Nondestructive Examination Services

Track-mounted ROSA™-based Examination System

Background

Westinghouse, through its subsidiary WesDyne International, has developed an inspection system capable of performing automated examinations of nozzle-to-shell welds, nozzle inner radii, nozzle-to-pipe welds, and pipe-to-pipe welds from the outside diameter (OD). This system provides significant advantages over conventional manual inspections in terms of:

- Reduced dose to inspection personnel
- The ability to collect and store encoded data for comparison with data acquired during future examinations

In certain instances, application of automated inspection techniques can also provide an extended interval between inspections when compared to manual techniques.

Using a more compact arm design, the track-mounted ROSA™-based examination system (T-Rex), in conjunction with the IntraSpect data acquisition and analysis system, is capable of performing conventional or phased-array ultrasonic examinations. The examinations are performed in accordance with ASME Code, Section XI, Appendix VIII, and performance demonstration initiative (PDI) program requirements.

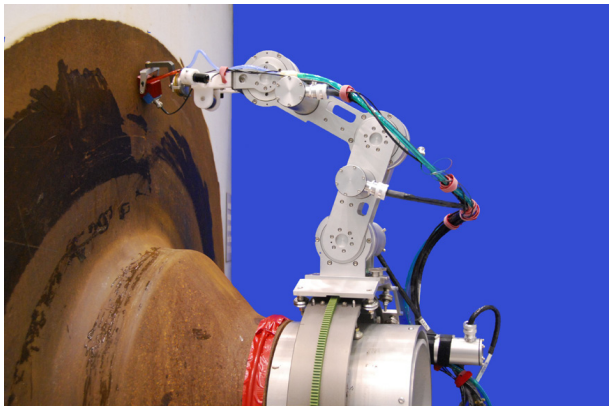
Description

The T-Rex scanner is mounted on a rigid track and designed for quick installation and removal, saving both time and dose. An integral dovetail and key design allow for precise and rapid assembly of the track sections. Adjustable locking feet on the track permit the use of one track to accommodate several pipe sizes and a variety of pipe surface obstacles. Once the track is mounted, the trolley quick-mount dovetail allows for a variety of scanner arms to be installed in multiple configurations and orientations in order to carry out the various examinations.

The size of the inner radius and nozzle-to-shell scanner arm is comparable to that of a human arm. The scanner arm is configured as an “elbow robot,” which permits multiple configurations to achieve flexibility around obstacles such as the bio-shield. The arm can be configured to reach out of the nozzle window and away from the reactor vessel for probe/wedge changes and for required calibrations checks. This flexibility helps reduce personnel dose.

The T-Rex inspection system consists of five major components:

1. The track and trolley system provides a mounted secure platform for scans around the pipe or nozzle.
2. The scanner arms provide probe delivery to the required scan areas through single or multi-axis motion. The nozzle-to-shell and inner corner radius arm consists of a three-axis articulating arm with detachable end-effector assembly and a fourth axis for rotation about the pipe. The nozzle-to-pipe weld arm consists of a single axis rigid arm that can hold two transducers or sleds, providing the axial scan motion, and a second axis for rotation about the pipe for circumferential scan motion.



Nozzle inner radius scanner

WESDYNE INTERNATIONAL
A Westinghouse Electric Company

3. The motion control system powers and controls the scanner and is operated using the WesDyne ROSA-based control software user interface.
4. The PDI-qualified IntraSpect system is used for acquisition and analysis of the ultrasonic data.
5. The digital audio/video system provides all of the requirements for communications and visual monitoring of the scanner and transducers to allow for safe tooling operation.

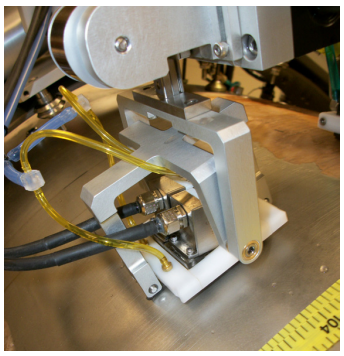
Benefits

- Equipment can be used for multiple applications using ASME B31.1 and PDI inspections
- Modular design and adaptability allow for inspection of a large range of pipe and nozzle sizes and configurations
- Low profile design allows for nozzle-to-pipe weld inspection of configurations that might otherwise be inaccessible
- Simplified scanner design requires minimal utility support at the component being inspected
- Remote operation, including skew control and adjustments between scans, provides reduced radiation exposure to operator and acquisition personnel when inspecting radioactive components or in radiation areas, minimizing down time
- Less dose due to ease of installation, continuous video monitoring of the scanner, modular end-effector design for pre-staged end-effector changes and manipulation of the scanner out of the nozzle window for required calibrations and probe/wedge changes
- Each probe delivery system, incorporating a constant force spring compliance system, allows for consistent and reliable contact on all surfaces
- System position accuracy and repeatability of within 5mm for the probe position

Experience

In August 2012, nozzle inner radius procedure qualifications were performed at the Electric Power Research Institute Nondestructive Examination (NDE) Center. OD examinations were completed on the N1, N2, N3, N8 and N9 nozzles during the procedure qualification. Scans were performed on the various nozzle sizes and in various blend radius diameters and wedge skew orientations.

The first field use of the T-Rex inspection system occurred during the fall 2012 outage season when WesDyne completed nozzle inner radius inspections on four feedwater nozzles from the OD. Scanning was performed on the barrel, blend and vessel surfaces to achieve maximum coverage.



Dissimilar metal scanner with circumferential phased-array probe

Inner radius arm end-effector scanning the nozzle barrel

WesDyne is the nondestructive inspection branch of Westinghouse and a leading supplier of mechanized nondestructive examination (NDE) products for all inspection needs worldwide. As such providing turnkey and one-off-type solutions with a focus on the nuclear market. WesDyne's expertise spans all aspects of remote and mechanized inspections, from problem analysis and solutions generation to development and manufacturing to field deployment of personnel and equipment. Inspection capabilities cover all key NDE areas such as ultrasonic, visual, eddy current, magnetic particle, dye penetrant and X-ray.

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