

**MONITORING OF OPERATING MODES OF DIESEL POWER PLANTS: MODERN
SOLUTIONS AND AREAS FOR IMPROVEMENT**

*O. Lymar, PhD;
D. Marchenko, PhD;
V. Laskovy, student;
D. Karpenko, student*

Mykolayiv National Agrarian University

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 NO_x and SO_x 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 joint activities are available to everyone. The effectiveness of such a strategy is much higher due to quick feedback and the exclusion of random subjective factors.

The ability of transport to perform its main task - transportation of goods, while ensuring safety - depends on the technical condition of the DEU. In addition to diesel engines, the DEU includes auxiliary diesel generators and a boiler. Current operating costs for these facilities, such as fuel, oil and repair costs, also occupy one of the first places. Therefore, the following tasks are relevant for the DEU: power control in all operating modes, accounting for fuel and oil consumption, as well as accurate accounting of engine life depending on the degree of load on the mechanisms. Of course, the task of developing an effective strategy for planning the operation of a diesel DEU, based on the analysis of the data obtained, is important.

Given the spread of diesel power plants, this is one of the most important tasks of increasing competitiveness in transport. In operation, the share of diesel DEU is up to 40% of operating costs. Specific to operation are variable load modes and the influence of numerous external factors. A characteristic feature of diesel DEU is that the main processes that characterize the technical condition are difficult to visualize and control. Also specific to the industry is that the main management personnel who make strategic decisions. In a situation of actual lack of detailed objective information about the current state of energy facilities as a whole, these strategic decisions may be inaccurate or even erroneous. The way out of the situation is obvious - to develop measures for timely delivery to management personnel of objective and detailed information about the state in real time.

The problem of remote control of diesel DEU parameters was addressed by a number of organizations and companies, among which the largest are A.P. Moller-Maersk, MAK International Shipping LLC and others, as well as leading companies: MAN, Wartsila-Sulzer, MAK-Caterpillar Marine Power Systems and others. The problem of controlling diesel DEU parameters is addressed by the work of both domestic and foreign authors: S.V. Kamkin, I.V. Voznitsky, Yu.Ya. Fomin, S.V. Semenov, V.G. Ivanovsky.

Analysis of the structures and functional capabilities of existing systems and methods for controlling the operational parameters of diesel DEUs showed that in most cases the control task was solved locally with data transmission to the office in a semi-automatic mode. In such cases, the subjective factor and possible distortions or delays in information were not excluded. When the task of automatic data reception and transmission was solved by large companies, the solution was individual, using specific measuring and communication equipment, and, as a rule, also expensive. The latter factor excluded the possibility of widespread use of methods for remote control of DEU operational parameters in transport.

In the practice of operating diesel DEUs, there is a problem of a gradual decrease in power and an increase in thermal load, which is accompanied by an increase in fuel consumption, associated with the accumulation of non-critical, difficult-to-detect defects of the fuel equipment, the gas distribution mechanism and the cylinder-piston group. This occurs due to the failure to take timely measures to restore the performance of the main engine components, which is a consequence of the lack of accurate and detailed data on operational parameters.

Therefore, taking into account the specifics of operation, the task of remote control of diesel DEU parameters obtained during operation is relevant. Remote control of DEU parameters is a necessary condition for cost-effective, trouble-free and environmentally safe operation of modern transport.

References

1. Kamkin S. V., Voznitsky I. V., Fomin Yu. Ya., Semenov S. V., Ivanovsky V. G. Monitoring of parameters of diesel ship power plants / S. V. Kamkin et al. - Kyiv: Publishing House of the National Academy of Sciences, 2018. - 256 p.
2. MAN Energy Solutions. Marine Diesel Engines and Remote Monitoring Systems. Technical Documentation. - MAN Energy Solutions, 2021. - 120 p.
3. Vasylychenko, V. Yu., and Pylypenko, O. M. Information approach to monitoring the technical condition of ship diesel generator sets. *Aerospace Engineering and Technology*. 2010. No. 8 (75). P. 136-139.
4. Lymar O., Marchenko D., Khramov M. Use of technological fluids coolants in cutting processing. Food security of Ukraine in the conditions of the war and post-war recovery: global and national dimensions. International forum = Food security of Ukraine in the conditions of the war and post-war recovery: global and national dimensions. International forum : reports of participants of the international scientific and practical conference (Mykolaiv, May 30-31, 2024) / Ministry of Education and Science of Ukraine ; Mykolaiv National Agrarian University. Mykolaiv : MNAU, 2024. P. 90-92. DOI: <https://doi.org/10.31521/978-617-7149-78-0-28>.
5. Marchenko D. D., Lymar O. O., Grigorenko A. O. Ways to improve the reliability of grain harvesting machines to ensure the country's food independence. Food security of Ukraine in the conditions of the war and post-war recovery: global and national dimensions. International forum: reports of participants of the international scientific and practical conference (Mykolaiv, May 28-30, 2025) / Ministry of Education and Science of Ukraine; Mykolaiv National Agrarian University. Mykolaiv: MNAU, 2025. P. 356-358. DOI: <https://doi.org/10.31521/978-617-7149-86-5-119>.
6. Marchenko, D., & Matvyeyeva, K. (2023). Research of Increase of the Wear Resistance of Machine Parts and Tools by Surface Alloying. *Problems of Tribology*, 28(3/109), 32–40. <https://doi.org/10.31891/2079-1372-2023-109-3-32-40>.
7. Light Metals (2016), The Minerals, Metals & Materials Society, 2016, 1053 p. <https://doi.org/10.1002/9781119274780>.
8. Kumar K., Davim J.P. Composites and Advanced Materials for Industrial Applications. Hershey, USA: IGI Global, 2018, 423 p.
9. Kala H., Mer K.K.S., Kumar S. A Review on Mechanical and Tribological Behaviors of Stir Cast Aluminum Matrix Composites. *Procedia Materials Science*, 2014, Vol. 6, pp. 1951-1960. <https://doi.org/10.1016/j.mspro.2014.07.229>.
10. Adebisi A.A., Maleque M.A., Rahman Md.M. Metal matrix composite brake rotor: historical development and product life cycle analysis. *International Journal of Automotive and Mechanical Engineering*, 2011, Vol. 4, pp. 471-480. <https://doi.org/10.15282/ijame.4.2011.8.0038>.
11. Bhushan B. *Modern Tribology Handbook*, Two Volume Set. USA, CRC Press Inc., 2000, 1760 p.
12. O. Lymar, D. Marchenko. Prospects for the Application of Restoring Electric Arc Coatings in the Repair of Machines and Mechanisms, *Proceedings of the 2022 IEEE 4th International Conference on Modern Electrical and Energy System, MEES 2022*. <https://doi.org/10.1109/MEES58014.2022.10005709>.