

UCI hardness measurement: Weld seam testing on pipes and boilers with SONODUR

Case & solution

Some microstructures in heat affected zones (HAZ) of welds on pipes and boilers develop cracks due to stress relaxation caused by heating and welding process and too rapid cooling. Some high-alloy steels for pressure pipelines and boilers in power plants develop precipitation hardening at the weld line in the HAZ with an increase in mechanical stresses in this area.

Hardness measurement is largely the only method to be able to identify possible damage risks from the hardness profile at an early stage.



Fig. 1: Weld Seam

Challenge

Without the detection via hardness measurement, cracks usually only appear after a certain period of time, depending on the load (pressure, temperature, vibration, etc.) and aging.

Detected hardness peaks may not exceed defined maximums and the hardness in the weld should not differ greatly from the base metal (e.g. DIN EN 288-3). – Where this is not prevented and detected, additional heat treatment or the expensive execution of a new weld seam is usually necessary.

Application solution

- First, thorough surface preparation is essential: remove weld beads with flap discs and approx. 0.5 mm from base material to remove rolling skin and possible edge decarburization to have original strength present.

- Next, hardness measurement is carried out manually with UCI probe: individual zones are scanned successively (pipes: at least 2 points on the circumference).
- Record test location and sequence / measuring direction (e.g. direction of flow of medium in pipe).

Benefits of the solution

- Very small indentation does not harm the material structure (e.g. as compared to rebound testing).
- Accessibility even in difficult positions like curved sections, other unevenness in the area of the weld seam, difficult installation position of the pipe.
- Instantaneous graphical display of results for feedback on possible distribution of hardness values in individual zones.
- Comprehensive documentation of individual results with statistics.

Technical setup

- SONODUR 3 Basic Package (2228025)
- Suitable probes:
 - SONO H100 (2215659)
 - SONO H50 (2215667)
 - SONO S50 (2215683), w. integr. probe guidance: can also be equipped with probe feet that correspond to curvature of pipes to be measured or bends in boilers
- Stand PS2 (2223406)

