OIL LEVEL AND OIL CONSUMPTION

APPERTAINING TO 4.25 / 4.5 LTR ENGINES

R-R Silver Dawn, Silver Wraith, Bentley MKVI, R type

N. W. Geeson

www.creweclassicsix.co.uk

Throughout the 50's and 60's the writer knew of some 15 or 20 engines that had been placed into service with high oil capacities. These engines of both diesel and petrol power had an unhealthy appetite for excessive oil consumption in service. In some instances service bulletins were issued to rectify the situation, in others the manufacturers altered the dip stick markings. On occasion resilient fleet engineers quickly realised the problem from oil consumption returns and applied remedies internally within their own organisations. In the case of some cars, the unfortunate individual owners who had no comparisons did not know any better.

Excessive oil consumption was usually manifesting itself when the vehicles were operated in very hilly terrain. Some were known to oil thrash on No l big end whilst going downhill, others had the opposite problem with No 6 big end whilst climbing. A reduction in oil fill of around 2 / 3 pints dependent upon engine oil capacity was usually enough to halve the oil consumption. In the 60's as a vehicle fleet engineer, I experienced similar problems with R-R 4.5 / 4.8 litre engines operating in particular over the old Gothard pass in Switzerland. Re-marking the oil dipsticks to provide a maximum level at the point between the normal maximum and minimum marks cured the problem.

My own feeling is that well into the 70's, before emissions became a somewhat emotive subject, there was a general theme amongst manufacturers of "put more oil in, and they might not run low". In the years since, manufacturers have needed to become more prudent with oil capacities to contain emissions. Oil levels are now much more of a fine art, if only to prevent catalytic converter damage.

In the last year or so, a number of owners of 4.5 litre cars have mentioned to me their surprise at the oil consumption of their cars. These cases have involved engines that are relatively new, in good condition and in no way could be described as needing an overhaul.

To investigate the reasons in detail why lower oil levels may improve oil consumption, I carried out a series of measurements and tests, on a 4.5 litre Bentley R type engine of my own car. Significantly the engine has always been operated using a middle mark between maximum and minimum on the dipstick as the norm for full oil level. Oil consumption being around half compared with that when operating at the normal full level, a fact I have known since my earlier days.

The following measurements were taken from the detached engine sump (oil pan), with the sump placed in such a position that the block mating flange was level. Measurements are in inches within a tolerance of 0.0625 inch unless stated otherwise and the thickness of the sump gasket is ignored, oil capacities are shown in imperial pints.

The sump was filled with 16 pints of oil, intermediate checks taking place to establish levels from 12 pints to the normal 16 pint capacity. The oil level being 2.25 inch below the flange face at maximum capacity. This position comes exactly at the top of the oil level gauge mounted on the right hand rear of the sump, very convenient for external assessment.

The oil dipstick part number RE4783 enters the crankcase from the left side of the engine at an angle. The distance between the max and min marks on the stick itself being 1.925 inches. Maximum mark on the dipstick corresponds with an oil level 2.25 inches below the sump face as noted above. In other words, this is when the sump itself contains 16 imperial pints, ignoring any oil in the engine lubrication galleries, filter or crankshaft. At a point, where the dipstick registers oil at its minimum mark the actual oil level is 4.00 inches below the sump face. The depletion of oil between the maximum and minimum marks on the dipstick does not correspond in a linear fashion to the oil level below the sump flange, due to the shape of the sump.

The oil capacities of the sump at various distances from the sump flange are shown below, tolerance in this case being within 0.125 inch.

16 pts. = 2.250, 15 pts. = 2.375, 14 pts. = 2.500, 13 pts. = 2.687, 12 pts. = 2.875

In practice, it should be noted that the actual maximum oil level would vary in an installed engine, unfortunately for the worse, depending upon the front and rear car suspension standing heights. In addition the engine is tilted a few degrees to the rear naturally and deterioration of the rear gearbox mounting will make this situation worse. For practical purposes the maximum oil level as marked on the dip stick will be just under 2.00 inch from the sump flange at the rear of the engine due to the fore and aft tilt of the installation. Again, this statically measured oil level will rise at the rear as the car is accelerated from rest. A horizontal oil baffle is fitted to the sump to help contain oil surge caused by high fore and aft and lateral acceleration forces. Unfortunately at the maximum oil mark level, it is less effective than when the oil level is lower.

The big end studs scribe an arc, their position at the bottom of this arc is around 1.125 inch below the cylinder block face. For our study, this can be taken as 1.125 inch below the sump face and it can be seen that no 6 big end studs will only be 1.125 inch above the oil even presuming the engine was level. Even allowing for a slight drop in oil level as the internal galleries take up pressure and hence oil, it seems more than probable that components of the crankshaft can strike oil during normal vehicle operations.

The situation is made worse when the relative position of the balance weight at the front of no 6 big end is considered. This large mass at its lowest point passes 1.125 inch below the cylinder block face and therefore below the sump flange. Its position is some 4.25 inch from the rear face of the sump to the rear face of the weight. For external reference, the front of the weight is in line with the centre of the third sump retaining bolt from the rear.

It should be noted that there are slight differences in the size, position and fixing of crankshaft balance weights between the various post-war six cylinder engines.

A circular labyrinth is machined into the rear main bearing cap. Oil passing through the main bearing to the rear end drains into this labyrinth and then by a large bore pipe some 4.312 inch long into the sump below the oil level. Any oil passing the circular labyrinth is subject to the vacuum produced by a left handed scroll machined at the rear of the crankshaft. The outlet of the drain pipe being positioned in a square recess at the base of the sump. This is in order that the labyrinth and scroll are not subject to crankcase blow by pressure directly through the drain pipe. This sump square recess contains oil whatever the angle of the engine. The bottom face of the rear main bearing cap and for our purposes, the bottom of the labyrinth, form a flat surface to which the extreme rear centre section of the sump is bolted. Should oil reach the rear sump flange it effectively has just about reached the labyrinth.

It can therefore be seen that if the engine is tilted rearwards such as when the car is driven up a long gentle incline the oil level will eventually overcome the horizontal oil baffle. At this point, severe oil thrash can occur from the No. 6 big end and to a lesser extent, the rear crankshaft balance weight. In the process excess quantities of oil can be directed towards No 5 and No 6 cylinder bores, to be readily consumed after passing the pistons and rings.

It is my own belief that as this phenomenon occurs only during hill climbing and in most cases for brief periods only, it does not give away its presence by oiling the two rear cylinder plugs. After normal service resumes any fouling seems to clear away.

If the incline was to become steeper or if the car engine was run on a steep house driveway the oil level could reach the rear sump flange. At that point, any excess oil from the rear main bearing will not drain away fast enough to prevent some oil flowing into the clutch or fluid flywheel housing. In addition, the oil thrash will be more severe.

Literature shows the engine oil circulation at 7.3 Gallons per minute at 4000 rpm, depending on which version of data you read. However even at the rear main bearing adjacent to the labyrinth, the oil flow is considerable and in practice over 20 lb. sq.in of pressure is obtainable. Some 50 % of this oil flow should return to the sump from the labyrinth and will do so unless the integrity of the return system is compromised by the oil level reaching the labyrinth. Any attempt by the owner to increase engine oil pressure will have an effect on the ability of the drainage system to return oil. Engine wear or other causes which increase crankcase pressures will also affect this oil return system as the return scroll area becomes subject to positive crankcase pressure.

The original 4.25 litre engines were fitted with a side crankcase breather. This was replaced with a later version that was connected to the front of the rocker cover. I am indebted to David Haines of Merton, London SW19 for reminding me that the reason for repositioning the breather was that the original one leaked oil as the car was driven around bends. This point shows just how much oil or oil mist is present at such a high level above the sump flange. Undoubtedly leakage from this original low level breather would have been assisted by crankcase positive pressure.

The re-positioning of the breather to the rocker cover may have prevented direct leakage from the breather but it did appear to cause another problem, that of raising the crankcase pressure. It is significant that in 1952 R-R drew up a scheme to increase the engine breathing by no less than 45% by increasing the size of the push rod holes on the 4887 cc inter Siam engine. I am unsure whether this scheme was incorporated into the new cylinder head, but it shows their concern. They also took the opportunity to position an integral oil thrower on the rear of the crankshaft to assist and improve oil return to the sump.

It is interesting to contemplate whether a re-introduced but modified low level side breather would have a positive effect, on either oil leakage or consumption. The relative oil level can be compared easily to the position of the components mentioned by viewing the sectioned Silver Wraith 4.25 litre engine on display at the R-REC HQ at Paulerspury. This particular engine exhibit shows remarkably well how oil thrash can occur, just remember that the engine is displayed in a level condition and that the normal oil level would be at the top of the electric sump gauge.

In the case of 1947 Bentley workshop manual for the 4.25 litre, instructions on the engine oil level stated the following. “It is not necessary for the oil level to be always at the MAX mark, but it should never be allowed to fall below the MIN mark". On the other hand the 1951 Handbook No V III goes on to say, " and the system regularly topped up as required so as to keep the level of the oil up to the MAX mark". Handbook No XIV for the later 1953 4.5 litre cars repeats the 1951 information.

All information on these engines shows the oil capacity to be 16 pints. Those who have taken note when filling a brand new 4.5 litre engine with oil will already be aware of one fact. That is that the engine will accept significantly more than 16 pints of oil before the level shows at the maximum point on the dipstick. Does this not strike a chord?

In summary operating at lower oil levels appears to improve oil consumption.

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