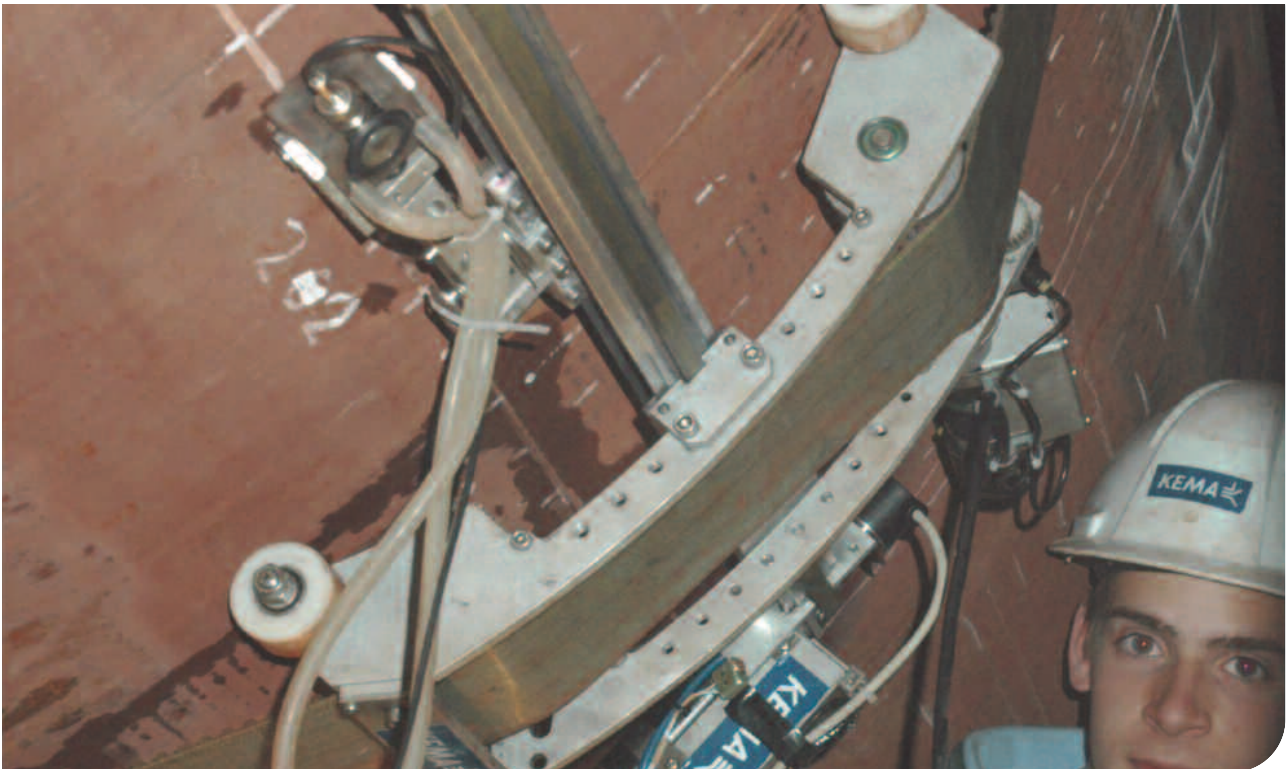


TOFD.

Time Of Flight Diffraction.



TOFD and more ultrasonic technology to inspect steam drums and other thick-wall high-pressure and high-temperature equipment.

Background

Since 1985 KEMA, Lloyds Registered Quality and the Electricity Producing companies in the Netherlands have developed four alternatives for the inspection of steam drums of boiler installations. The four variants are alternatives to the Dutch Rules for Pressure Vessels and include WBH 35 and WBH 36 materials with and without prolongation of the inspection interval. The alternatives consist mainly of ultrasonic inspections for the detection of in-service defects and are executed from the outside.

Acceptance criteria for ultrasonic testing from the “Regels

voor Toestellen onder Druk” (RToD) are used for newly built constructions (T0117) and TOFD criteria first developed in the Netherlands in 1997. Many older steam drums contain “non-acceptable” indications, especially the nozzle welds. For this reason Fitness-for-purpose criteria were developed for these steam drums based on in-service conditions. Inspection sensitivity, measurement accuracy and sizing capabilities from ultrasonic inspections are the basis for these fracture mechanical FFP calculations.

Ultrasonic testing is a useful tool to detect defects in constructions. Especially in-service grown defects, often resulting in cracking, can be handled this way. Conventional ultrasonic techniques are, however, not always sufficiently reliable when it comes to crack sizing. The Time Of Flight Diffraction (TOFD) method provides this possibility.

Service

For quasi flat structures like seam welds, the location of longitudinally welded strips and girth welds, detection and sizing is easily executed using the TOFD technique. The TOFD technique is nowadays an established method and its capabilities are well recorded. However, the execution and interpretation of TOFD results of large nozzle welds (downcomer pipes) is less straightforward.



The pulse echo technique is used for the inspection of the nozzle welds. Stacked A-scans are used as a recordable imaging technique. Results are

quickly available after on-site inspection has been completed. Dedicated B-scan imaging for use on site has been developed to reduce the time needed for evaluation even further. Apart from a shorter evaluation time, Characterization of reportable indications with focused probes is another possibility. Sizing of inner radius defects with the TOFD technique is easily executed for smaller-diameter nozzles.

Application

TOFD can be applied to:

- Large steam drums
- Water and steam headers
- Feed water, live, warm and cold reheat steam lines
- Boiler and steam turbine bypass and control nozzles
- Large range of applicability: wall thickness from 6 mm to > 200 mm
- Large range of applicability on materials such as carbon steel, stainless steel, non-ferros, glass fiber reinforced plastics, concrete, et cetera.



Benefits

- Quick scanning method
- Reliable defect detection and defect sizing method
- Possibility to "trend" degradation
- Possibility to extend repair or replacement of the equipment
- Recorded inspection data.

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