

Training at Mechanized and Automated Ultrasonic Testing Equipments in the Context of the Course Program of the DGZfP

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Abstract. The requirements of quality assurance concepts and the demanded detailed data collection of the individual production course of the individual construction unit as basis for safety-relevant components fast advance the automation of production plants. On the surface of ultrasonic testing are the graphic representation of inspection results, their clear documentation and the quality management as well.

To come up to the increasing requirements to the qualification of the appropriate testing personnel a new course had been included in the training programme of the DGZfP and regularly successfully accomplished since then several times per year. A goal of this course is to learn the general fundamental characteristics of automated ultrasonic testing equipment and the inspection- task- and producer- independent usage of it. The associated contribution is presenting the underlining, practically relevant educational concept.

Today the non destructive examination belongs to the most important methods of quality control in the production process and during the safety-relevant process monitoring. Hidden errors in construction units and constructions forwards and during the enterprise are to be recognized so in time that unexpected failure is prevented.

In nearly all branches of industry the NDT became the indispensable instrument for quality control and quality assurance. It is an important factor for the lowering of the costs in production and enterprise.

The German society for non destructive examination is world-wide the oldest scientific-technical association for the NDT. The training of test personnel ranks among the tasks, to which the DGZfP dedicates itself for more than 60 years with special attention. It is the largest training centre for NDT personnel in Europe.

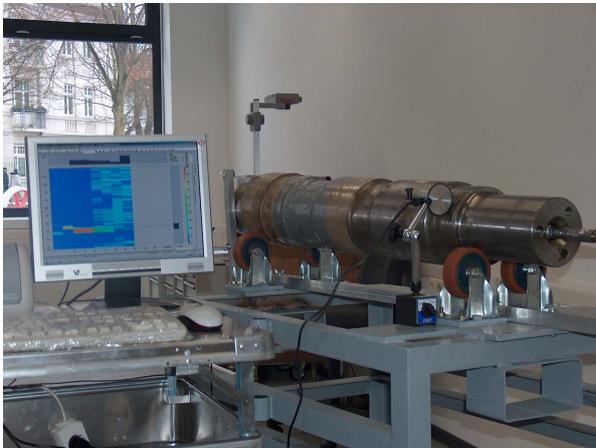
The requirements from quality assurance concepts and the demanded detailed data acquisition of the individual course of production of the individual construction unit as basis for safety-relevant components advance the automation of production plants fast. In the range of the examination with ultrasonic above all the possibilities of the graphic representation of inspection results stand for a fast and clear documentation as well as the quality management in the foreground.

In order to become fair the increasing requirements to the qualification of the appropriate test personnel, in the year 2004 a new course was installed in the context of the training programme of the DGZfP. A goal of this course is learning the general fundamental characteristics of automated ultrasonic testing equipments and testgave up and producer-independent handling these.

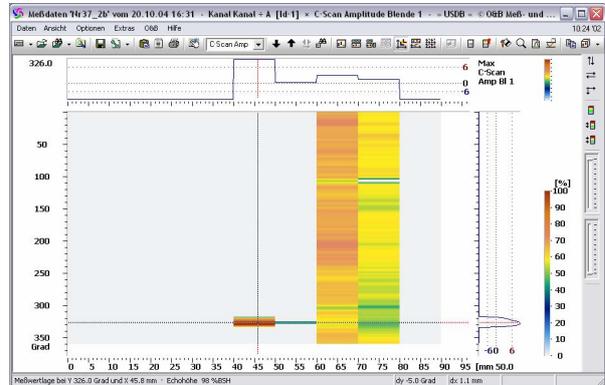
Numerous development concepts offered and offer solutions for the NDT at railway wheels and wheel set waves. With the German course AG there are at present 10 wheel set test stands, 5 lower floor panel testing equipments (UFPE), 12 plants for mechanized examining of wheel set waves with longitudinal drilling and 5 test stands for the ultrasonic testing of wheel set waves without longitudinal drilling.

Altogether approx. 180 employees of the railways AG work on such testing equipments. Already after the first testing equipments went into enterprise became very fast clearly that good training of the future test personnel is the best preparation on this new quality of the NDT. Therefore became in co-operation with the Federal Institution for Material Research and Examination BAM, the railways system engineering TZF - 92, the company O&B Mess- und Prüftechnik, which specialized committee formulated course of the DGZfP e.V. and the DGZfP training and training a goal and purpose as well as contents of this qualification.

From the beginning the demand existed that with this training apart from the lectures, which form practical exercises for the measuring data admission and evaluation an important emphasis.



Pic. 1: Data acquisition at wheel shaft



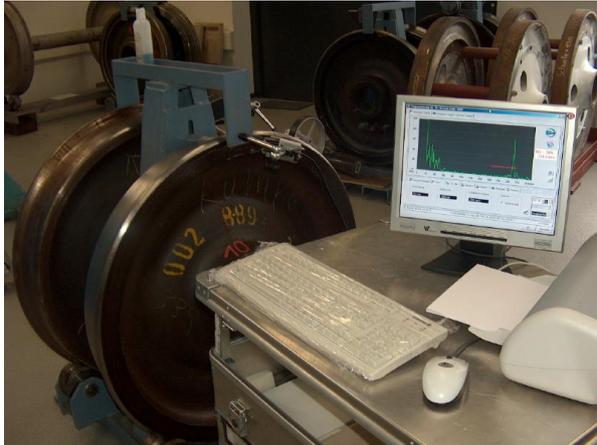
Pic. 2: B-picture representation of this object

The emphasis of this course results from the conception of testing equipments. Apart from the actual ultrasonic test task here the test robotics (the manipulation technology) and the graphic result representation are the center of attention with all applications.

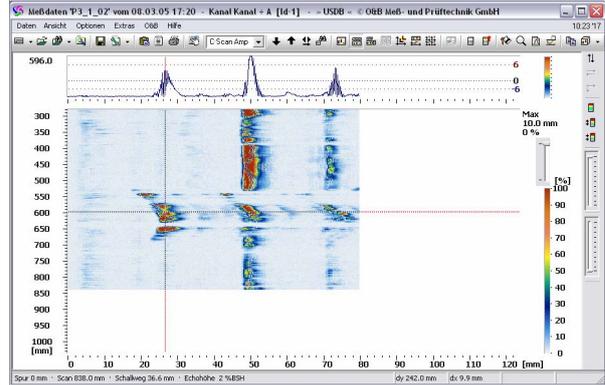
The 10 lectures treat among other things repeating the bases of the ultrasonic testing, object customer of wheels, waves and rails, testing equipments, the possibilities of the result representations, in addition, EMUS, group emitter technology and the eddy current inspection. The measuring data admission with the practical exercises takes place at original railway wheels, waves and pieces of rail. Thus also a purchase is to that already admitted to testpieces manufactured, with which the participants already have experience from the manual examination. At the same time the possibility at "off-line" jobs exists to practice the evaluations measuring data sets stored from there.

For this goal conversion a general test system with the components test robots (predominantly manually led), ultrasonic electronics (Windows PC been based) and evaluation software is used.

The picture-giving representation and analysis of the taken up data take place thereby with the analysis software "USDB". A-picture -, B-picture and dynamic representation along measuring cursor lines belong likewise to the standard like "classical" C and D-image representation.



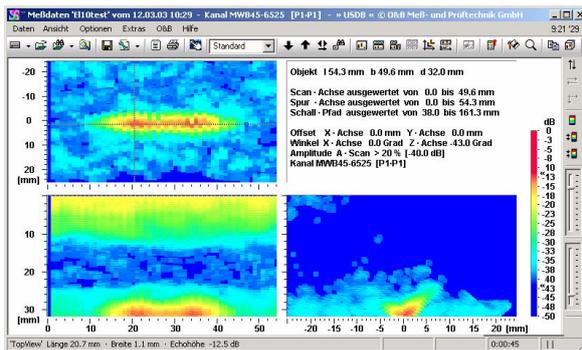
Pic. 3: Data acquisition at wheel set



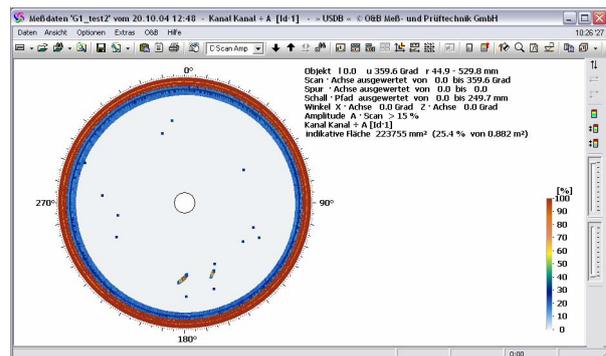
Pic. 4: B-picture representation of this object

Additionally to these standard representations some characteristics were implemented, which are to facilitate an evaluating of measuring data.

For a descriptive data presentation a three-view drawing, as from technical designs admits, is present. Special representation possibilities are contained for radialsymmetric inspection items and for weld seamtesting.

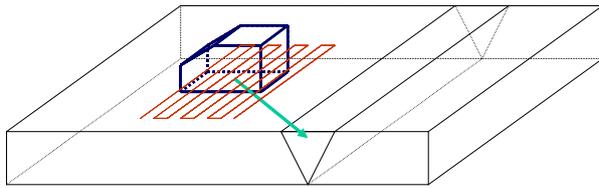


Pic. 5: P-picture as three-view drawing

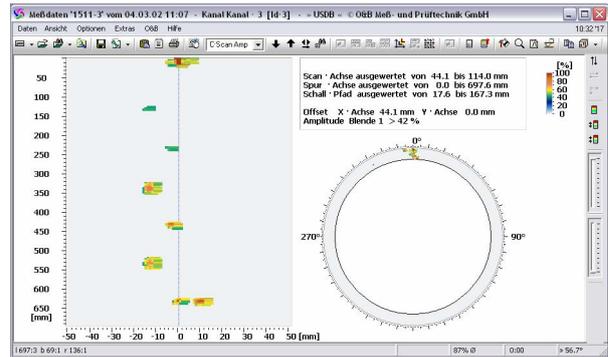


Pic. 6: radialsymmetric P-picture representation

In all the measuring data are represented to these opinions both with a angle and with a geometrical adjustment. In addition special representation possibilities for radialsymmetric inspection items and for the weld seamtesting at curved surfaces.



Pic.7: Data acquisition at longitudinal weld



Pic. 8: B-picture representation of this object

These representations of measuring data belong do not however only facilitate the evaluation, also mathematical aids are from large use. Thus belong to the equipment also a statistics function with a curve evaluation, Gauss' normal distribution function and sum frequentness.

A further aid is the automated reflector recognition, which produces reflector lists for the evaluation. For the automatic evaluation only the boundary conditions are such as amplitude height and sound way range to indicate as well as the permissible expansion of the reflector in x and y axis. With suitable measuring data in the list the computation of the spare reflector sizes is likewise accomplished immediately and indicated in circular disk equivalences defects (KSR) sizes.

Prüfahrt Bewertung												
Ausdruck Parameter Protokoll												
Nr	Meßkanal	Scan-Achse [mm]			Spur-Achse [mm]			Echohöhe [dB]		KSR [mm]	← 0° → [mm]	Tiefe [mm]
		min	max	max	min	max	min	max				
1	Kanal · 3	62.9	68.1	66.0	230	240	230	1.6	1.4	3.3	1.2	13.0
2	Kanal · 3	58.7	70.2	65.0	426	445	429	6.7	6.5	4.4	1.7	11.6
3	Kanal · 3	61.8	79.6	69.1	624	640	630	7.2	7.0	4.5	5.1	12.3
betroffene Fläche		554 mm ²			[1.3 % von total 43848 mm ²]							

Pic. 9: Reflector list with data concerning situations relative to the welding seam

The participant, who confirmed accomplished course UT1 M2 the fact that contents of the lectures and the exercises are in line with standard usage and automated the goal posed, the bases of the mechanized/examination to mediate, descriptive and interesting fulfills. Even participants, who already have an extensive experience with these testing equipments, confirmed much new to have learned and new insights win.

The specialized committee recommends, the personnel in this course to all repair enterprises, in addition, companies outside of the railways AG, which accomplish non destructive examinations with automated/mechanized testing equipments too qualify.