**Title**
Wheelset scanning

**1 Wheelset measuring stand**

**2 Wheelset in the measuring stand**

**3 Optical wheel profile sensor**

**4 CAD model measuring stand**

**Photos:** Fraunhofer IFF

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**Technical Specification**

1. **Main dimensions**
   
   Width: 5,600 mm  
   Height¹: 2,660 mm  
   Depth: 3,100 mm

2. **Total weight**
   
   Approx. 17 t

3. **Connection data**
   
   Power supply: 400V, 50Hz  
   Installed load: approx. 24 kVA

4. **Permissible ambient temperature**
   
   +10° C to +35° C

5. **Permissible wheelsets**
   
   Gauge width²: 1435 mm  
   Measuring circle diameter²: 630 – 1005 mm  
   Max. wheelset weight²: 2 t  
   Axle length²: 2000 – 2300 mm

6. **Typical cycle time**
   
   Approx. 5.0 min  
   Handling: approx. 2.5 min  
   Scanning time: approx. 2.5 min

¹ Additionally requires a machinery pit for the lift frame
² Modifiable at customer request
The interaction between wheel and rail stresses the wheels of rail vehicles tremendously. The wheel profile geometry, the radial and axial runout tolerances and the wheel disk’s position on the shaft are critical quality parameters for a rail vehicle’s safe operation and high ride comfort. These quality parameters must be assured by objective measurements, especially as vehicle speeds continue increasing.

Parameters are measured both when wheelsets are manufactured and when they are serviced.

Train wheelset maintenance in a wheelset shop requires inspection of their geometry before and after machining. Preliminary measurement determines condition (wear condition) before maintenance begins. This measurement determines condition (wear before and after machining. Preliminary shop requirements include geometric parameters.

These quality parameters are assured by objective measurements, especially since vehicle speeds continue increasing.

Wheelset Measuring Stand Design

The wheelset measuring stand consists of a wheelset handling and a wheelset measuring equipment module.

The wheelset handling module automatically inserts, removes, lifts and clamps wheelsets between two rotatable spindle sleeves, which turn the wheelset on its own shaft axis to scan the geometric feature along the entire circumference. This ensures that even local tolerances are measured reliably. All other dimensions are calculated from 360 individual measurements over the entire circumference. Afterwards, the means and the minimums and maximums are output. The number of measurements can be modified for customer requirements.

Technical Solution: Wheelset Measuring Stand for Automated Geometry Scanning

The wheelset measuring equipment performs the following tasks:
- Determining the wheelset and wheel profile coordinate system
- Determining all of a wheelset’s relevant geometric parameters

This is done by adjusting a sensor cluster of a total of five optical sensors radially to the wheelset’s shaft axis. The individual sensors of the cluster operate in a shared coordinate system.

The wheelset being measured is rolled along a rail into the measuring stand where a mechanical stop brings it to a halt. A lifting system elevates the wheelset vertically until it reaches a specified setpoint position. Then two spindle sleeves move in axially to the ends of the axle and clamp the wheelset using the centering bores on the end faces. A friction drive rotates the wheelset continually.

Wheelset Measuring Equipment

The following measurement profiles are determined in accordance with the guidelines of the Deutsche Bahn AG and compared with their nominal specifications:
- Distance of the inner wheel flange faces
- Distance of the inner wheel flange face to the center of the wheelset shaft and to the bearing journals
- Measuring circle diameter
- Radial runout tolerance in the measuring circle planes
- Axial runout tolerance of the wheel disks
- Diameter and radial runout tolerance of the wheelset shaft
- Gauge size

In addition, the following profile dimensions are determined on both sides:
- Flange thickness
- Flange height
- Cross dimension on the flange flank
- Flange and rim width

The measured data is acquired in the wheelset’s horizontal neutral plane. All other dimensions are calculated from 360 individual measurements over the entire circumference. Afterwards, the means and the minimums and maximums are output. The number of measurements can be modified for customer requirements.