Retighten oil filter.
- Retighten oil radiator housing.

Additional services for A and LA engines

- Retighten turbocharger on header.
- Retighten turbocharger pipes.