HAT - Hollow Axle Testing

A mobile system for the testing of wheel set axles with longitudinal bore

The hollow axle testing unit is designed for the mechanised ultrasonic testing of in-service wheel sets. The object of the test is to locate transverse cracks in the wheel set axle. The cross sectional transitional zones and, especially, the zone where the wheel seat runs into the body of the axle are regarded as particularly susceptible to cracking.

On axles with a bore diameter of 30 mm, ultrasonic testing is carried out at inspection angles of 45° in both axial directions.

For larger bore diameters, tests are carried out at inspection angles of 0°, 45° and 70° applied in both axial directions. The test unit is based on specifications issued by German Rail.

The heart of the testing unit is an extendable probe holder on the outer end of which the probe module is located. This probe holder is mounted on a torsion proof cable which provides the actual feed motion in the axial direction.

At the connection between the probe module and the forward feed there is a turntable drive unit which causes the probes to rotate at approx. 60 rpm. Oil is used as the couplant for the probes. The ultrasonic signals are transmitted from the probe to the device via slip ring joints. The circumferential position is determined by means of an angle encoder.

Normal beam probes are used that have 45°/70° angle beam probes with a testing frequency of 4 MHz. During inspection the probe module is advanced at a constant rate of feed through the hollow axle, while each ultrasonic signal is being stored together with exact information on the axial and circumferential position of the probe.

Features
- Mobile unit
- Compact, robust construction
- Tried and tested components from renowned manufacturers
- Low maintenance costs
- High positioning precision
- Long service life, high reliability
- Easy to use
- Adapter for docking to various different types of axles
- Suitable for testing of axles with bore diameters between 30 and 90 mm
- Fast inspection
- Analysis of findings
- Documentation of inspection results

Peripheral conditions
- Max. length of wheel set axle is 2300 mm
- Shaft center height of bores is between 350 and 1200 mm
- Bore diameters starts from 30 mm
- Wheel sets with or without brake discs
- Axle end cap to has be removed at one end only
- Axle temperature between 5° - 35° C
- Only 1400 x 1400 mm of space required adjacent to axle being tested
- Max. distance to power supply 20 m
- Temperature in testingshed between 15° - 40° C

Basic construction
The test unit comprises the following modules:
- Feed mechanism (mechanical components and couplant)
- Ultrasonic testing system
- Data acquisition and evaluation
- Programmable logic control
- Frame for test wheel set or test axle
- Database for storage and display of test results

Fig 1: A mobile for the testing of wheel set axles
Carrying out the test

The testing unit is docked on to the face of the axle and centred. The probe is introduced into the bore automatically. At the same time, the oil supply for the coupling of the probes is activated.

The probe module is set to 80 rpm and advanced at the same time into a predetermined position, in which the gain is automatically calibrated using a reflector (e.g. a geometric indication of the axle to be tested).

Once the gain has been set, the probe module moves into the initial testing position and begins with the scanning of the wheel set axle. The test data are stored together with exact information on the axial and circumferential position of the probe. The probe module is advanced at a forward feed of 5 mm per revolution (though a slower feed is also possible). The testing frequency is selected in such a way as to ensure that the surface is covered with the required sensitivity using an axial pitch of 5 mm. The coupling of the probes is monitored by evaluation of the background noise.

At the end of the scanning procedure, evaluation follows immediately. If the evaluation shows a fault, the probe module is at first retracted to the position where the fault was indicated. The tester then has the opportunity to decide by means of an A-scan whether what he is looking at is actually a material defect, or whether the fault indication may perhaps have been caused by external influences. To assist himself in making that decision, he can switch the testing unit over from automatic to manual and stop the probe in a predetermined position, or in any other position he cares to select.

Data storage

A database is used to store all information on the tests carried out which is relevant to long-term data archiving, such as data on the axle tested, test parameters and test results. All data stored can be reviewed at a later date.

The actual testing of a flawless wheel set takes approx. 10 minutes. If a defect is found, extra time is required for the analysis of the findings.

References

The first four systems were delivered to the CITC in the year 2007. Further systems were delivered to DB AG (German railway).

The systems are operating since then without interrupt.

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<thead>
<tr>
<th>Systems</th>
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<tr>
<td>6</td>
<td>China International Tendering Company (China)</td>
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<td>Beijing Xinliantie Technology &amp; Trade Co., Ltd. (China)</td>
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<td>Nanjing Lin Cheng Environmental Communication Technology Co., Ltd. (China)</td>
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