

INVESTIGATING THE FACTORS INFLUENCING WEAR IN ENGINE COMPONENTS FOR IMPROVED PERFORMANCE

Patidinov Aslidin Khusniddin ugli

Andijan state technical institute,

Teacher of the Department of Automotive Engineering and Transport

Abstract: This article explains that the gap between the cylinder and piston plays a crucial role in the functioning of the ring. It allows lubricating fluid to pass through, which aids in cooling the ring's contact surfaces and lowering the applied force. If this clearance is not properly sized, it can lead to increased ring temperature and faster wear. As a result, the article concludes that maintaining an optimal clearance is essential for the ring's durability and the overall performance of the machine.

Keywords: ring, cylinder, piston, slit, lubrication, wear.

Introduction.

This year, it is planned to produce localized products worth about 6.5 trillion soums through the implementation of 960 projects. 122 types of products proposed for development have been identified.

The process of studying additional reserves for reducing imports of products has shown the possibility of reducing imports by an additional 23 percent this year by expanding intersectoral industrial cooperation and organizing the production of new types of import-substituting products [1].

Approved by Appendix No. 2 to the Decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. UP-60 "On the Development Strategy of New Uzbekistan for 2022-2026." In accordance with paragraph 105 of the State Program, on the basis of public-private partnership, projects worth about 14 billion dollars were implemented in the fields of energy, transport, healthcare, education, ecology, utilities, water management, and others [2].

Methodology.

The books "Internal Combustion Engines (Theory and Design) " by S.M. Kadyrov and "Internal Combustion Engines" by M.M. Fayziev were used. M.M.Fayziyev's book details the calculation of engine parts, while S.M.Qodirov's book presents the design, materials, and requirements for them [3-5].

The operating conditions of the piston rings, the factors influencing them, and other information were described in Professor T.S. Khudoyberdiyev's manual "The Importance of Piston Rings" [6].

In performing thermal calculations, there are discrepancies in many literature sources.

In U. Karimov's book "Theory of Internal Combustion Engines," the heat calculation of an engine is presented in a more understandable way with examples.

Information is provided from the scientific works of Professor B.Y. Ginsburg on the wear of piston rings. It is widely covered in the works of L. Burstein on the study of oil burns [5-7].

Result and discussion.

It is desirable that the gap between them be sufficiently large for the piston to move freely in the cylinder, but from the point of view of the hermetic seal of the combustion chamber, it is

desirable that this gap be as small as possible. These two ideas are a constant problem in engine engineering. Many scientific works have been devoted to their solution, but this problem has not yet received a definite solution. Determining the optimal size of this clearance is very difficult, since during operation the cylinder and piston undergo deformation under temperature and load. Measuring its magnitude directly is a complex task. Moreover, the size of the initial gap between them is determined for their cold state.

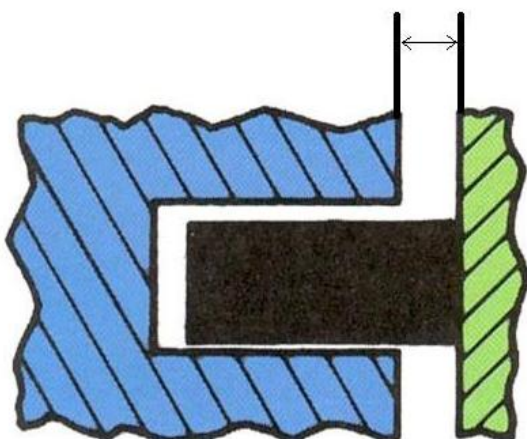


Figure 1. Cylinder-piston clearance

Taking precautions so that the piston does not get stuck between the cylinders, it is marked more than necessary. Moreover, the size of the gap is determined for the largest diameter of the piston skirt. As the piston moves upwards, its diameter decreases, and the clearance size ($e_{sub>a</sub>}$) increases. Due to this, the tightness deteriorates, the operation of the first ring deteriorates, and its temperature rises. Therefore, analyzing the design of each engine piston, taking into account its operating conditions, and developing measures to reduce the cylinder-piston clearance is an actual task. Because as this gap increases, crankcase oil burnout increases. If the gap between the piston skirt and the cylinder is increased, the gap between the piston bottom edge and the cylinder increases, and the engine's performance deteriorates.

The reason for the deterioration of the ring operation with increasing clearance is that the angle of inclination of the piston inside the cylinder increases. With piston deflection, the twist of the ring in the groove increases. As a result of twisting, firstly, the parameters ensuring good operation of the ring change, and secondly, the radial surface of the ring does not fully touch the cylinder walls. As a result, under the pressure of gases in the combustion chamber, the ring separates from the cylinder walls, creating a gap between them. Therefore, it is necessary to minimize the gap between the piston and the cylinder as much as possible. However, the question of how to reduce it remains unanswered. The idea that the piston temperature should be lowered and that various thermal insulation coatings should be used has little effect. However, for this purpose, an oval-barrel-shaped piston was used, which made it possible to reduce the gap in the D-144 engine from 0.20...0.24 mm to 0.10...0.12 mm. As a result, due to the reduction of oil burnout, one oil scraping ring was also removed. As a result of studying the work in this direction, the following conclusions were made: The cylindrical piston slot plays a significant role in increasing the tightness of the

combustion chamber from the ring side.

2. If, as a result of the application of effective methods, the initial clearance is minimized, then the clearance, which increases due to wear of the cylinder and piston during the engine's operation, does not pose a significant risk to the engine's service life.

Influence of cylinder shape on piston ring operation

The ring must be in close contact with the cylinder walls along its radial surface. However, the shape of the cylinder influences the performance of this function of the ring. Because the initial shape of the cylinder being oval or Changing its initial shape during operation leads to the formation of a gap at a certain point in the ring. The size of the gap depends on the degree to which the shape of the ring is adapted to the changed cylinder. This issue is an important part of ring theory and was thoroughly studied by Professor B. Y. Ginsburg.

The high oil burnout in cylindrical engines with an oval shape has been confirmed in a number of scientific studies.

The oval shape of the cylinder can be formed during engine assembly, under the influence of temperature, or as a result of wear.

It should be noted that the size of the oval formed during cylinder assembly and under temperature can be up to 0.80...0.160 mm. For internal combustion engines, such an amount of oval is unacceptable, which inevitably affects the engine's longevity and efficiency.

if the pressure distribution along the circumference of the piston ring is not adjusted to the shape of the cylinder, a gap will remain between the ring and the cylinder. The presence of a gap leads to a violation of the airtightness of the combustion chamber. In hermetically sealed engines, oil burnout increases.

Studies have confirmed that in an engine with cylinders with an ovality of 0.04 mm, the initial amount of crankcase oil loss is 2%, with an ovality of 0.08 mm - 4%, with an ovality of 0.12 mm - 6%, and with an ovality of 0.18 mm - 8%. In the subsequent period of engine operation, these values decrease and fall within the permissible limits, but in cylinders with high ovality, the amount of oil burning remains higher than in cylinders with low ovality.

Consequently, the greater the ovality of the cylinder, the greater the amount of oil burning. Because the greater the ovality, the wider the gap between the ring and the cylinder. This property of the ring was tested on a motorless device. For this, rings with openings of 10°, 20°, 40°, and 50° are inserted into the piston sequentially without gaps, and the oval shape of the cylinder is adjusted using a special device.

The results show that the appearance of a gap in a ring without an initial gap begins with an ovality of 0.6...0.8 mm. In rings with an initial gap, an increase in ovality leads to a further widening of the gap. However, the wider the initial gap, the more it increases, starting with a large oval.

Consequently, to perform the ring function well, it is necessary to reduce the oval shape of the cylinder. This requires large-scale work. However, by using oval pistons, it is possible to reduce the influence of the annular-cylinder clearance. For this, it is necessary to ensure that the piston's ovality corresponds to the cylinder's ovality. The same path was used for the D-144 engine and a good result was achieved.

Nevertheless, the engines do not meet the calculated service life in dusty and high-temperature conditions. The wear of the rings of engines undergoing major repairs does not exceed 0.12...0.15 mm. However, oil burnout in engines exceeds the limit. A pertinent



question arises: why, despite the low wear of the rings, does oil burnout increase, and why do the engines not meet the intended service life? Why does the tightness-forming property of the rings be exhausted with a small amount of wear?

These problems require the study of the theory of ring wear, the analysis of the properties of bonding and the influence of factors influencing it.

The results of numerous studies lead to the following conclusion:

The shape of the cylinder undoubtedly influences the work of the ring. This leads to a decrease in engine performance.

2. If measures have been taken to prevent cylinders from becoming oval-shaped or the use of oval pistons covering its ovality improves the operation of the ring. In this case, it does not pose a danger to the operation of the oval ring formed by the wear of the cylinder.

3. When increasing the service life of the ring, it is advisable to analyze the theory of wear of the ring and supplement it with influencing factors.

Conclusion

There are many works devoted to the study of the service life of a ring. Their assigned tasks are also diverse. In many cases, the goal is to determine the total wear of the ring. The conclusion is that their wear is the reason for the shortening of the ring's service life. In some works, such values of wear are given that the ring, especially the first one, will never wear out in such a quantity. The failure of the first ring without wear of the chromium coating is often ignored. In some cases, the ring does not perform its function at all. In the completed works, the reasons for such events are not analyzed. In practice, the degree to which the ring functions is determined by the engine's oil and fuel consumption.

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