Scientific Journal of Impact Factor (SJIF): 4.14
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 3, Issue 9, September -2016

Review on Causes of oil consumption

Antala Romilkumar[1], Tarpara Akshay[2], Hiren Makwana[3]

[1]Mechanical dept,Atmiya institute,romilantala1995@gmail.com
[2]Mechanical dept,Atmiya institute,akshaytarpara90@gmail.com
[3]Mechanical dept,Atmiya institute,hiren_sos@yahoo.co.in

Abstract - *The wear patents of rings and grooves of a diesel engine where analyzed by using a ring dynamics and ring-pack oil film thickness model. The calculation focused primarily on the contact pressure distribution on the ring side and grooves as well as on the contact location on the ring surfaces. Up-scraping of the top ring was studied by considering ring dynamic twist and piston tilt. On the other hand various types of oil are using in diesel engine for providing lubrication, cooling, prevent corrosion and etc. Engine lubrication oil contains many compositions by changing this composition better lubrication oil can be used in diesel engine. These work shows providing practical guidance to optimizing the ring pack and oil grade to control wear and reduce oil consumption.*

Keywords – *ring pack, oil grade, wear, oil consumption, diesel engine*

I. INTRODUCTION

Diesel engine contains many accessories like cylinder, piston, liner and piston rings are most important parts for power transmission. It is well known to power cylinder engineers that the ability of the piston rings to conform to liner distortions greatly affects engine oil consumption. The main primary function of oil rings are responsible for scraping the oil off the cylinder wall thus preventing most of the oil from reaching the combustion chamber.
In reality, ring and liner inevitably make direct contact and wear occurs which tends to increase inside temperature of cylinder which cause oil consumption which is available as a small film between cylinder liner and piston ring. Once in the chamber, part of the oil will be burned into carbon deposits, which contribute to the engine performance. The remaining residues from the burned oil will be exhausted as air pollutants which have acceptance levels limited by the EPA. Therefore, it is paramount importance to the engine manufacturer to reduce and maintain a low level of oil consumption throughout the entire engine life.

The main function of the piston ring is to maintain Radial pressure so as to seal the space between the piston and cylinder liner and prevent the leakage of gases past the piston. Therefore oil rings are traditionally made of ductile cast iron with an electro-deposited layer of chrome at the outside diameter for wear protection. Due to good wear strength alloy cast iron containing nickel, chromium and molybdenum used as a ring material.
Lubrication oil is necessary for the satisfactory performance and durability of the engine. The lubrication oil should have sufficient viscosity, volatility, carbon content and storage, flash point and oxidation resistance etc.

1. EFFECTS OF RING DYNAMICS ON OIL TRANSPORTATION AND OIL CONSUMPTION

One phenomenon from the model calculation performed here is directly related to oil transportation and may be important mechanism for engine oil consumption.

1.1 TOP RING UP-SCRAPPING DUE TO RING DYNAMIC TWIST AND PISTON TILT

The oil scrapped by the top ring has been recognized as one of the important oil consumption mechanism for diesel engines [1, 2]. From a set of conclusive diesel engine takes data, Mihara et al. [2] found that the variation of the engine oil consumption to directly related to change of the top ring running surface profile due to wear. However, their analysis was based on fully loaded ring lubrication condition and did not take into account the effect of ring dynamic twist and piston tilt.

Here the worn top ring running surface profile has the general features of diesel engines, namely; a barrel placed shape with an offset. Considering the tilt of the ring running surface due to the positive ring static twist, the ring running surface would reassemble a scraper ring in shape and at like a down-scrapping scraper ring. However, it can be demonstrated the dynamic twist of the top ring and piston during the late compression stroke can greatly alter the top ring running surface profile and make the top ring lose hydrodynamic film support and scraped oil up the liner during the late compression stroke.

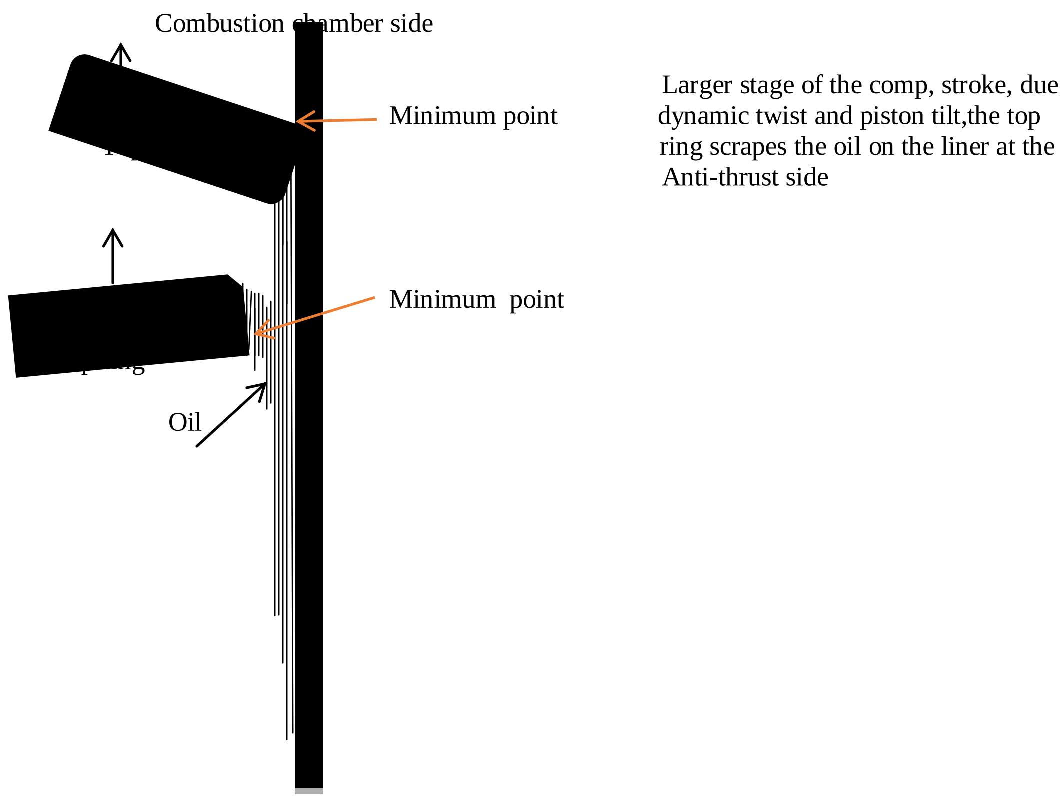

Figure.1 illustration of top ring up-scraping at the anti-thrust side during the late part of compression stroke

The profiles of the worn rings at section 2 and groove tilt at -0.2° during the engine operation are used for this analysis. As demonstrated earlier, -2° can be considered as the most probable of groove tilt angle during the engine operation for engine test. The dynamic minimum point never moves to the upper edge and the top ring is found not scrapping oil up the liner if the piston tilt is not considered. However, the piston head tilts towards the anti-thrust side during the late compression stroke because of the pin offset to the thrust side. With the addition of the piston tilt, the dynamic minimum point of top ring running surface of the part of the ring at the anti-thrust side move further to the upper edge during the late part of the compression stroke and results in top ring behaving up scrapping.

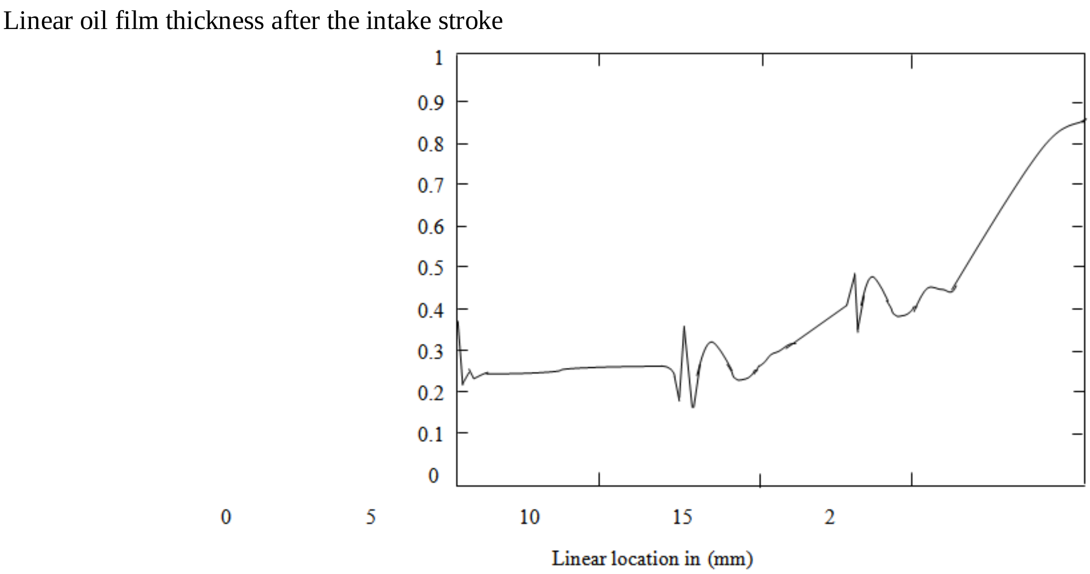

Figure.2 linear oil film thickness in the upper linear region after the intake stroke

A rough estimate was made to examine if the rate of oil scrapped up by the top ring, if the existing, matches the oil consumption rate in order of magnitude. A typical piston tip value(20 min.) is used as the piston (20mm from the TDC position of the top ring on the liner) the dynamic minimum point of the top ring move to the upper edge at the anti-thrust side due to the combined effect of ring dynamic twist and piston tilt. When the minimum point of the op ring moves to the upper edge, the hydrodynamic lift on the ring running surface disappears and thus the ring radial load can only be supported by the line contact as a result, the oil on the liner is scrapped up by the top ring (fig.1). Some of the scrapped oil may be thrown out to the combustion chamber by the inertia force, which directly contributes to oil consumption, and the rest may return to the liner or flow to the top ring grooves. To estimate this up-scrapping rate by the top ring, the liner oil film thickness in the upper liner region after the intake stroke (fig.2) is used. This is the oil that the top ring "sees" when it travels to region during the compression stroke. Inn fig.2 the origin of the horizontal axis is the liner location of the top ring at TDC. Assuming 1/10 of the entire circumferences of the ring(around the anti-thrust side) is involved in up scrapping process. We obtain the oil up scrapping rate as approximately 3mg/sec. this is closed to the oil consumption value of 1.5mg/sec. obtained from the measurements during the entire test.

While more analysis and engine test data are useful to establish a more number of model, in order of magnitude between the estimated top ring up-scraping rate and the entire oil consumption does show that the combination of the ring dynamic twist and piston tilt may be the cause of the top ring-scraping and this is due to late compression stroke. The measurement of Tamai [3] was conducted at the thrust side and the crown land of the piston head was found to be neat and dry. All these piece of experimental evidence and proof indicate fresh oil may be present on the crown land at the anti-thrust side and support the present and also the previous analysis based on this experimental work.

2. Due to worn fuel injection pump:

The lubrication of the moving parts of an in-line injection pump is usually performed via the oil circuit of the engine. When elements of the pump become worn, engine oil can enter the working chamber of the pump elements between the cylinder and piston of the pump during the downward stroke of the pump piston (from TDC-BDC). There the engine oil is mixed with the diesel fuel and injected into the combustion chamber during the fuel injection process and is then burned and due to this oil consumption will take place.[4]

Figure 3. Injector pump

Figure 4. Air intake system

3.Due to oil escaping into the intake system:

The sucked in intake air has a long path until it reaches the combustion chamber. In between there are many joints and connecting points which are sealed by means of gasket or rubber hosing. If these become porous and/leaky, then unfiltered and contaminated air is sucked in at these points. This air then reaches the combustion chamber. Inadequate intake air filtration resulting from missing, defective or unsuitable air filters has the same effect on lubrication oil consumption.[4]

4. Due to Excessively high oil levels:

If the oil level is too high the crankshaft will splash more into the oil, creating more oil mist in the process. If the oil being used is unsuitable, contaminated or hold then this splashing cause the oil to foam. Together with the "crankcase blow-by gases" and the increasing level of oil mist being generated, this then raised through the positive crankcase ventilation system towards the intake track. If the engine is not equipped with an oil separator t, this is then sucked back in by intake system and burn in combustion chamber so that there is a possibility of higher oil consumption.[4]

Figure 5. Oil level indicator

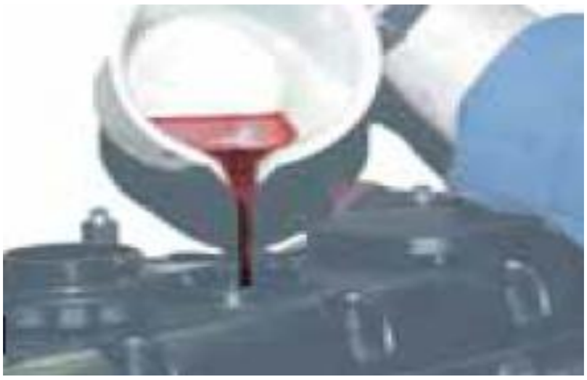

Figure 6.Pouring of mineral oil

5.Due to use of low-quality mineral oils:

Reliable operation of the engine can not necessarily be guaranteed in all operating situation if unsuitable or low quality engine oils is used. Wear inside the engine will increase unnecessarily in situation such as cold start or during operation with over ally high temperature. The chosen oils should correspond to the manufacturer's recommendation. If the oil is lacking in key properties, for example if it has in sufficient additives for the additives are nor right for the engine, Then there is an risk of wear and an associated risk for engine damage.[4]

6.Due to excessively high oil pressure:

If the oil pressure is too high, the mating phases cannot withstand this higher pressure there can be various reasons of the oil pressure is to high:

Figure 8.Oil pressure indicator

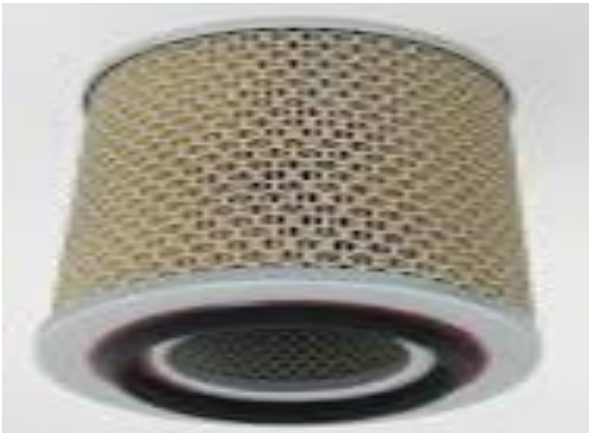

Figure 9. Air filter

Reasons :

- Oil lines and oil filters can become blocked by dirt and contamination
- The oil circuit can be hampered by a defective oil, non-return valve or oil pressure control valve.
- Blocked oil filters without a bypass valve.
- The use of incorrect parts, such as incorrect non return valve or hoses, or the use of incorrect engine oil will lead to faults in the oil circuit and causes oil consumption.[4]

7. By using out dated air-filter:

Air filter is a main component of the intake manifold or inlet system. Atmospheric air contains more amount of moisture, dirt and so many dusts. So by using air filter at the intake system one can prevent inlet of dust and moisture inside the cylinder and also decrease the clogging of inlet hose pipe. But if there is any problem into the air filter than it will allow the out sided atmospheric air inside the cylinder wall and that dust will stack on the cylinder inside periphery and possibility of wearing of piston ring and generated of heat so much. Overall this effects the oil consumption very high. [4]

II. CONCLUSIONS

This is a first attempt to analyze the effect of ring dynamics on ring/groove wear, ring/liner wear, and oil consumption in a diesel engine by combining engine test data and model calculations. Good agreement is obtain between the ring/groove wear pattern measurements and the modal calculations.The analysis indicate that under the engine test operating condition, there exists a tilt angle on the bottom of the top-ring groove that might give a uniform wear to the bottom of the top ring and its groove and thus this angle would be sustained. Coinciding which the findings from other work, this study also shows that the worn profile of the upper running surface of the top ring is primarily determined by the tilt angle of the bottom of the top groove during engine operation.

The profile of the worn upper wedge of the top ring was found critical for oil consumption for various diesel engines. The examples here shows that the profile of the worn top ring running surface can scrape up on the liner at the anti-thrust side during the late compression stroke. This top-ring up-scrapping is due to combine effect of ring dynamic twist from high cylinder pressure and piston tilt. An estimate of the oil up-scrapping rate is of the order of the oil consumption valve from measurements. The top-ring worn a running surface profile used has a typical profile found in other diesel engine. Therefore, the top-ring up-scrapping mechanism explored here may have broader application. Which the understanding of the top-ring/groove wear mechanism and the worn top-ring up-scrapping mechanism, one can potentially optimize the ring profile, groove profile, and ring/groove coating minimize the oil loss from top-ring up-scrapping.

On the other hand faulty oil lubrication system, clogged air filter, worn injection pump may cause for high rate of oil consumption and leakage but this can be controlled by regular maintenance and precaution. While valve timing mechanism, changing design of tappet, cam dimension can cause various internal hazardous problems like increasing temperature and burn out of oil particle inside cylinder which cannot be removed easily, stuck on the wall of cylinder create thin gap between cylinder wall and liner causes oil leakage between piston and liner, effects oil loss from crank sump oil level and high rate of consumption.

REFERENCES

[1] Yoshida H., Kusama K., and Kobayashi, H., 1997, “Diesel engine oil consumption depending op piston ring design,” SAE paper 911699

[2] Mihara, K., and Inoue H., 1995, “Effect of pistonring desing on oil consumption,” SAE paper 950937

[3] Tamai, G., 1995, “Experimental study of engine oil film thickness dependency on liner location, Oil properties and operating condition,” M.S. thesis, Department of Mechanical Engineering, MIT

[4] Automobile Engineering Reference book –R.B. Gupta

