

Laser Scanning

Reactor Pressure Vessel Sealing Surfaces

Our long-term experience in reactor pressure vessel (RPV) mating surface laser scanning and inspection leads to highly efficient detection and assessment of surface defects. 3D imaging allows prediction on leak tightness and timely planning of repairs.

Challenge

Safe operation of a nuclear power plant (NPP) is highly linked to the early detection of potential failures.

Leak tightness of the RPV is important for system integrity as leakages occurring during plant operation may result in unplanned shutdowns. Especially the RPV vessel head flange and sealing surface must be free of any defects to ensure leak tightness. To prevent the risk of leakages, efficient methods are required for precise inspection and assessment.

Solution

We provide automated inspection and laser scanning to survey the sealing surfaces of RPV flange and closure head. The line scanning procedure enables the determination of surface defect depth with very high accuracy of up to 5 μm .

The measurements not only show 3D geometry and position of surface defects, they also include information about pre-tension of the RPV seal ring and the planarity of the seal surfaces.

Accompanying replica and swab sampling techniques facilitate predictions about the existence of corrosive wear.

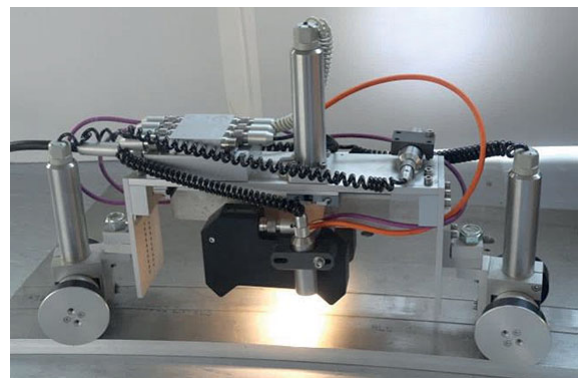
The laser scan head is mounted to a wheel driven remotely-operated vehicle (ROV), thus enabling remote control with exact position indication and performance at minimized personnel dose. The adaptable ROV design meets the requirements of plant-specific geometries of RPV flange and closure head as well as head stand.

Upon demand, we apply a waterproof flange manipulator to avoid delays on the critical path of an outage.

The combination with other Framatome technologies like remote-controlled cleaning manipulators and qualified repair process provides an integral RPV flange sealing solution.

Customer benefits

- Safe and reliable plant operation without unplanned shutdowns
- Precise and repeatable execution and documentation of inspections
- High accuracy of scanning and identification of defects
- Universally applicable tool family for quick setup and performance
- Field service available worldwide



Manipulator for inspection and scanning of RPV flange



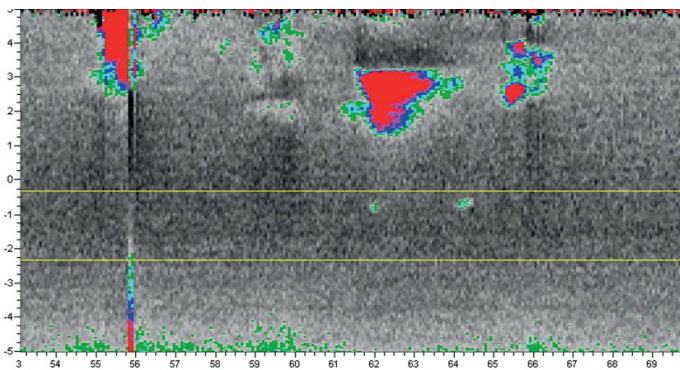
Camera inspection image

Your performance
is **our** everyday **commitment**

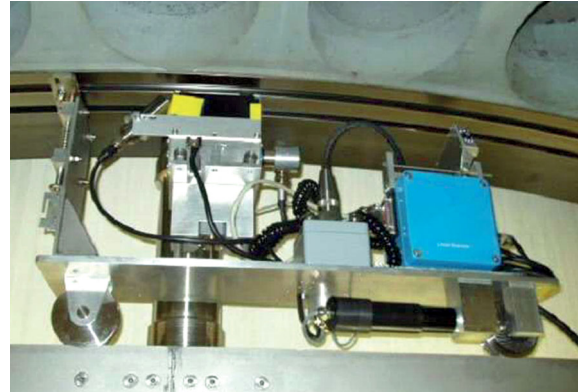
Technical information

Main features:

- Qualified according to nuclear standards KTA, ASME
- Line laser with automatically controlled distance adaption
- High resolution cameras for synchronous visual inspection
- Radiation resistant electrical and mechanical parts
- On-line observation of laser line position
- Unlimited number of measurements and automated data recording
- Precise location of failure position relative to seal trace as well as size determination
- Color marked indication of failure depth



Scan area and laser line



Manipulator for scanning of RPV closure head

Key figures

About **20** years of experience in RPV flange and sealing surface laser scanning

Accuracy of up to **5 μ m** on determination of surface defects

References

RPV flange and vessel head mating surface laser scanning has been performed at several NPPs to prevent leakages and/or precisely detect and localize defects in the sealing area.

Reactor types/designs:

- KWU BWR and PWR
- Framatome PWR
- Westinghouse PWR
- General Electric BWR

NPPs in:

- Europe (Germany, Switzerland, Netherlands, UK, Spain, Slovenia)
- USA
- South Africa
- South Korea

BWR: boiling water reactor PWR: pressurized water reactor

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