



Technical Service Bulletin

Date: 05/05/04
 Product Description: All Motor Oils / Oil Analysis
 Subject: Engine Oil Consumption

Description: *REASONS FOR MOTOR OIL CONSUMPTION* provides explanations for using “too much” oil. It serves as a handy reference when the question of “abnormal” oil usage arises.

It is interesting to note that the only two *oil related* problems contained are explained by “dirty oil” and by overfilling the crankcase. The balance of the problems are all *mechanical* in nature.

Before we review the reasons why oil consumption occurs, it should be noted that a degree of consumption should be anticipated in all engines. What is considered normal or acceptable, however, will vary from one engine or application to the next. For example, Ford Motor Company considers consumption as high as one quart of oil per 1,000 miles to be acceptable in a gasoline engine. For large diesel engines used in over the road trucking applications, many manufacturers are not concerned until consumption reaches one gallon of oil per 10,000 miles of operation.

Table of Contents

	PAGE
1. External Oil Leaks	2
2. Front or Rear Main Bearing Seals	2
3. Worn or Damaged Main Bearings	2
4. Worn or Damaged Connecting Rod Bearings	2
5. Worn or Damaged Camshaft Bearings	2
6. Worn Crankshaft Journals	2
7. Tapered and Out-of-Round Cylinders	3
8. Distorted Cylinders	3
9. Clogged “PCV” Valve	3
10. Honing Abrasive	3
11. Worn Ring Grooves	3
12. Cracked or Broken Ring Lands	3
13. Worn Valve Stems and Guides	4
14. Bent or Misaligned Connecting Rods	4
15. Worn or Improperly Fitted Wrist Pins or the Wrong Pins	4
16. Wrist Pins Fitted Too Tightly	4
17. Clogged Oil Passages	4
18. Unequal Tightening of Main Bearing Bolts or Connecting Rod Bolts	4
19. Unequal Tightening of Cylinder Head Bolts	4
20. Dirty Cooling System	5
21. Dirty Oil	5
22. Too Much Oil in Crankcase	5
23. Incorrect Piston Rings for Type of Engine or Type of Service	5
24. High Engine Vacuum	5
25. Worn Timing Gears or Chain	5
26. Piston Rings Fitted with Too Little End Clearance	6
27. Worn or Broken Piston Rings	6
28. Piston Rings Stuck in Grooves	6
29. Late Valve Timing	6
30. Oil Pressure Too High	6
31. Oil Viscosity	6
32. Piston Slap	6
33. Internal Gasket/Intake Breach	7
34. Spark Knock	7
35. Aftermarket Performance Chips and Modifications	7
36. Lugging Engine	7
37. Inappropriate Operation of Overdrive	7
38. Leaking Turbocharger Seal	7
39. Restricted Air Intake	7
40. Fuel Dilution	7

REASONS FOR MOTOR OIL CONSUMPTION

1 External Oil Leaks

Some of the many points where external oil leaks may occur include: oil lines, crankcase drain plug, oil pan gasket, valve cover gaskets, oil pump gasket, fuel pump gasket, timing case cover and camshaft bearing seal. No possible source of leakage should be neglected because even a very small leak will cause extremely high oil consumption. For example, it has been estimated that a leak of one drop of oil every twenty feet is approximately equal to a loss of one quart of oil every 100 miles. The best way to check for external leaks is to road test the vehicle with a large piece of light-colored cloth tied under the engine. Oil on the cloth will indicate a leak which should be traced to its source.



2 Front or Rear Main Bearing Seals

Worn front or rear main bearing seals almost always result in oil leakage. This can only be determined when the engine is operated under load conditions. Bearing seals should be renewed when worn because a slight leak will result in extremely high oil consumption just as it would with an external oil leak.



3 Worn or Damaged Main Bearings

Worn or damaged main bearings throw off an excessive amount of oil which flows along the crankshaft and is thrown up into the cylinders. The amount of oil throw off increases rapidly when bearing wear increases. For instance, if the bearing is designed to have .0015" clearance for proper lubrication and cooling, the throw off of oil will be normal as long as this clearance is maintained and the bearing is not damaged in any way. However, when the bearing clearance increases to .003", the throw off will be five times normal. If the clearance is increased to .006", the throw off will be twenty-five times normal. When the main bearings throw off too much oil, the cylinders are usually flooded with more oil than can be controlled by the pistons and rings. This causes burning of the oil in the combustion chamber and carboning of pistons and rings.



In a conventional, full-pressure lubricated engine a large loss of oil at the main bearings may starve the downstream connecting rod bearings of lubrication to such an extent that sometimes, especially at low speeds, insufficient oil may be thrown on the cylinder walls. This will cause the pistons and rings to wear to such an extent that they will not be able to control the oil at high speeds. The effect of main bearing wear will be high oil consumption.

4 Worn or Damaged Connecting Rod Bearings

Clearances on connecting rod bearings affect the throw off of oil in the same proportions as mentioned for main bearings. In addition to this, the oil is thrown more directly into the cylinders. Worn or damaged connecting rod bearings flood the cylinders with such a large volume of oil that the pistons and rings, which are designed to control a normal amount of oil or a reasonable increase in the normal amount, are overloaded to such an extent that some oil escapes past them to the combustion chamber and causes high oil consumption.

CAUTION - Insufficient bearing clearance can also produce piston, ring and cylinder damage as well as damage to the bearing itself.

5 Worn or Damaged Camshaft Bearings

Camshaft bearings are generally lubricated under pressure and, if the clearances are too large, excess oil will be thrown off. Large quantities of this oil may flood valve guide and stem areas resulting in increased oil consumption.



6 Worn Crankshaft Journals

Worn crankshaft journals will have the same effect on oil consumption as worn bearings. When they are worn out-of-round, they cannot be set up with round bearings to give uniform oil clearance. A bearing fit to the larger dimension of a worn journal will be loose at the smaller dimension and throw off many times the proper amount of oil. Journals which are out-of-round, rough or scuffed should be reground and fitted with undersize bearings of the correct size.

7 Tapered and Out-of-Round Cylinders

In slightly tapered and out-of-round cylinders, the oil can be controlled by the pistons and rings. However, with increased taper and out-of-roundness, satisfactory oil control becomes more difficult to maintain. This is due to a combination of many factors. The increased piston clearances permit the pistons to rock in the worn cylinders. While tilted momentarily, an abnormally large volume of oil is permitted to enter on one side of the piston. The rings, also tilted in the cylinder, permit oil to enter on one side. Upon reversal of the piston on each stroke, some of this oil is passed into the combustion chamber.

For each revolution of the crankshaft, the pistons make two strokes - one up and one down. When an engine is running at 3000 R.P.M. (approximately 60 miles per hour) the rings in tapered and out-of-round cylinders are changing their size and shape 6000 times per minute. Consequently, at high speeds, the rings may not have time to conform perfectly to all worn parts of the cylinders on every stroke. Whenever this occurs, the engine consumes higher amounts of oil due to what is commonly referred to as oil pumping.



8 Distorted Cylinders

Cylinders which are distorted so that they are out of shape - not from wear, as in #7, but from other causes, such as unequal heat distribution or unequal tightening of cylinder head bolts - present a surface which the rings may not be able to follow completely. In this case, there may be areas where the rings will not remove all of the excess oil. When combustion takes place, this oil will be burned and cause high oil consumption.

9 Clogged "PCV" Valve

The main purpose of the PCV (positive crankcase ventilation) valve is to recirculate blow-by gases back from the crankcase area through the engine to consume unburned hydrocarbons. Blowby is a mixture of air, gasoline and combustion gases forced past the rings on the combustion stroke. The PCV system usually has a tube leading from the crankcase to the carburetor or intake manifold. Vacuum within the engine intake manifold pulls blowby gases out of the crankcase into the combustion chamber along with the regular intake of air and fuel.

A valve can become clogged with sludge and varnish deposits and trap blowby gases in the crankcase. This degrades the oil, promoting additional formation of deposit material. If left uncorrected, the result is plugged oil rings, oil consumption, rapid ring wear due to sludge buildup, ruptured gaskets and seals due to crankcase pressurization, oil thrown out around the filler cap and consequent rough engine operation.



10 Honing Abrasive

If cylinder honing or glaze breaking is performed on an engine, cleaning instructions should be carefully followed to prevent metal fragmentation or abrasive damage to the rings' seating surfaces.

Cleaning instructions for reconditioned cylinders: After honing thoroughly wash cylinder walls with soapy water and a scrub brush and oil immediately thereafter, or swab cylinders with No. 10 oil and carefully wipe clean. Repeat until all evidence of foreign matter is removed. In either method that is used, a white cloth wiped on the surface should remain clean.

Note: Do not use gasoline or kerosene to clean the cylinder walls after honing. Solvents of this nature will not remove the grit from the cylinder wall and often carry particles of abrasives into the pores of the metal. Failure to properly clean the cylinder walls will leave abrasives that will cause rapid wear and ring failure and will result in elevated oil consumption.

11 Worn Ring Grooves

For piston rings to form a good seal, the sides of the ring grooves must be true and flat - not flared or shouldered - and the rings must have the correct side clearance in the grooves. Normally, automotive ring groove side clearance should not exceed .002-.004. As the pistons move up and down, the rings must seat on the sides of the grooves in very much the same way that valves must seat to prevent leakage. New rings in tapered or irregular grooves will not seat properly and, consequently, oil will pass around behind the rings into the combustion chamber. Worn grooves are usually flared or tapered causing increased side clearances which permit more than the normal amount of oil to pass the rings into the combustion chamber. Excessive side clearances also create a pounding effect by the rings on the sides of the piston grooves. This promotes piston groove wear and, if the condition is not corrected, breakage of rings lands may occur.



12 Cracked or Broken Ring Lands

Cracked or broken ring lands prevent the rings from seating completely on their sides and cause oil pumping by a process similar to that described in #7. In addition to this, they also lead to serious damage of the cylinders as well as complete destruction of the pistons and rings. Cracked or broken ring lands cannot be corrected by any means other than piston replacement and this should be done as soon as there is the slightest indication of a crack.



13 Worn Valve Stems and Guides

When wear has taken place on valve stems and valve guides, the vacuum in the intake manifold will draw oil and oil vapor between the intake valve stems and guides, into the intake manifold and then into the cylinder where it will be burned. If this condition is not corrected when new piston rings are installed, an engine is likely to use more oil than it did before because the new piston rings will increase the vacuum in the intake manifold. When gum or deposits on the valve stems are removed - a procedure recommended when overhauling an engine - the seal previously formed will be removed and leakage will be more pronounced. This is particularly true on overhead valve engines where loss of oil may occur on the exhaust valves as well as on the intake valves. High oil consumption caused by too much valve guide clearance can frequently be cured by reaming or nerring the valve stem. In some cases new valves may also be required. Use of a permanently bonded valve stem seal will give added insurance against oil leakage on complete engine overhauls or on valve jobs.



14 Bent or Misaligned Connecting Rods

Bent or misaligned connecting rods will not allow the pistons to ride straight in the cylinders. This will prevent the pistons and rings from forming a proper seal with the cylinder walls and promote oil consumption. In addition to this, it is possible that a bearing in a bent rod will not have uniform clearance on the crankpin. Under these conditions, the bearing will wear rapidly and throw off an excessive amount of oil into the cylinder.



15 Worn or Improperly Fit Wrist Pins or the Wrong Pins

The use of worn or improperly fitted wrist pins or the installation of the wrong pins, as in the case of rifle drilled rods where oil is forced to the wrist pins under pressure, can cause such an excessive throw off of oil onto the cylinder walls that the piston rings may not be able to control it. This will not only result in the direct loss of the excess oil but also in the formulation of carbon which will clog the oil passages and cause the rings to become stuck in the grooves.

16 Wrist Pins Fit Too Tightly

Wrist pins that are fitted too tightly at both ends prevent the pistons from expanding and contracting freely under the repeated heating and cooling encountered in engine operation. The piston distortion results in scuffing and scoring, which inevitably leads to blow-by and high oil consumption.

17 Clogged Oil Passages

After an engine has had long, hard service the oil passages in piston rings and pistons will likely become clogged from carbon or an accumulation of foreign matter in the oil. The passages are designed for carrying oil - in excess of the amount needed for lubricating the cylinders - back to the crankcase. When the passages become clogged, oil may be trapped in areas reducing the indicated level of oil within the engine. It may also pool in areas such as above the valve guides, which can further promote consumption.

Clogged passages in rifle drilled rods or any clogged oil line will starve the engine of lubrication, promote wear and lead to high oil consumption. To avoid clogging of oil passages, the same precaution should be taken as recommended in #28. Initial side clearance is not applicable in this case.



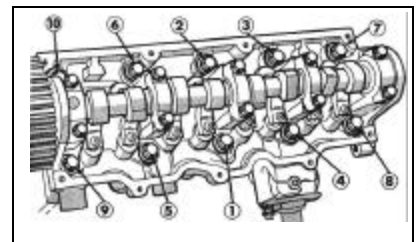
18 Unequal Tightening of Main Bearing Bolts or Connecting Rod Bolts

Unequal tightening of main bearing bolts or connecting rod bolts will throw the bearing bores out-of-round enough to shorten bearing life and to cause an abnormally large throw off of oil from the bearings. The effect on oil consumption is described in numbers 3 and 4. When bearing bores are originally machined, at the time of engine manufacture, the bolts are tightened to the manufacturer's torque. A torque wrench must be used to insure roundness of the bearing bores whenever the bolts are tightened after having been removed and reinstalled. Unequal tightening of connecting rod bolts may also cause connecting rod distortion, with results similar to those described in number 14.



19 Unequal Tightening of Cylinder Head Bolts

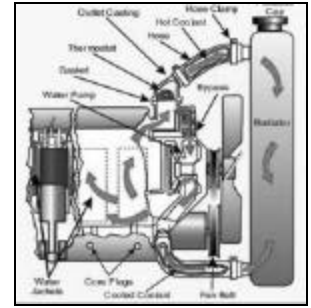
The strains developed by unequal tightening of cylinder head bolts may cause serious cylinder distortion and result in oil pumping as mentioned in #7 and #8. When re-installing a cylinder head, a torque wrench should always be used on the head bolts. The engine manufacturer's instructions should be followed for the torque readings and the sequence in which the bolts are tightened.



20 Dirty Cooling Systems

Rust, scale, sediment or other formations in the water jacket and radiator, or corrosion of the water distributing tube, will prevent a cooling system from performing its duties efficiently. This is likely to cause cylinder distortion with a direct loss of oil as mentioned in #7 and #8.

A defective cooling system causes overheating of the engine with the possibility of developing localized hot spots in some of the cylinders. This may also lead to scuffing and scoring of cylinders, pistons and rings which results in high oil consumption.



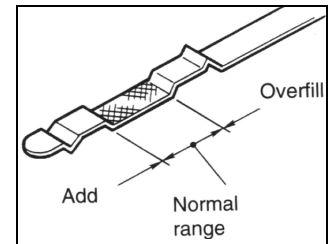
21 Dirty Oil

Failure to change the oil at proper intervals or to take proper care of the oil filter may cause the oil to be so dirty that it will promote clogging of the oil passages in the piston rings and pistons. This will increase the oil consumption as described in #17. Dirty oil will also increase the rate of wear on bearings, cylinders, pistons and piston rings. All of these worn parts, as explained in individual items on each part, will contribute to a further waste of oil. Note: as a rule, dirty oil by nature is also consumed at a higher rate than cleaner oil.



22 Too Much Oil in Crankcase

Due to an error in inserting the oil dip stick so that it does not come to a seat on its shoulder, a low reading may be obtained. Additional oil may be added to make the reading appear normal with the stick in this incorrect position which will actually make the oil level too high. If it gets so high that the lower ends of the connecting rods touch the oil in a pressure lubricated engine or the dippers go too deep into the oil in a splash lubricated engine, excessive quantities of oil will be thrown on the cylinder walls and some of it will work its way up into the combustion chamber.



23 Incorrect Piston Rings for Type of Engine or Type of Service

If rings of an incorrect size are installed (for instance, .020" oversize rings in .040" oversize cylinders) they can readily cause oil pumping because they will not fit the cylinders and will be unable to keep the oil down from the upper cylinder walls. In this example, ring end gap will also be greater, resulting in additional oil loss, as described in #26. Different types of engines and their use in different types of service require individually engineered ring sets which vary in many ways. Each set has been designed for a particular purpose, but if one is used in an engine for which it is not intended, it may be incapable of controlling the oil in that engine. It is extremely important to always make sure that the correct set is used.

24 High Engine Vacuum

Engine vacuum has increased in modern engines due to the fact that engine rpm, valve overlap and compression habits have also increased with these models. Some of the late model engines will draw as high as twenty five inches of vacuum on deceleration, as compared to twenty inches in older engines. This high vacuum characteristic has made it necessary for the development of an oil ring to seal both (top & bottom) sides of the ring grooves and eliminate oil from passing around the back and sides under high vacuum or deceleration. Such vacuum could be the main cause of smoking and oil consumption so it is important that you use a side sealing piston ring when called for.



25 Worn Timing Gears or Chain

Worn timing gears or chain can cause the valves (and sometimes the distributor) to be out of time with the crankshaft. The large amount of backlash, which is caused by this wear, will prevent proper engine adjustment because timing may vary from one revolution of the crankshaft to another. When the valve and piston motions are not synchronized, extremely high oil consumption may result. This will be caused by excessive vacuum which draws large quantities of oil into the combustion chamber where it will be burned.

26 **Piston Rings Fit with Too Little End Clearance**

When fitting new rings, care must be taken to see that, with the rings in the smallest part of the cylinder, sufficient end clearance is allowed for expansion due to heat. Normal gap clearance in automotive engines with cast iron rings usually runs .003 - .005 per inch of bore diameter. The rings will heat more rapidly and will operate at a higher temperature than the cylinder because they are exposed to the direct heat of the burning gases from the combustion chamber. The cylinder walls are kept at a lower temperature by the water in the water jacket. This means that the rings expand more than the cylinder and this expansion must be allowed for by use of a gap - known as end clearance - between the two ends of each ring. If sufficient end clearance is not provided, the ends of the rings will butt while the engine is in operation.

Butting will cause scuffing and scoring of rings and cylinders which leads to oil consumption. If the engine is allowed to be used for continued operation, especially under heavy load, scoring will become more severe. The ends of the rings will be forced inward - away from the cylinder wall - so that a space opens up between the rings and the cylinder. This provides a direct path for hot gases from the combustion chamber to burn the oil on the cylinder and greatly increases the oil consumption of the engine. Severe cases of butting may also cause ring breakage, with the same results as described in number 27. Excessive ring end clearance leads to increased oil consumption as well.

27 **Worn or Broken Piston Rings**

When piston rings are broken or are worn to such an extent that the correct tension and clearances are not maintained, they will allow oil to be drawn into the combustion chamber on the intake stroke and hot gases of combustion to be blown down the cylinder past the piston on the power stroke. Both of these actions will result in burning and carboning of the oil on the cylinders, pistons and rings.

Broken rings are especially damaging because their loose pieces with jagged ends are likely to cut into the sides of the piston grooves. This causes land breakage which results in the complete destruction of the piston assembly. Instead of reinstalling worn rings during engine overhaul, it is always advisable to replace them. New rings have quick-seating surfaces which enable the rings to control oil instantly, unlike rings which have been used in the past. Used rings, even those that have been only slightly worn will still have polished surfaces that will not seat-in properly and will lead to excessive oil consumption.



28 **Pistons Rings Stuck in Grooves**

Obviously, oil cannot be controlled by piston rings which are stuck in their grooves, so every effort should be made to prevent rings from becoming stuck. First, they should be installed with sufficient side clearance to enable them to remain free while the engine is working under load at normal operating temperatures. Second, every precaution should be taken at the time of assembly to see that all parts of the engine are clean of any dirt particles which might cause the rings to stick. Third, a good grade of oil should be used to lessen the possibility of carbon or varnish. Fourth, the oil should be kept clean by regularly scheduled oil changes and proper care of the oil filter. Fifth, every precaution should be taken to keep the engine from becoming overheated from any cause.

29 **Late Valve Timing**

Late valve timing will keep the intake valve closed too long after the intake stroke has started, and will increase the vacuum in the cylinder. The high vacuum will have a tendency to suck oil up past the piston and rings into the upper part of the cylinder where it will be burned.

30 **Oil Pressure Too High**

An incorrect oil pressure setting or a faulty relief valve may cause the oil pressure to be too high. The result will be that the engine will be flooded with an abnormally large amount of oil in a manner similar to that which occurs with worn bearings.



31 **Oil Viscosity**

The use of an oil with a viscosity that is too light may result in high oil consumption. Refer to the vehicle owner's manual for the proper oil viscosity to be used under specific driving conditions or ambient temperatures.

32 **Piston Slap**

Some late model engines meeting the latest emission requirements have changed their piston design. This can sometimes lead to a light "knock" at startup. In some cases this can increase oil consumption levels.

33 Internal Gasket/Intake Breach

Newer engine designs sometimes implement a combination of composite materials and metals. Gaskets and seals can sometimes breach or become stressed over time due to differences in heat expansion and contraction differences causing oil consumption levels to increase.



34 Spark Knock

Most new automobiles have knock sensors to adjust timing to reduce emissions as well as increase engine power and performance. Spark knock is due to premature ignition of the fuel during the combustion process. Preignition results in surges of pressure being forced upon the piston. This disrupts the movement of the piston ring, resulting in a loss of ring seal on both the top and bottom of the ring, and ultimately allowing for increased blowby and oil consumption past the rings. This may also occur due to a faulty mass air flow sensor or throttle positioning switch.

35 Aftermarket Performance Chips and Modifications

Increasing performance through the use of performance/power enhancement products to a stock or factory engine can increase the chance of excessive oil consumption.

36 Lugging Engine

Lugging is running the engine at a lower RPM in a condition where a higher RPM (more power/torque) should be implemented. This causes more stress loading on the piston and can lead to increases in engine oil consumption.

37 Inappropriate Operation of Overdrive

Operating the overdrive mode in conditions where it is not recommended will cause the engine to consume oil for a variety of reasons. Such conditions include towing or stop-and-go driving in city traffic. See also reason #36.



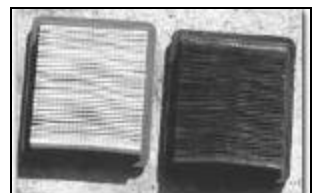
38 Leaking Turbocharger Seal

A leaking turbocharger seal will draw oil into the combustion chamber where it will burn and form carbon deposits which contribute to further oil consumption as they interfere with proper engine function.



39 Restricted Air Intake

Excessive restriction in the air intake system will increase engine vacuum and can increase oil consumption as noted in #24. A heavily plugged air filter would be one example of this situation.



40 Fuel Dilution

If unburnt fuel is allowed to enter the lubrication system, the oil will become thinner and more volatile. Both will result in higher oil consumption. Excess fuel can enter and mix with the oil via a leaking fuel injector, fuel pump problem, restricted air intake or through excessive idling.



**Clean Injector
Spray Pattern**

**Dirty Injector
Spray Pattern**