

Boiling Water Reactor Core Shroud Inspection

Background

Westinghouse, through its subsidiary WESDYNE® International, has developed and deployed state-of-the-art tooling, controls and refuel floor parallel coordination techniques for core shroud weld examinations on boiling water reactors (BWRs). These examination methodologies use phased-array technology, are fully automated and can be controlled from a remote location.

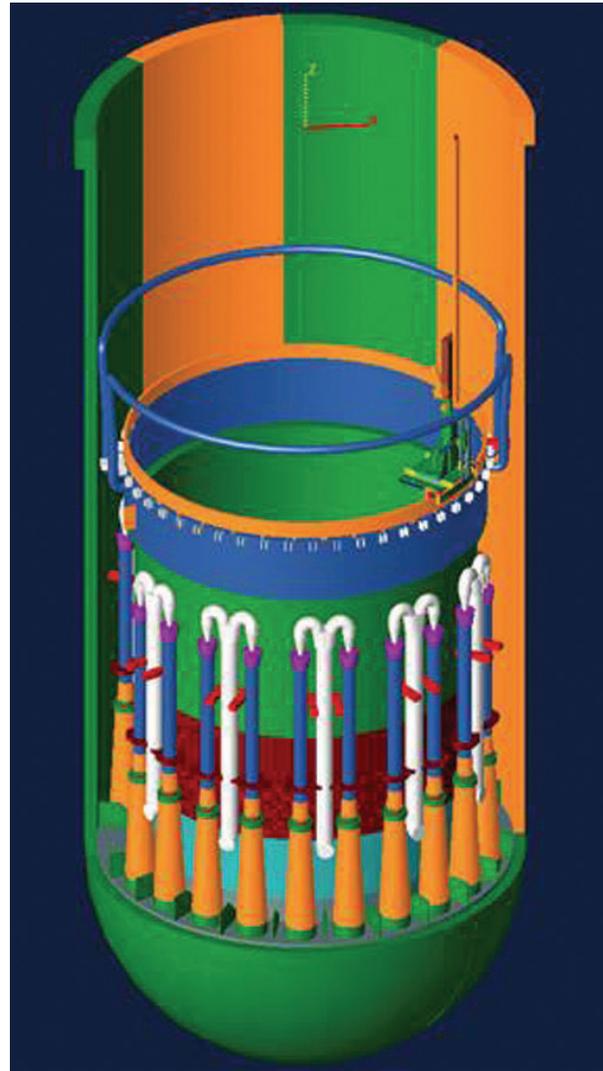
Description

The core shroud examination tooling consists of a track, trolley, radial drive, telescopic mast and special purpose end effectors.

The track mounts on the core shroud flange and aligns the tooling to the plant. The trolley is attached to the track and provides 360 degrees of circumferential motion. End effectors, which consist of a back-plate, scan wing, stabilizer, four-bar mechanism and tool-point camera, are inserted under the core spray headers via the radial drive, and are positioned by a telescopic mast. The combined length of the mast and end effectors permits vertical orientation during the insertion.

The end effector's scan wing places the phased-array transducers circumferentially for the examination. The transducers are mounted to the wing with a highly compliant coupler that allows ± 0.75 radial and ± 20 degree out-of-plane compliance.

A high-radiation-tolerant tool-point camera with a dual high-intensity light ring provides visual feedback for tooling operations.



BWR core shroud

Benefits

These unique BWR core shroud examination tooling and control systems provide a flexible, real-time scheduling and optimization feature that allows the examination to be performed in parallel with other critical-path activities, such as fuel unload or shuffle, in-vessel maintenance and in-vessel visual inspection (IVVI).

Databases for the fuel shuffle, core maintenance, shroud ultrasonic testing and IVVI services are integrated and all task positions are optimized to provide a minimum outage schedule.

Other benefits of using these core shroud inspection techniques include:

- A 3-D solids model is assembled for each customer and plant. The model provides coverage and examination time estimates and a tooling fit-up study.
- A pneumatic air-over-water design prevents air bubble interference to parallel activities.
- The combined weight of the equipment is less than 400 pounds, which enables it to be compatible with the standard bridge hoist.
- Phased-array technology combined with the highly compliant mounting provides two-sided coverage on all seven of the shroud welds.

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