Centre of Excellence for Wheelsets and Bogies

The critical point for optimum wheel/rail contact

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The contact face between wheel and rail is one of the critical points of railways. The safety relevance of wheelsets and bogies requires specialisation in their manufacture and maintenance. This entails high cost of purchase and approval. Therefore, an increasing number of operators of rail vehicles place overhauls with external partners. Robel, with its Freilassing centre of excellence for the reconditioning of powered/trailing wheelsets and bogies of on-track machines has been the contact for maintenance in Germany, Austria, Switzerland and Europe for decades. The Centre of Excellence for Wheelsets and Bogies (KRD) has the resources, all European certifications and approvals as well as measurement and test equipment for the complete service of components, independent of make and manufacturer.

For smooth running: From enquiry to certification

It is a condition for outsourcing maintenance that the service partner conforms to standards, is certified and delivers on time so that the machine is ready for operation according to schedule.

The customer decides on the basis of a detailed quote including a feasibility check by the KRD. Depending on the scope, an engineer inspects the machine in advance to define the work jointly with the customer. The many years of experience from design, manufacture and maintenance of track construction machines enter into the assessment: The measures agreed ensure function, safety and availability within the scope of the country-specific standards or rules, and the costs stay within the framework agreed in advance. Equipment and capacity of the service centre facilitate full flexibility for the acceptance of contracts: In addition to Robel as well as Plasser & Theurer products, other manufacturers' components are also processed.

Once the order has been placed, the KRD takes care not only of the overhaul, but also of the complete logistics:

- Organisation of transport from and to the customer's or service provider's site.
- Procurement of spare parts, on request also of third-party products.
- Consultation and additional ordering if further defective parts are identified during maintenance work.
- Cooperation with certified service providers or original manufacturers, e.g. for the overhaul of brake cylinders.
- Continuous information on the status of the work.

The customer receives a binding commitment regarding turnaround time, availability and price and receives a product which has been completely overhauled, certified conforming to the approval and documented, at the time agreed (Fig. 1).

Time is money

The most important requirement for each order is to carry out the service in the shortest possible time so that the vehicle can return to work on the track. The KRD reacts quickly, even for orders at short notice, e.g. accident repairs, and independently of whether the customer is new or a long-term partner. To do this, the service centre preferentially uses the broad spectrum of the in-house capabilities in its Freilassing works: Space, staff and storage capacities are used flexibly depending on requirement.

The availability of spare parts is another important condition for short processing times. Stock-keeping is based on the knowledge where the pressure is greatest, which wear parts are standard and which components have long delivery times. The KRD obtains the main components exclusively from certified European manufacturers. The manufacturing capabilities of the company also permit the in-house production of many parts from original drawings. The aim is complete adherence to deadlines and fast reaction – from renewal of wheel disks within one day to unplanned bogie repairs after derailment within eight weeks.

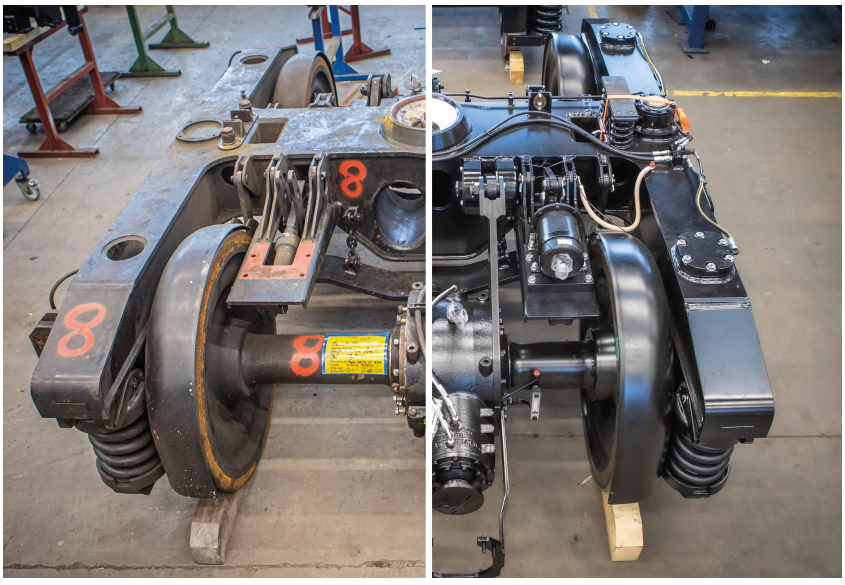

Fig. 1: Bogie of a 09-3X tamping machine before and after overhaul *Source of all Figures: Robel*

Worldwide service competence: Facts and figures

The Wheelset and Bogie Centre of Excellence (KRD) is:

- certified to ISO 9001 and ISO 14001.
- Q1 supplier and repair works for Deutsche Bahn AG.
- certified by RISAS (Great Britain) and SNCF (France).
- ECM Level 4 and TransQ (Scandinavia).

About 100 bogies and about 1100 wheelsets will have been reconditioned by the end of 2020. There are hardly any limits to the scope of servicing work - the KRD works for customers from all over the world with the focus on the European Union, Great Britain, Switzerland, Norway, India and Japan.

Bogie reconditioning in detail

The work on components subject to testing follows a standardised sequence, for legally prescribed overhauls as well as examinations or post-accident repairs.

After arrival at the works, the complete bogie is cleaned with a steam jet in the in-house cleaning unit. The goods received documentation includes an endoscopy of the wheelset (Fig. 2) and determination of the delivery scope recording all data and comparing this to the works order. At this point, any initial obvious damage is entered into the product file which accompanies every bogie. This is followed by disassembly including removal of all attachments. The bogie frame is stripped of paint by external contractors. The disassembled wheelsets pass through a separate reconditioning process (see wheelset reconditioning).

Fig. 2: Endoscopy of the wheelset shows the condition of the distribution gearboxes in detail

Step change in quality due to digitisation of the measurement processes

Calibrated measurement and test equipment specifically adapted for track vehicles is used for the frame measurement, including non-destructive testing, to keep the processes compliant with the standards and the process times short.

The latest investment in automated testing and measurement quality is a measurement arm which records data with a resolution of one hundredth of a millimetre and records actual and nominal values as well as tolerances (Fig. 3). While the previous manual measurement of a bogie frame took around one hour, the new procedure provides exact and, above all, reproducible measurement results in half that time.

Overhaul for verifiable safety and quality

If the non-destructive testing shows damage, e.g. faulty welds, an overhaul of the frame will be carried out. The KRD employs specialist in-house staff for this: Certified welders repair damage and, if required, the fitting shop, turning shop and design department are available at short notice.

At the same time, the overhaul of the attachments starts based on Robel's maintenance specifications:

- Checking and certifiable recording.
- Removal of paint from all parts (except bogie frame) using the in-house equipment.
- Reconditioning and testing of all hydraulic and pneumatic components.
- Disassembly of brake rigging, replacement of all bushes and wear parts, checking of bolts.
- Testing and recording of coil springs on our own spring test rig.

Sustainably sprung - reconditioning instead of replacement

A calibrated spring test rig (Fig. 4) is used for the primary and secondary suspension, usually 16 springs per bogie. Spring length, force and deviations are electronically measured, documented and transferred to a test certificate. If the tested spring conforms to the parameters, it is marked in accordance with the standard and is re-used. A procedure which pays off: A reconditioned spring, sand-blasted, painted and tested, costs a fraction of a new one.

For the overhaul of external attachments, e.g. brake cylinders, the service centre arranges the complete processing and progress supervision in cooperation with certified service providers.

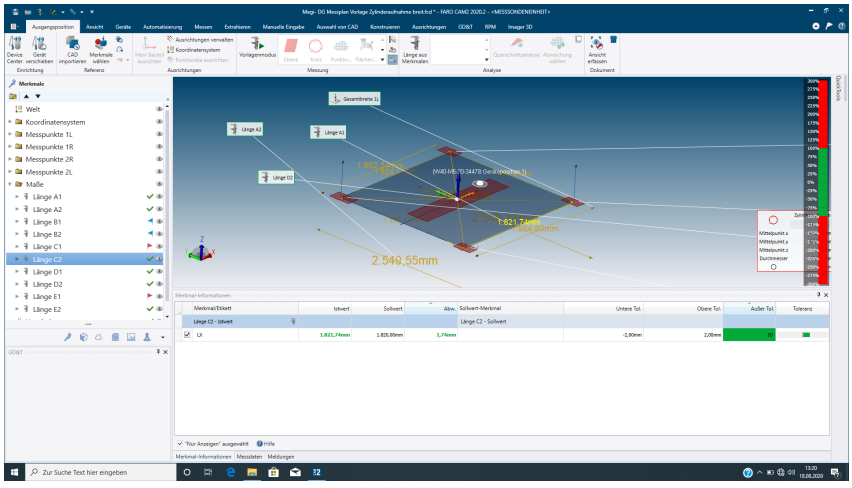

Fig. 3: The digitised frame measurement provides reproducible actual and nominal values for standard tolerances in half the time of a manual measurement.

Fig. 4: A calibrated measurement rig tests the primary and secondary suspension of the bogies.

Wheelset reconditioning in detail

The KRD regards it as its responsibility to ensure long-term wheel quality and, at the same time, work as sustainably as possible. The decision whether components are reconditioned or replaced by new parts is based on accurate measurement data and many years of experience.

The first information for the decision on the scope of work is provided by the data for wheelset, wheel disk and brake disk recorded with a laser measuring instrument on receipt of the items. The wear tolerances of all wheelset types are stored to be able to measure wheelset and profile parameters accurately to one hundredth of a millimetre. The corresponding measurement record (Fig. 5) shows without doubt whether wheel disks can be reprofiled or have to be renewed – a considerable cost factor.

Made-to-measure reconditioning

The wheelset is prepared for reconditioning in an environmentally certified paint stripping plant on site. In addition to the time gained – cleaning now only takes one instead of four hours – and the noticeably reduced contaminant load for staff, the plant has the advantage of complying fully with the standards mandatory for European approvals.

The incoming goods documentation including endoscopy is followed by disassembly of the axle box. Cylindrical roller bearings or cartridge bearing units are removed with special tools in a non-destructive manner. The ultrasound or magnetic particle tests of the axles provide a complete record of the finest irregularities.

The wheel disks are pressed off by our own wheelset press (Fig. 6). If the system exceeds a defined pressing-off force, for example due to scoring in the seat, the process will stop automatically so that the axle is not damaged. The wheels will then be removed by flame cutting or milling instead. If the axle has no faults, it will be re-used after testing (Fig. 6). No additional costs will be incurred for reconditioning.

The wheel disks are reprofiled and the friction surfaces turned in a standardised manner using a CNC machine. All common wheel profiles are stored in this. New profiles are programmed based on the original drawings within one day.

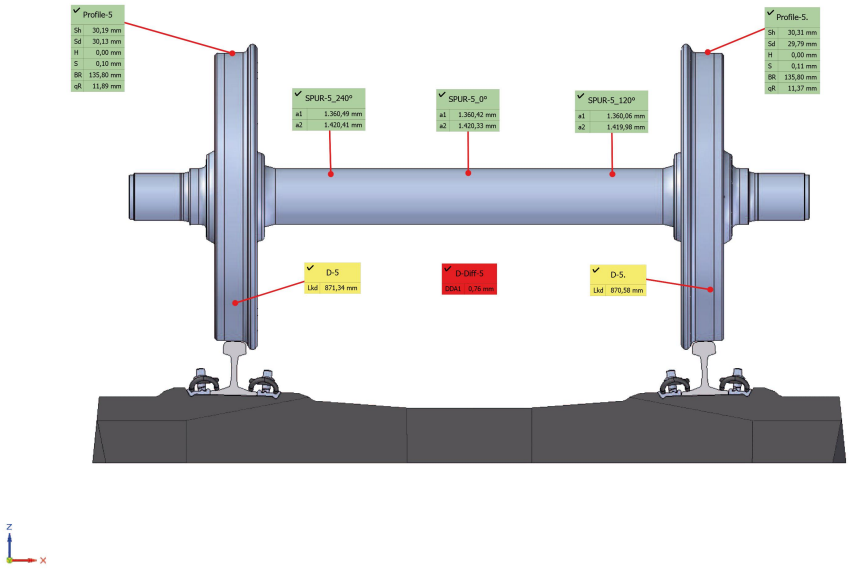

Fig. 5: The test record of the laser measuring instrument shows whether wheelset, wheel disk and brake disk are within the wear tolerances (=green), are close to the upper or lower limit (=yellow) or are outside the tolerance (=red).

Complex task: Axle drive maintenance

For axle drives there is the option of endoscopy and thus of maintenance and repair as required. Reconditioning requires special expertise: The multi-disk clutch of an RM 900 ballast cleaning machine alone has about 200 parts, for example.

The KRD is set up for all types of axle drives. Special tools are used on dedicated axle workstations to

- disassemble the axle,
- replace all bearings and seals,
- set and record bearing play, contact pattern and backlash,
- check the attached components,
- paint the inside with special paint,
- reassemble the axle drive and
- test it for leaks and running noise.

High-speed wheel change

If it becomes necessary during an overhaul to fit new wheels, their procurement can lead to considerable time delays depending on the manufacturer. The large stock of spare parts held by the KRD creates planning safety: The standard stock comprises about 1000 wheel disks and 300 shafts in all common EU diameters and designs.

When everything fits: pressing and measuring

The core of wheelset reconditioning is a fully automatic double cylinder wheelset press. It deals with the press-fitting and pressing off of wheels and brake disks and the measurement of the pre-assembled wheelsets. The press-fitted wheelset is measured with a laser during and after the operation, recording and reporting are in line with EU standards and approvals. Lateral and radial runout as well as electrical resistance (impedance) of the fitted wheelset are also measured. With a cycle time of about 16 minutes for two

wheel disks and brake disks (without measurement and recording), the KRD achieves optimised turnaround times and simultaneously an increase in quality. This also affects the throughput: in 2020 (as of August), more than 1000 wheelsets passed through the service centre.

The finish: last steps

All components are painted in the in-house paintshop in accordance with the current health and safety and environmental standards. Finally, all components are assembled, the brake rigging is fitted, and the wheelsets overhauled in-house are installed. One last component test needs to be done before delivery to the customer: Every bogie and every wheelset leaves the works at the agreed date, in accordance with the standards and with a certified test certificate.

High standards in uncertain times

2020 was the year of unexpected bottlenecks, but the KRD nonetheless carried out the reconditioning of wheelsets and bogies largely according to schedule. Within a few weeks, processes were bundled, secured with redundant capacity, and the external testing capacities were enhanced to minimise travel. At the same time, procurement and logistics were expanded to stabilise the supply chain. Thus, the difficult situation led to an increase in the speed of innovation with a positive result. As early as September 2020, the KRD recorded an increase of 25 % in wheelset reconditioning compared to the previous year.

Fig. 6: Pacemaker and precision instrument: The wheelset press ensures and records quality and function of the critical connection between wheels, brake disks and shafts.

Conclusions

The outsourcing of wheelset and bogie overhauls to specialist service partners is the economical solution for the operators of on-track vehicles due to the increasing purchase and approval costs. Robel is thus pushing on with the expansion of the service section into a Europe-wide, manufacturer-independent Centre of Excellence for Wheelsets and Bogies of on-track machines, with the aim of further reducing turnaround times and increasing efficiency. The increase in demand across Europe confirms this concept: During the last two years, the KRD doubled the number of overhauls of wheelsets and bogies.

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