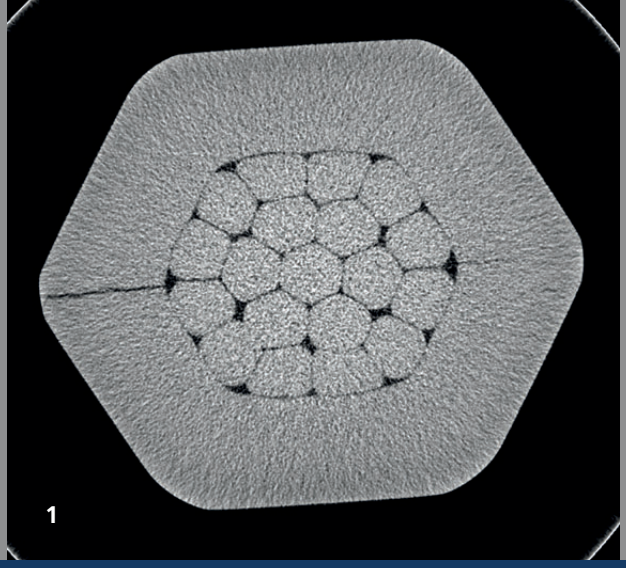



# ULTRASOUND TEST SYSTEM OF TENSION-PROOF CRIMP CONNECTORS ON CATENARIES

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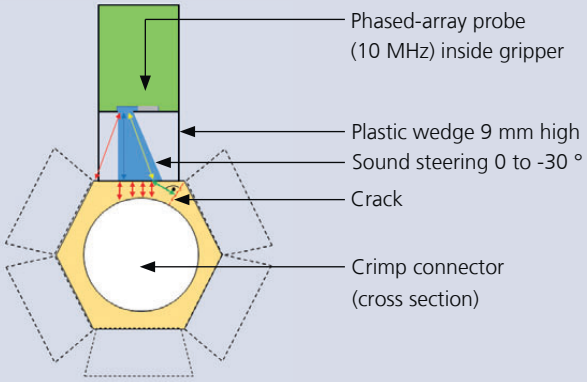
In electric railway technology, contact wires are mechanically and electrically connected to each other via tension-proof crimp connectors made of copper-containing alloys. The connectors must permanently sustain static tensile forces of up to 10.8 kN, withstand the dynamic vibration load caused by passing trains, and guarantee a service life of 30 years under the harsh, climatic conditions at the place of use.

In addition, the electric current needs to be guided safely and reliably without the connection heating up excessively. Consequently, after pressing the copper sleeve to a hexagonal cross section and mechanically fixing the cable ends inside, the electrical connection resistance must be as low as possible. This means that a very good electrical contact must be achieved when pressing the copper sleeves, which must not be allowed to increase excessively over time due to relaxation of the materials, cracking or chemical environmental reactions. The mechanical hold must not be endangered either.

Until recently, the only way to inspect these crimped connections has been visually, from the outside. Only where the crack has grown to the outside, through the cross section (Figure 1), can it be detected as a potential connector failure. Now, for the first time, a test system using ultrasound developed and successfully tested in the field by IKTS makes it possible to detect cracks as they form. By means of a test gripper (Figure 2), which is adapted to the hexagonal cross section of the crimp connector, an ultrasound probe is pressed onto the crimped surface. The ultrasound signals are controlled with the PCUS® pro Array ultrasonic electronic system developed at IKTS, and guided into the side of the press connector at 0 to 30 degrees to one side and 0 to -30 degrees to the other side. This directs the sound waves directly to the inner cracks and generates reflected echo signals. These echoes reach back to the test probe, indicating the presence of cracks. Crimp connectors found to be at risk of failure can now be detected in good time and replaced accordingly during the inspection.

The system has been successfully evaluated in the field as a prototype. In the future, it will be extended by integrating six ultrasonic probes in the gripper, making it possible to test complete crimp connectors without moving the gripper around.

Principle of measurement




1 *X-ray image of crimp connector (cross section).*
2 *Testing gripper and defect, removed connectors.*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