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To Study Heat Transfer of Cylinder Liner Using Various Materials: A Review

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Abstract:- A cylinder-forming element called a cylinder liner has to be placed into an engine block. It is most important functional components that make up a motor's interior. The chamber liner creates a smooth sliding surface for the cylinder rings while containing the grease inside by filling in as the interior mass of a chamber. The spectacular signature as a sliding surface and these four key focuses are the chamber liners' most important features. High anti-galling qualities, reduced wear on the cylinder lining, reduced wear on the partner piston rings, and reduced lubricant consumption Based on previous research, the objective of this review paper is "Thermal analysis of cylinder liner with various thickness and materials.

I. INTRODUCTION

A chamber liner, otherwise called a chamber sleeve, is a tube-shaped part that is utilised in gas-powered motors. It is normally made of solid metal or steel and is intended to give a smooth and strong internal surface for the cylinder to move inside the motor's chamber.

The chamber liner is embedded into the motor block and gives a fixed chamber where the burning system happens. It has a few significant capabilities:

Wear obstruction: The liner safeguards the motor block from wear brought about by the responding movement of the cylinder. It gives a harder surface that can endure the grating and intensity created during burning.

Heat dissemination: The chamber liner assists with scattering the intensity created by the ignition interaction. It works as an intensity sink, drawing heat away from the cylinder and moving it to the motor coolant.

Grease: The liner holds a slight film of greased-up oil on its inward surface, which lessens contact between the cylinder rings and the chamber wall. This grease is essential for smooth activity and the life span of the motor.

Pressure fixing: The liner frames a tight seal with the cylinder rings, preventing ignition gases from getting into the crankcase. This guarantees proficient ignition and keeps up with the expected pressure proportion.

Chamber liners come in various sorts, including wet and dry liners. Wet liners are in direct contact with the motor coolant, while dry liners are not. Wet liners give better intensity dispersal yet require more perplexing planning and establishment.

In the event of wear or harm, chamber liners can be replaced without supplanting the whole motor block, which makes them a practical solution for motor fix and support.

It's vital to take note that while chamber liners are regularly utilized in most gas-powered motors, there might be variations in plan and materials based upon the particular motor setup and expected application.

II. LITERATURE REVIEW

The various researches have been study for the performance of the cylinder liners some of them are:

Mr. MudduKrishna C Shetty, Mr. Kiran C H (2014) investigated the effect of thermal distribution and structural stresses on the liner material and thickness of cylinders liners. The thickness of liner varied from 1mm to 2mm and materials are taken Aluminum and Cast iron. The results indicate a little temperature drop and a slight stress increase caused by a slight thickness change. Next, Aluminum is used as the lining material. Because of the same materials for the block and liner, Due to the structure's thermal loading, there are hardly any stresses. Both a tabular and visual representation of all the results are provided. The findings show that the structure experiences reduced stress development if the materials used for the liner and the blocks are the same.

M. Saravanakumar, S. Prakash, J. Sendhil, M. Prabhahar, and C. Thiagarajan (2020) in this paper works on the Variations in fin design and material have been made to increase the heat release rate. The temperature differential between the combustion chamber's surfaces on the outside and inside is the other component. The thickness and kind of coating for a cylindrical shell have been considered in this work in order to reduce thermal stress and increase wear and corrosion resistance. Autodesk Inventor was used to create the two-wheeler cylinders, and Ansys was used to analyze the steady-state thermal.

When analyzing cylinder liners, using titanium alloy can provide better resistance to high temperature changes compared to other materials. One way to improve heat transfer rates is by reducing the thickness of the cylinder liner. Through analysis and observation, it has been found that a cylinder liner with a thickness of 0.5mm and made of

titanium alloy improved thermal flux, thermal gradient, and temperature changes. Cylinder liners are an essential component of internal combustion engines, providing a surface for the piston to move against. The use of titanium alloy in cylinder liners has become increasingly popular due to its high strength-to-weight ratio and resistance to corrosion and high temperatures. By reducing the thickness of the cylinder liner, the heat transfer rate can be improved, leading to better engine performance and efficiency. The analysis of different materials and thicknesses can help to optimize engine design and performance.

J. Hari Narayana Rao, M. Anand Kumar and A.A.V. Prasad Rao (2015) the aim of this project is to analyze and design the cylinder liner Hino-X diesel engine. One of Ashok Leyland's models uses a Hino - X engine cylinder dry liner made by Using the ANSYS analysis programme, determine the quantity of heat created, the component's rate of heat transmission, and the temperature produced within the cylinder. This article studies the cylinder liner's thermal stresses, heat flux, thermal gradient, thermal displacement and nodal temperatures utilising a range of surface coatings, including aluminum alloys ceramic and nickel-chrome alloy steel

In this paper they view the Temperature distribution and evaluation of several dry cylinder liner materials, both uncoated and coated, in terms of performance.

In this article from **(2020), P.L. Rupesh, K. Raja, and N.V. Sai Deepak Raj** investigated heat transport on the surface of engine cylinders. The goal of the present research is to make tapered, rounded fins for 2-stroke engines. The different forms' fin surfaces' temperature distribution and heat dissipation have been tracked using a steady-state thermal study. They display the outcomes of various cross sections, including tapered, rectangular, and circular fins made of aluminum and alusil materials that display the heat flow and temperature distribution. The alusil engine cylinder fin's angular form makes it an excellent material for reducing engine fragility and extending engine life.

S. Dineshkumar and V. Sriprashan (2015) The main objective is to investigate how changing the material of the cylinder wall, or sleeve, affects the performance of the diesel engine. The combustion process in an internal combustion engine utilising diesel as fuel produces a temperature of roughly 2500°F. The cylinder walls lose around 35% of the heat during this combustion, and any further heat transfer to the coolant would reduce engine performance. This project's goal is to choose the right cylinder liner material to minimise heat loss through the liner wall in internal combustion engines. Materials with the necessary mechanical qualities are taken into consideration in order to attain this low heat conductivity.

III. CONCLUSION

The results of this study indicate that a number of techniques, such as the finite difference approach, steady state thermal analysis method, and static structural method, may be used to analysis a heat transfer rate, temperature distribution and stress condition in cylinder liner of an engine while employing various materials. Performance may be calculated precisely using any of the methods mentioned above.

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