

Automotive Workshop AUTO 109

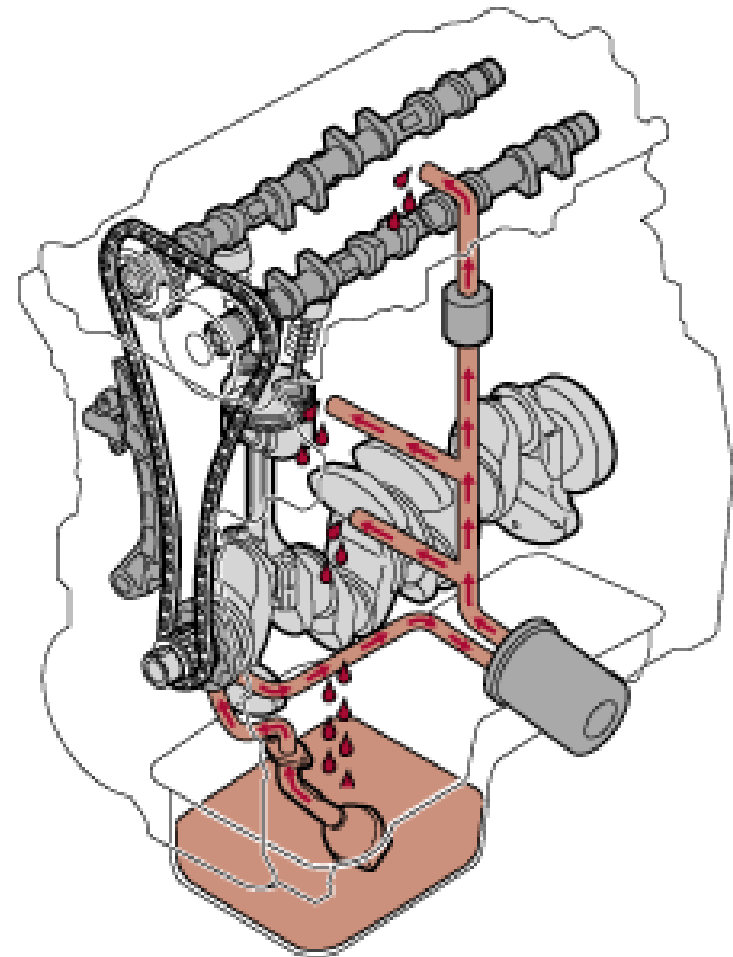
Lubricating System / Oil Consumption

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Lubricating System

The oil passes from the oil pump to the oil filter which is of the full-flow type. The filter is located directly ahead under the oil pump and seals against the oil sump which is part of the lubricating system.

From the filter the oil is pumped through an oilway in the intermediate section to the main bearings. The oil is then pumped through drilled channels in the crankshaft to the big ends. The camshafts and the hydraulic tappets are lubricated via a drilled channel in the front left edge of the block.



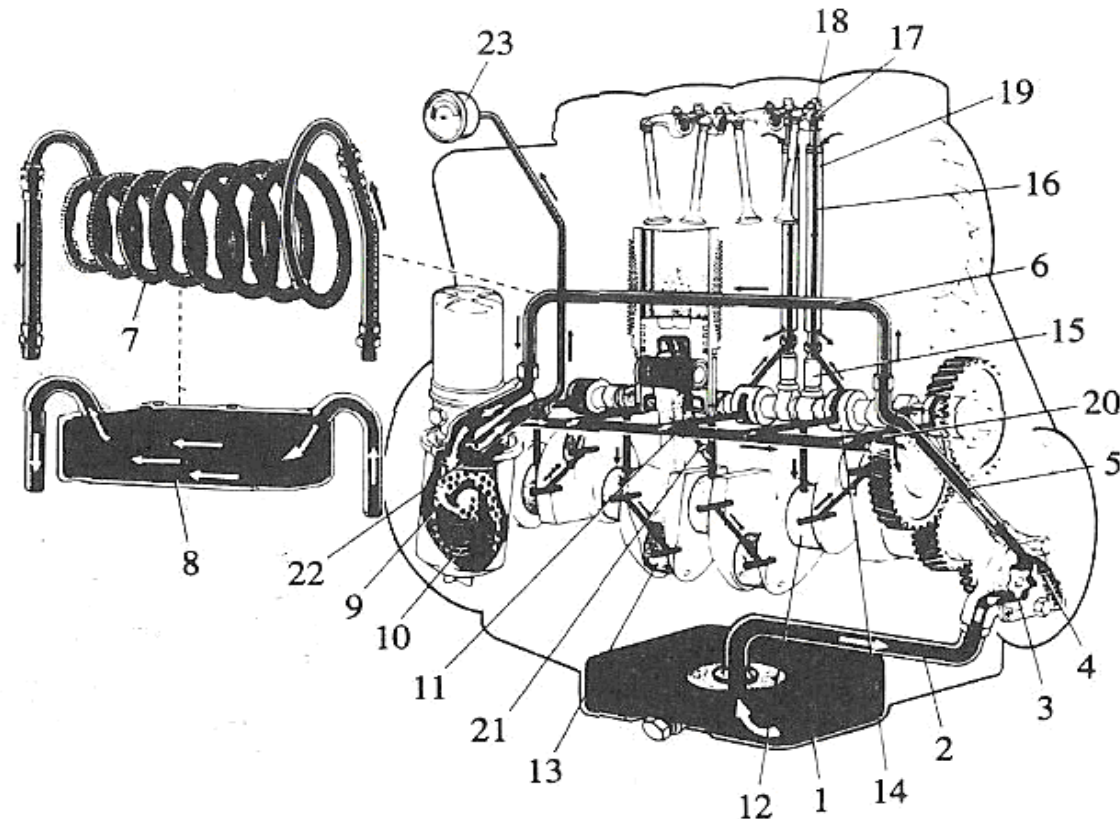
The oilway continues through the cylinder head discharging into the underside of the upper half of the cylinder head. From here the oil is pumped via an oilway to the left camshaft bearing and tappets (intake side).

The right side camshaft bearing and tappets (exhaust side) are supplied via a cast transverse oilway in the front edge of the upper half. The oil then returns from the cylinder head and the crankshaft bearings to the oil sump via the drains in the block.

LUBRICATION SYSTEM LAYOUT

- 1 Sump
- 2 Suction pipe
- 3 Lube oil pump
- 4 Oil pressure control valve
- 5 Pressure pipe
- 6 Bypass pipe or alternative
- 7 Cooling coil or, alternatively:
- 8 Block-type oil cooler
- 9 Oil filter
- 10 Safety valve
- 11 Main oil gallery
- 12 Main bearing
- 13 Big end bearing
- 14 Camshaft bearing
- 15 Tappet (with timing groove to pulse-lubricate rocker arm)
- 16 Push rod (hollow, used as rocker arm oil feed pipe)
- 17 Rocker arm bearing
- 18 Metering plug (to control valve lubrication)
- 19 Push rod duct (used as cylinder-head-to-crankcase oil return pipe)
- 20 Splash hole to lubricate timing gears

- 21 Piston cooling nozzle
- 22 Oil pressure gauge adaptor
- 23 Oil pressure gauge



Oil Consumption

Is normal for a car engine to use a certain amount of oil when running. Oil consumption can vary considerably depending on a number of factors:

- Condition of the engine - how well it has been maintained.
- Dirty engine.
- Blocked air filter.
- Driving conditions - heavy loads or a lot of idling.
- Quality and viscosity of oil.
- Cylinder volume - larger engines generally use more oil than small ones.
- Engine power - a more powerful engine uses more oil than less powerful ones.
- Oil level - too high a level (above the max line on the dip stick) results in increased oil consumption.

Causes

-Overfilling. If the oil is filled to a level above the recommended maximum level, a large amount of oil is thrown up against the cylinder walls and oil is thrown out through the crankcase ventilation. Do not fill the oil level above the MAX line on the dip stick.

-Oil grade. If an oil grade other than that recommended by the manufacturer has been used, this can result in increased oil consumption. If the oil is too thin, it will contain a larger proportion of volatile molecules. It becomes even more difficult for the oil to maintain an unbroken film around the cylinder walls at high temperatures, leading to increased engine wear and consequently increased oil consumption.

-Hard driving. Long, continuous driving at high engine revs leads to high oil temperatures, which in turn leads to the oil being thinner and consumption higher.

Hard cornering at high engine revs results in the oil being thrown against the side of the cylinder block and against the cylinder walls, leading to increased oil consumption.

The same conditions arise during extended periods of driving at high revs in low gear on level roads (no inclines).

-Driving in mountainous areas. Frequent and extended engine braking heats the oil in the engine; it also results in more oil being sucked into the cylinders because of the high partial vacuum in the intake manifold.

-Idling. If the car is used in urban traffic, getting caught in traffic jams etc., the engine can be running for a number of hours without covering much distance. This does not necessarily affect oil consumption, but the measurement result - liters of oil/road distance covered - will be misleading.

-Climate. In countries where very high temperatures are the norm, the engine also runs at a higher temperature, leading to increased oil consumption.

Mechanical causes

Leaks: Worn crankshaft and crankshaft seal, external leakage, e.g., leaking gaskets, etc.

Crankcase ventilation: Overpressure in the crankcase caused by blocked crankcase ventilation.

Pistons and piston rings: Worn piston ring grooves. Fatigued, worn, scored, broken or scratched piston rings. Fouled oil control rings. Incorrectly installed rings.

Cylinder walls: Worn or scored.

Valves Worn guides or valve stem: Worn, damaged or valve stem seals missing.

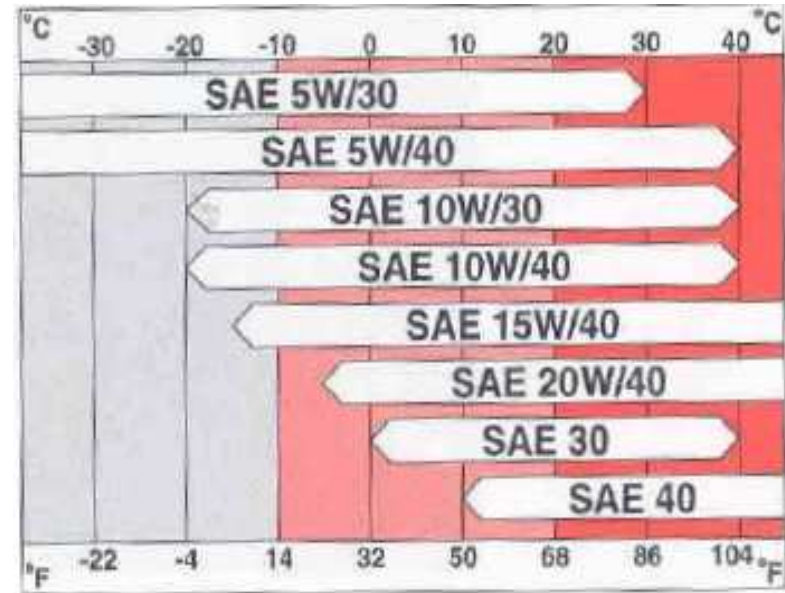
Cylinder head: Internal leakage between oil ducts and leakage into the combustion chamber.

There are two methods of determining the oil consumption. The oil is measured using a dip stick in the first method, before and after driving a test distance of 2000 km. This gives a sufficient first indication of the oil consumption. The second method consists of weighing the oil in the sump after driving 1000 km.

To reach as a correct result as possible, with both methods, the car must be driven to normal operating temperature (not idling) for 30 minutes before noting the oil level or draining the oil. Change the oil and replace the oil filter to ensure that an approved oil is used in the engine during the test period. Also replace the air cleaner (ACL) before measuring. The car must be standing on a flat surface and in the same position when measuring or weighing before and after the driven test distance.

1. Measuring using the dip stick

Replace the oil, oil filter and air cleaner. The oil must be of correct viscosity. Drive the car to operating temperature for 20-30 minutes (not idling). This is so that the oil reaches normal operating temperature. Switch off the engine. Leave the engine switched off for 15 minutes. Check the oil level. Top up with oil if necessary. Fill to the maximum mark on the dip stick.



Run the engine for 5 minutes so that the existing oil and the additional oil mix. Switch off the engine for 15 minutes. Note the oil level on the dip stick. Note the odometer setting and vehicle data. Drive the car 2000 km, or until the oil level has dropped to the minimum mark on the dip stick.

Drive the car to operating temperature for 20-30 minutes (not idling). This is so that the oil reaches normal operating temperature. Switch off the engine. Leave the engine switched off for 15 minutes. Measure the oil level on the dip stick using a sliding gauge. Note the result.

2. Weighing

Drive the car to operating temperature for 20-30 minutes (not idling). This is so that the oil reaches operating temperature. Drain the oil from the oil trough for 15 minutes. A large amount of oil is collected in the cylinder head when the car is running. This factor, together with the design of the splash guard in the sump, means that it takes a long time for the oil to drain out of the engine. The oil must not be reused.

Replace the oil filter and air cleaner. Fill with the specified amount of approved engine oil. Drive the car to operating temperature for 20-30 minutes (not idling). This is so that the oil reaches normal operating temperature and the oil filter fills. Carefully weigh an empty clean container (± 1 gram). Drain the oil from the oil trough into the container for 15 minutes.

Carefully weigh the container and oil. Fill the engine with the weighed oil. Ensure that as much oil as possible leaves the container. Weigh the empty container. The container may weigh more than it did the first time due to the remaining oil film. The difference in weight is taken from the weighed oil weight. Note the oil weight odometer setting and vehicle data.

Drive the car 1000 km, or until the oil level has dropped to the minimum mark on the dip stick. Ensure that the engine is at normal operating temperature. Drive to normal operating temperature if necessary for 20–30 minutes (not idling). Carefully weigh an empty clean container (± 1 gram). Drain the oil from the oil trough into the container for 15 minutes.

Carefully weigh the oil and container. Deduct the weight of the container. If abnormal oil consumption is discovered when measuring, the engine needs to be remedied as follows.

Corrective action for high oil consumption

Conditions

If the engine consumes more than 0.4 litres of oil every 1000 km, the following checks must be carried out to check whether the oil consumption problem is in the cylinder head, crankcase ventilation or piston ring and sleeve surface.

Check

Remove the intake manifold. Check to see if there is an oil film or drops of oil in the cylinder head intake passage and/or oil on the valve stem and top of the valve crown.

Conclusions

If there is not an abnormally large amount of oil in the intake passage and valves and the oil consumption gradually, from being acceptable, begins to quickly increase, or consumption is between 0.30-0.80 litres per 1000 km, the problem is in the piston, piston ring or cylinder sleeve surface.

Faults in valve stem seals for example, or internal leakage in the cylinder head cannot be completely ruled out.

If the oil consumption has always been high, or there are traces of oil in the intake passage and valves, or the oil consumption is above 0.80 litres every 1000 km, the problem is probably in the cylinder head.

The cause could be leaking valve stem seals, internal leakage in the cylinder head or a fault in the crankcase ventilation (other than a blockage).

Corrective actions

If the problem seems to be in the crankcase ventilation, this must be thoroughly checked and remedied if necessary, before reconditioning or replacing the cylinder head. If the problem seems to be with the piston, piston ring or cylinder sleeve surface, the engine should be reconditioned or if necessary, replaced

Oil pressure

Start the engine and read off oil pressure at different engine speeds (RPM), when oil level and oil pressure the engine should be at normal operating temperature which corresponds to 15 minutes normal driving (100 °C). If the oil quality/type and/or oil filter condition cannot be determined replace oil and filter.

RPM	Oil pressure
13.3-14.2 rps (800-850 rpm)	minimum 0.10 MPa
66.7 rps (4000 rpm)	minimum 0.35 MPa max 0.70 MPa