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EVALUATION AND DEVELOPMENT OF DIAGNOSTICS OF THE CRANKSHAFT OF DIESEL LOCOMOTIVES

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Abtract. A significant increase in the efficiency of the equipment used is achieved through the introduction of modern methods and means of technical diagnostics. Technical diagnostics makes it possible to increase the overhaul life of units and assemblies, prevent the dismantling and disassembly of units and individual mechanisms, reduce downtime for technical reasons, reduce the labor intensity of maintenance and operating costs, which significantly increases the efficiency of the use of equipment. Technical diagnostics makes it possible to control the technical condition of machines during operation and predict their service life until the next repair in accordance with the indicators obtained. It allows not only to assess the technical condition of the units and assemblies of machines, but also makes it possible to determine the volumes and types of necessary work using in-place methods. The main tasks of technical diagnostics are: control of the technical condition for compliance with the requirements of technical documentation; search for the causes of failure (malfunction); collection of initial data for forecasting the technical condition; maintaining machine reliability.

Keywords: diesel, crankshaft, diagnostics, operation, overhaul, lubrication, cleanliness.

Introduction. To maintain locomotives in working condition, to prevent gradual failures due to aging and wear of equipment, a smoothly preventive system of repairs is needed. It includes a set of interrelated provisions and standards that determine the organization and procedure for the maintenance and repair of rolling stock. The advantage of this system is the ability to guarantee the established resource and safe operation of the most important units and parts of the diesel locomotive.

The main disadvantage of the system is the high level of costs for the production of a specified amount of work for a given type of maintenance or repair. However, despite the large material costs, the use of a preventive system is advisable to ensure a high level of safety and guarantee reliability in terms of serviceability for a strictly defined period of operation of the locomotive fleet.

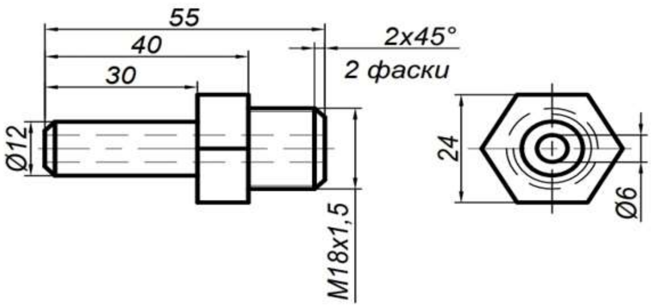
Research method. An example of a research method is the malfunctions that occur during operation. When overhauling the engine, especially after grinding the crankshaft, many do not attach importance to the cleanliness of the crankshaft oil channels, clean them correctly. This operation is also very important because when grinding the crankshaft to the repair size of the liners, abrasive and processing products (metal dust) get into the oil channels. If after that you do not thoroughly rinse the oil channels of the crankshaft, then at the first start of the engine, the remaining dirt can do a lot of trouble, at best, it will simply greatly reduce the life of the engine. Therefore, thorough flushing of the internal cavities of the crankshaft is very important. The crankshaft oil channels, in addition to their function of supplying oil to friction pairs (crankshaft journals and liners), also serve to trap dirt particles (in special cavities) that can pass through the filter (very small particles) using centrifugal force. There were times when dirt completely clogged the oil channels, and from this, naturally, friction pairs began to work dry and quickly failed.

Oil starvation of the engine leads to irreversible consequences - in addition to penny liners, the crankshaft is damaged. And it often happens that the seizures on the crankshaft remain larger than the last repair size, and this is the purchase of a new expensive part. Oil starvation of the engine does not mean that there is no oil at all, it just wasn’t enough for some parts due to the low level, low throughput of the lubrication system due to clogging or other reasons. Not necessarily the entire engine does not receive oil - most often there is not enough oil in individual engine components.

Consequences of engine oil starvation. For example, when the crankshaft rotates, it does not come into contact with the liners, there is always oil between them, the so-called oil wedge. But when there is not enough oil, it stops flowing to the crankshaft and liners, then this oil wedge disappears and the shaft begins to rub against the liners and the shaft wedges due to friction and the resulting temperature increase, but since it continues to rotate by inertia, this wedge breaks, the more thereby tearing out the surface layer of metal from both surfaces. The result is an insert in foil, deep scuffs on the crankshaft. If the oil pressure methodically gradually begins to decrease in the system, that is, it passes through the pipeline less, the connecting rod bearings of the crankshaft will suffer first of all, since they are located the farthest and the oil approaches them according to the residual principle. One of the most important elements of the internal combustion engine is the crankshaft. Due to it, energy from fuel combustion can be transferred to adjacent elements and ensure the rotation of the wheels. Responsible for reducing friction losses and preventing the wedge of parts at the point of contact of the crankshaft with the engine block bed (main bearings) and piston rods (rod bearings).

- **Indigenous.** Such liners are located between the shaft itself and the places where it passes through the engine housing;
- **Connecting rod.** They are installed between the connecting rods and the crankshaft journals.

Results. One of the important tasks is to improve the diagnostic method of the crankshaft. D49 diesels were used in diagnostics. A thermal sensor is installed on the connecting rod and root joints of the crankshaft. The oil has protection against this, but it does not signal a crankshaft failure. Thermosensor DS18B20 is used for this. Basic functional options DS18B20 is a temperature converter. The resolution of the temperature converter can be changed by the user and consists of 9, 10, 11, or 12 bits, corresponding to 0.5 °C, 0.25 °C, 0.125 °C, and 0.0625 °C, respectively. Resolution is set to 12-bit by default. In the initial state, the DS18B20 is in a dormant state (in an inactive state). To start temperature measurement and conversion, the master must issue the start temperature conversion command [0x44]. After conversion, the received data is stored in a 2-byte register temperature in RAM, and the DS18B20 returns to the inactive state. If the DS18B20 is switched on with external power, the master can control the temperature conversion (after command [0x44]) according to the bus status. The DS18B20 will generate (response to the read time slot from the controller) logic "0" when a temperature conversion occurs. And a logical "1" when the conversion is done. If the DS18B20 is enabled with parasitic power, this notification technology cannot be used because the bus must be driven high (supply voltage) for the duration of the temperature conversion. In this case, the control device must independently control the conversion time. The DS18B20 temperature output is calibrated in degrees Celsius. The temperature data is stored as a 16-bit signed number. The flag (S) bits indicate whether the temperature is positive or negative: for positive numbers, S = 0, and for negative numbers, S = 1. If the DS18B20 is configured to convert 12-bit resolution, then all bits in the temperature register will contain valid data. For 11-bit resolution, bit 0 is undefined. For 10-bit resolution, bits 1 and 0 are undefined, and for 9-bit resolution 2, 1 and 0 are undefined.



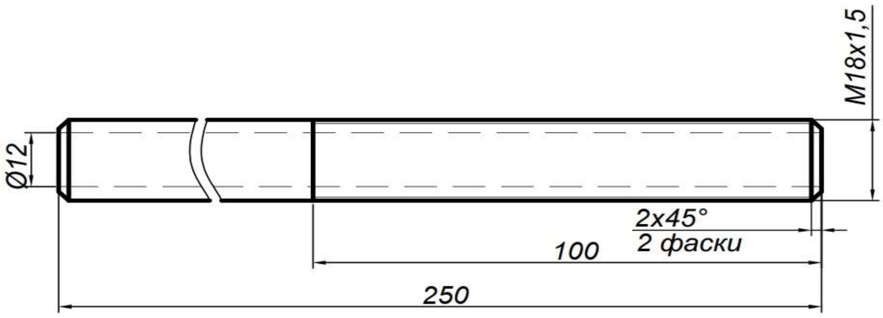


Figure 1. DS18B20 Mounting Tool and Signal Processing via Microcontroller

Conclusion. The thermosensor DS18B20 is installed on the crankcase cover, as a result, it reports the temperature of the coolant coming out of the crankshaft. The signal from the sensor is sent to the microcontroller, as a result of which the signal is processed and displayed as a number. This makes it possible to diagnose the crankshaft of diesels. As a result, a diagnosis is made, the bearings are checked, the oil channels are inspected, or the high-pressure fuel pumps are inspected and their technical standards are checked. To extend the life of the crankshaft, change the oil in a timely manner, choose high-quality oil filters and change them at the same time as changing the oil. Periodically carry out a visual inspection for diesel oil leakage, to prevent engine overheating. Monitor the condition of the cylinder cover to prevent water and fuel from getting into the diesel oil. DS18B20 it was found that the work on the creation of methods and means of technical diagnostics should be carried out in the direction of reducing labor intensity, improving the quality and efficiency of the obtained diagnostic information about the technical condition of the object being diagnosed. It is advisable to create diagnostic systems taking into account the modular basis, since it becomes possible to create additional functions and diagnostic capabilities by introducing an additional module into the system.

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