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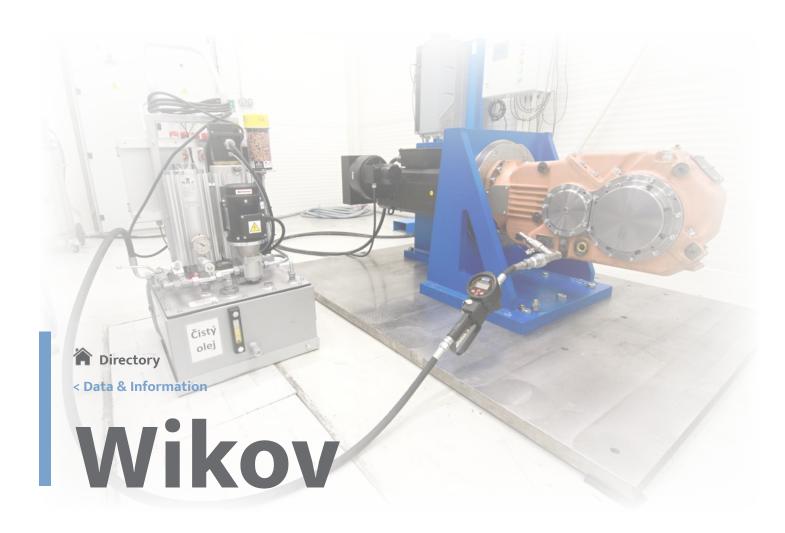
Gearboxes & Drives

- Solution for light rail vehicles, metro & suburban applications, locomotives and other mass transport vehicles
- From one prototype to large series production
- Gear manufacturing tradition since 1918
- Complet drive train solution (gear units, couplings, traction motor, brakes)
- Extensive test facility up to 1,4 MW and simulated dynamic load 300 m.s^{-2}

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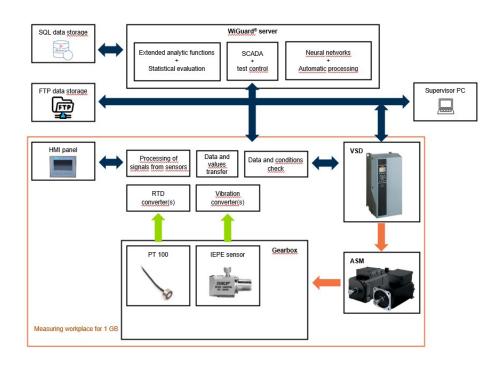# No-Load Series Testing of Rail Vehicle Gearboxes with Artificial Intelligence

For the efficient series manufacture of rail vehicle gearboxes, it is also necessary to ensure that there is sufficient capacity for the no-load testing of every gearbox.

For the last 18 years, Wikov has built up its position as a key European manufacturer of gearboxes and drives for rail vehicles. It has a strong development workplace with experimental test stands, including

those with dynamic loads; Wikov further has a cooling chamber for cold climate tests at its disposal. Up to now, no-load testing has been performed according to the current needs of individual projects within a big test room, in which gearboxes for trams or underground units used to be in the immediate vicinity of industrial gearboxes for rubber mixers or mobile recycling crushers. These days are over. Wikov has opened a new test room exclusively intended for rail vehicle gearboxes, utilising state-of-the-art elements of present-day testing, including the integration of artificial intelligence.

Concept Behind the New No-Load Test Room

The site for testing rail gearboxes is equipped with two mutually independent test beds. According to the test being performed, these test beds are mechanically arranged by means of prefabricated unified devices which are able to cover the entire range of gearbox types, from spur-gear, through bevel-spur-gear, up to special planetary-bevel ones. At the same time, to minimise the influence between the first and last gearbox of any given series tested, the test room is equipped with an

Measuring workplace for 1 GB

automated system for oil filtration and heating. Thanks to this system, gearboxes are filled with clean, pre-heated oil of a constant quantity and temperature, which is ensured by a special filling device with measuring.

With regard to the run unit, every workplace is equipped with an asynchronous motor (ASM) which is able to rev up the input shaft of the gearbox to up to ±7500 rpm. Thanks to this, the test aggregate does not necessitate any additional step-up gearbox or belt transmission to meet the input speed parameters for gearboxes of the extensive portfolio of modern rail vehicles. In coupling with a frequency converter (VSD), an ASM features sufficient power for the required dynamics of no-load tests. The tested gearbox is connected to this motor through a flexible coupling, enabling the quick replacement of the tested gearbox with another one.

Proprietary Online Monitoring and Artificial Intelligence

The entire driving block is

supplemented with online monitoring – WiGuard®, developed right in Wikov, used for the recording and automatic evaluation of temperature and vibrations within the prescribed test specification. The system has been created for measuring and evaluating up to eight temperature points on the gearbox (bearings + oil) and up to four vibration sensors. The temperature sensors can be located in prepared holes (if the gearbox is also equipped with temperature monitoring on the vehicle itself) or used through special contact magnetic sensors. The vibration sensors are fastened to the tested gearbox by means of screwed fixtures at places specified by the designer.

The system identifies the gearbox according to its type and series number. From the server, it automatically downloads the limit settings of the individual sensors, intervals for the individual records and the timeline of the rotations tested, on the basis of which it then sets up the requirements for the frequency converter.

During the test, the values of the

measured variables and selected characteristic quantities from the frequency converter are then saved in the server storage. Simultaneously, these values are continually verified within the given test phase limits. Currently, the time recording of vibrations for the individual sensors is put through FFT analysis; the evalution of the vibration state is made on the basis of artificial intelligence.The AI is preset to recognise gearbox defects in relation to the gearing, bearings and/or imbalance by means of neural networks.
If the system detects a serious error, the given test is suspended prematurely.

If the entire test proceeds without serious error, it is completed; the data is saved and then evaluated. Moreover, the data collection system enables the additional evaluation and comparison of gearboxes within the tested series. This comparison is based on the statistical processing of the given gearbox series data saved on the server.

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Check out this video to learn more about Wikov!