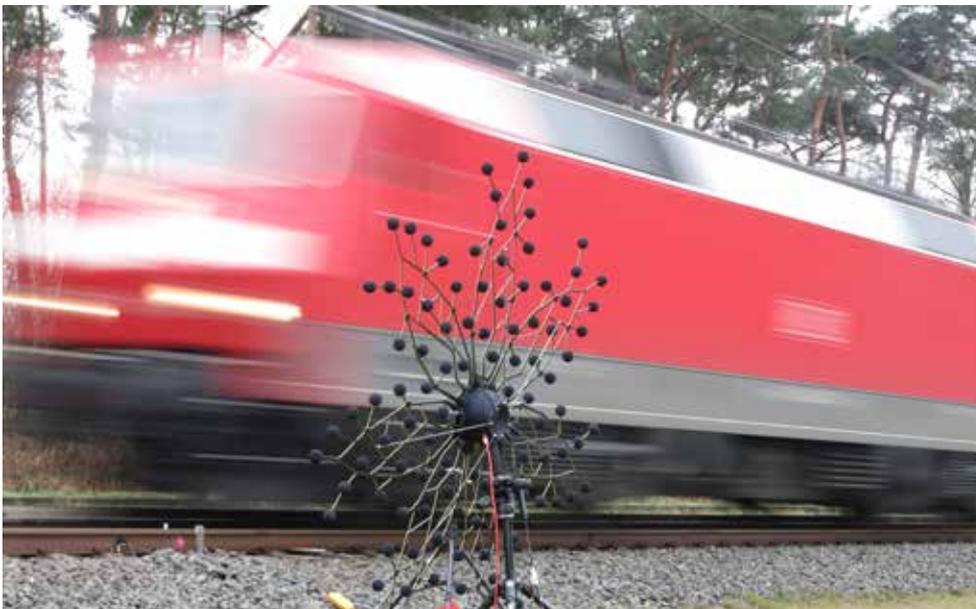


Testing & measurements



Obtaining homologation for new rail vehicles from authorities requires extensive stationary and on-track tests to verify safety and passenger comfort. As an accredited test laboratory, PROSE can perform a wide variety of measurements related to rail vehicle technology and operations with the aim of enabling homologation of vehicles and systems. Our teams measure oscillations and vibrations, mechanical stresses and forces, noise sources, electrical values, heat, traction dynamics and adhesion. PROSE also measures track characteristics, rail roughness and track vibration decay rates.



- Measurement of running dynamics
- Deployment of measuring wheelsets
- Pantograph measurements
- Service load tests
- Brake-system tests
- Noise and vibration measurements
- Electrical measurements
- Railway test operations

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We conduct these tests and measurements using state-of-the-art, specialised equipment. This includes compact, configurable measurement systems that we can install in the electrical cabinets or equipment rooms of vehicles. This allows us to perform most measurements during normal operations, without affecting them. We deploy automatic measurement systems wherever they are needed or whenever they make sense. PROSE also offers efficient solutions for measurements during test runs under intentionally generated extreme conditions.

Measurement of running dynamics

PROSE teams consisting of running behaviour experts and measurement engineers carry out both small and large measurement campaigns. PROSE develops the test plan, takes charge of organising the tests and performs all measurements autonomously.

For line trials, PROSE uses its own instrumented wheelsets to measure running behaviour from the viewpoints of safety, demands on the track and oscillation behaviour and determines comfort values in line with EN 12299. Static trials allow PROSE to determine the forces between wheel and rail on a mobile torsion test stand and therefore verify safety against derailment and sway behaviour in line with EN 14363 and UIC leaflet 518.

During tests, PROSE continuously monitors the measurement signals and assesses homologation criteria for the vehicle in real time. PROSE uses its own specific software package to evaluate measurement data. We also prepare the test reports that document the trials we have conducted and explain the results in detail so that

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the responsible authorities can make quick decisions.

Deployment of measuring wheelsets

Guaranteeing safe running and obtaining vehicle homologation requires test runs with measuring wheelsets to determine the forces at the contact point between wheel and rail. PROSE supports you in measuring wheel-rail forces for all kinds of wheelsets, from mechanically independent single wheels to locomotive wheelsets powered via hollow axles.

To do this, PROSE uses its own flexible instrumented wheelset system. Its modular structure is made up of the wheelset, a signal transmitter and the wheelset processor. To determine wheel-rail forces, the system measures the deformation of a wheel or an axle by means of strain-gauge bridge circuits. A system component mounted on the wheelset amplifies the measurement signal from the strain gauge and transmits it to the wheelset processor. Available signal transmission options include the analogue-but-very-robust slip-ring technology, an optical telemetry system and radio transmission. In these latter two variants, the system digitalises the data right on the wheelset to enable smooth transmission.

The wheelset processor plays a critical role in determining forces precisely. On the basis of wheel deformation, the processor uses an algorithm to calculate the wheel-rail forces in all directions and other parameters such as the position of the wheel-rail contact point. PROSE provides the results as analogue signals for further processing.

Pantograph measurements

PROSE competently supports customers during vehicle homologation processes by measuring contact forces and catenary-wire lift in order to verify conformity with European standards and national network access rules.

These regulations aim at guaranteeing proper current transmission, minimising wear and tear on the catenary wire and the pantograph contact strip, and – last but not least – ensuring that the passing pantograph does not lift the contact line excessively.

PROSE assists you with pantograph measurements in line with EN 50119, EN 50317 and EN 50367.

Such tests require a system that measures catenary-wire lift.

On some reference lines, this system may be a permanent feature; otherwise, PROSE can install one for the tests.

Service load tests

The measurement of mechanical stresses and forces in rail vehicles enables manufacturers and operators to produce various verifications. Such measurements can also help with root cause analyses. Thus, for example, measurements of operating loads can provide the basis to verify load assumptions for bogie design according to EN 13749. We carry out static type tests in compliance with UIC.

In order to quantify load collectives of the drive train, the bogie and the connecting rods, we record the mechanical strain and forces and analyse them by using the rain-flow counting method. At the same time, we are able to record the operation date as well as ambient conditions, which allow us to extrapolate the overall load configuration to the whole life cycle of the vehicle.

Our test equipment is mobile and enables us to test the railcar body and bogie at the supplier. Furthermore, we have wide experiences in executing on-track measurements. For difficult measurement tasks, problem-specific measurement components are designed, fabricated and then calibrated on a test stand.

A high expertise on torsional vibrations of the drive train is vital for the design of locomotives as they have a great impact on the lifetime of the driving components. We can assist your specialists during the traction control optimization by analysing the convergence of torsional vibrations according to the specification of the German

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Federal Railway Authority. Thus, we are able to minimize the measurement duration on track.

PROSE is an accredited test laboratory according ISO/IEC 17025 (by the Swiss Accreditation Service, SAS) for railway rolling stock.

Brake-system tests

The brake system is a crucial part of your railway vehicle and its testing is an important step within the homologation process. We carry out complete static and dynamic tests of your brake system according to the relevant norms and documents like European standards, UIC leaflets, Swiss AB-EBV or outlines defined by the German Federal Railway Authority (EBA).

We are also experienced in testing vehicles with vacuum brake systems and rack railways with all their special requirements. Recording the temperature behaviour of the components during field tests, measuring static brake block or brake pad forces, functional check of the wheel slide protection systems as well as the analysis of the blending processes and checking the failure behaviour are our common tasks.

Our experts can assist you during your research or fault diagnostic projects on your brake system like monitoring of wheel and block wear, analysing of roughness, crack propagation, wheel stress, long-term behaviour of the friction coefficient, etc. PROSE is an accredited test laboratory according ISO/IEC 17025 (by the Swiss Accreditation Service, SAS) for railway rolling stock. The German Federal Railway Authority (EBA) has approved our colleague Prof. Dr.-Ing. Ulrich Kleemann as an assessor for the testing of brakes. Therefore, PROSE can now also offer assessments of brake systems of vehicles within the field of responsibility of the EBA.

Noise and vibration measurements

PROSE is an accredited test laboratory according ISO/IEC 17025 (by the Swiss Accreditation Service, SAS) for railway rolling stock. PROSE is a notified body NB 1990 for machine noise and on the basis of such measurements delivers CE certificates in accordance with the European guideline 2000/14/EG for equipment and construction machines.

PROSE performs interior and exterior noise measurements according to the EN ISO 3095, EN ISO 3381 as well as according to the TSI CR noise (Technical Specification for Interoperability Noise), at standstill and while running. For those measurements PROSE is maintaining an acoustic grinded, standard compliant reference track, where PROSE checks the rail roughness according to EN 15610 and the track decay rate according to DIN EN 15461 periodically. PROSE is also familiar with measuring the wheel roughness of railway vehicles.

According to EN ISO 3744, the sound power of equipment and machines can be determined from acoustic pressure measurements at open air test sites. Using intensity measurement technology, PROSE can also identify and localize noise sources in interior spaces and according to ISO 140 determine noise reduction due to mounted components. Special measuring methods such as intensity measurements, the determination of the absorption coefficients and sound reduction indexes, in combination with detailed measuring data of laboratory and field tests, give us a stable basis for noise design. Measurements in the vicinity of railway lines are conducted according to DIN 4150-2 and DIN 45672-1 and serve to characterise emission, transmission (via track structures or the ground) or immission (in buildings). This allows forecasts of immissions for various configurations of the system comprising source, propagation and recipients according to DIN 4150-1. Moreover, with the wide experience in the field of locomotive noise, especially regarding the topics rolling, ventilation and cab noise, PROSE supports manufacturers in designing vehicles that meet the noise requirements right from the beginning.

To this end, for each assignment PROSE develops a specific concept for efficient, goal-driven measurements, organizes and carries it out, evaluates the measurement results and recommends appropriate and practicable steps for noise and vibration mitigation. Experienced and competent measurement teams and special equipment enable multi-channel measurements of noise and vibrations in a wide spectrum of amplitude and frequency ranges.

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Electrical measurements

Electrical and electronic components in rail vehicles are important elements for traction, auxiliary systems and safety-critical control functions. These roles demand high reliability in these components and verification that their performance limits match the specifications. This is particularly important for electronic equipment that is ever more compact and requires ever less maintenance, and whose life expectancy is limited.

Dealing with component failures and disturbances in electrical signals requires knowing the relevant limits. In addition, in most cases a measurement of the real situation simplifies finding a fault or explaining a mysterious phenomenon. Here PROSE possesses extensive experience and special equipment for the measurement of electrical values in rail vehicles. Measurements of voltages up to 25 kV and currents up to 2 kA are possible in practically all parts of a vehicle.

A well-versed team with expert knowledge takes on the problems, plans measurements in close collaboration with the customer and carries them out professionally. As desired, the measured signals can be processed with modern analysis tools and made available in various formats to the customer. This service also draws on synergies with other PROSE service areas and is accompanied by comprehensive advisory services in the relevant fields.

Railway test operation

PROSE is capable to organize all necessary services and approvals to operate test vehicles in Switzerland. We know the suitable tracks for the corresponding tests. We have partners authorized to reserve slots and run trains on the Swiss railway net.

If necessary, PROSE provides its measuring coach containing all features to operate test equipment or to perform slip tests.

Certificates and quality management

Quality is as an integral part of our work. Therefore, we sustain a certified quality management system in accordance with ISO 9001:2000.

PROSE is an accredited test laboratory according ISO/IEC 17025 (by the Swiss Accreditation Service, SAS) for railway rolling stock. The scope of accreditation can be found on the official web page of the Swiss State Secretariat for Economic Affairs.

PROSE is also an accredited calibration laboratory according ISO/IEC 17025 (by the Swiss Accreditation Service, SAS) for pressure, force and measuring wheel sets. The scope of accreditation can be found on the official web page of the Swiss State Secretariat for Economic Affairs.