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UDC 621.43.016:621.89

FACTORS CONSIDERED WHEN ASSESSING WEAR OF INTERNAL COMBUSTION ENGINE CYLINDERS

ФАКТОРИ, ЩО ВРАХОВУЮТЬСЯ ПРИ ОЦІНЦІ ЗНОСУ ЦИЛІНДРІВ ДВИГУНІВ ВНУТРІШНЬОГО ЗГОРАННЯ

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Determining cylinder wear using calculation methods and predicting engine durability are of great practical importance. In addition, knowledge of the wear diagram of designed engines is necessary for the development of optimal cylinder manufacturing technologies that ensure maximum engine life during operation. Obtaining an operational wear diagram for new engines requires a significant amount of time and high material costs. To achieve reliable results, it is necessary to conduct research on many engines over a long period. Creating a mathematical model for calculating cylinder wear significantly speeds up the process and reduces costs, allowing you to obtain the necessary data several times faster and cheaper. However, to date, there is no single and reliable method for calculating cylinder wear. This is due to the large number of factors that affect the wear of internal combustion engine cylinders, and their different effects on different engines and in different operating conditions. All factors that affect the intensity of cylinder wear can be conditionally divided into two groups: internal and external. Internal factors include those that cannot be changed during operation, in particular: the design features of the engine and the physical and mechanical properties of the rubbing materials (bushings, rings, piston). External factors include a large number of variable parameters that can vary during operation, such as: used oils, air, fuel and oil purity, operating modes (load, speed, temperature), as well as indicator parameters of engine operation (compression ratio, boost ratio, maximum combustion pressures, gas temperatures, etc.).

The main problem is that external factors that affect the friction of piston rings against the cylinder vary along the height of the cylinder and differ at different points in it. Even when all internal and external factors are taken into account, cylinder wear is caused by friction between the piston rings (which can be from 3 to 8 per piston) and the piston. Each ring operates under different friction conditions and in different areas of the cylinder. Cylinder wear is the result of the complex influence of all factors.

When creating a mathematical model of cylinder wear, an important role is played by the selection of the main factors that significantly affect this process. To simplify the calculations, it is necessary to make certain assumptions and highlight the main factors. In modern engines that have a reliable air and fuel cleaning system and use high-quality oils, the influence of some factors can be ignored, taking them as constant and such that only shift the wear curve. This applies, for example, to the type of fuel or oil. The physical and mechanical properties of rubbing materials do not change the nature of the wear curve, but only affect its absolute values, so they can also be ignored.

Among the factors that cannot be ignored are objectively existing and variable parameters along the cylinder height: friction pressure, piston speed and cylinder surface temperature. So, the main factors that affect cylinder wear are:

- gas pressure in the cylinder;
- instantaneous piston speed;
- cylinder wall surface temperature.

Other internal and external factors can be considered secondary and not taken into account at the first stage, since their influence is manifested not in changing the qualitative nature of wear, but only in shifting the wear diagram by a constant value in the direction of increasing or decreasing the ordinates. For example, the type of fuel or oil can affect the wear diagram, but this only changes the overall level of wear. Similarly, the physical and mechanical properties of rubbing materials (rings, piston and cylinder) do not change the shape of the wear diagram, but only its magnitude.

Regarding the consideration of certain factors or the calculation of the wear diagram, it should be noted that the methodology developed by the authors allows, if necessary, to expand it by including additional factors, both primary and secondary, that can affect the wear diagram.

Thus, the following conclusions can be drawn:

- Changing the engine operating modes has a significant impact on the nature and magnitude of wear of diesel cylinder liners.
- For each diesel engine, there is an optimal crankshaft speed at which bushing wear is minimal.
- Increasing the boost ratio has a positive effect on the nature of the wear pattern, smoothing it out.
- Increasing the temperature of the bushing surface reduces the intensity of wear and has a positive effect on the resource of the cylinder-piston group parts.
- The most desirable way to increase the engine resource is to increase the boost ratio when operating at optimal speeds and ensuring the maximum possible and permissible temperature level for the cylinder-piston group parts.

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UDC 621.43:004.65

STATUS AND DEVELOPMENT TRENDS OF SYSTEMS FOR MONITORING OPERATING MODES OF DIESEL POWER PLANTS

СТАН І ТЕНДЕНЦІЇ РОЗВИТКУ СИСТЕМ МОНІТОРИНГУ ЕКСПЛУАТАЦІЙНИХ РЕЖИМІВ ДИЗЕЛЬНИХ ЕНЕРГЕТИЧНИХ УСТАНОВОК

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The problem of remote control of the operating parameters of a diesel power plant (DEU) of a transport vessel is extremely relevant for several reasons. First, because of the high cost of fuel. In less than ten years, the price of the main types of fuel (MDO, IFO180, IFO380) has increased almost threefold, and today it is more than $ 1,000 per ton of MDO. Secondly, the current requirements of MARPOL 73/78 P.VI limit NOx and SOx emissions in the exhaust gases of a diesel power plant. Exceeding these standards due to the lack of detailed and objective information about the condition of a diesel DEU leads to large fines for shipowners. In addition, regular control of operational parameters increases the level of technical operation of a diesel DEU, contributing not only to detailed accounting of operating costs and planning of repairs, but also to effective management of a complex multi-system modern diesel power plant. The time of local solutions for controlling technological processes is quickly becoming a thing of the past. Today, networked, corporate online management and control are relevant, when the opinions of many competent specialists are taken into account when making complex decisions, and the results of