Lower Dose. Save Time. Reduce Cost.

The innovative ARCHER™ nuclear inspection and repair system provides eddy current testing (ECT) and ultrasonic testing (UT) of reactor vessel closure head (RVCH) penetrations by use of various test modules. ARCHER is the only system of its kind that delivers high speed quality inspections, combined with an automated surface repair of a J-groove weld and/or control rod drive mechanism (CRDM)/control element drive mechanism (CEDM) outside surface, saving utilities dose and time where manual grinding has been the norm.

Babcock & Wilcox Nuclear Energy, Inc. (B&W) teaming with INETEC (Institute for Nuclear Technology), offers this advanced technology in its suite of nuclear inspection and repair solutions.

ARCHER meets code requirements of the American Society of Mechanical Engineers (ASME), and NRC 10 CFR 50.55a rule.

- Case N-729-1 and N-729-2 “Alternative Examination Requirements for PWR Reactor Vessel Upper Heads With Nozzle Having Pressure-Retaining Partial-Penetration Welds, Section XI, Division I”

B&W has earned the qualifications necessary to use its ARCHER robot, designed by INETEC, to perform inspections on nuclear reactor vessel closure heads. The qualifications were granted through a demonstration program administered by the Electric Power Research Institute. This program qualifies ultrasonic testing personnel, procedures and equipment in accordance with industry requirements defined in the U.S. Code of Federal Regulations (10 CFR 50.55a).

- ISP- UT-44-E, “Procedure for the Automated Ultrasonic Examination of Reactor Vessel Head Penetrations with Thermal Sleeves”
- ISP-UT-45-E, “Procedure for the Automated Ultrasonic Examination of Reactor Vessel Head Open Tube Penetrations”

Key features of the ARCHER system

- Different modules used for various types of RVCH geometry
- Easy module exchange through the docking system without requiring personnel entry below the head region
- All penetrations accessible without manipulator repositioning
- Remotely operated distance up to 650 ft (200 m)
- IP protection level: IP65
- Main air supply: 90 psi (6 bar)
- Power supply: 110-220V AC, 50-60 Hz
- Rotation speed: max. 20 °/s
- Linear horizontal speed: 4 in./s (100 mm/s)
- Linear vertical speed: 4 in./s (100 mm/s)
- Repetitive linear positioning accuracy: 0.008 in. (0.2 mm)
- Repetitive angular positioning accuracy: 0.2°
- Implemented safety features
- Feedback control based on resolvers
Test Modules Provide Flexibility

Weld-OD tube module
- Eddy current examination of J-groove weld shell and nozzle side
- Designed to cover complex weld geometry
- Applied array probe (PRO ARCHER)
- Rotation speed: 0 - 20 °/s
- Linear vertical speed: 0 to 4 in./s (100 mm/s)
- Linear positioning accuracy: ± 0.02 in. (0.2 mm)
- Angular positioning accuracy: ± 0.1°

Gap-ID module
- Designed to perform ECT and UT examination from the tube inner surface
- Special blade probe used for inspection with embedded time of flight diffraction (TOFD) probes, eddy current probe and UT 0° probe
- Detection and length information of surface flaws conducted by eddy current probe
- UT inspection using TOFD technique for detection and sizing of circumferential and axial cracks
- Straight beam ultrasound examination for leak path detection

Open tube module (open housing)
- Used for penetrations without thermal sleeves
- Delivers an eddy current and an array of ultrasonic probes at the inner surface of the penetrations
- Detection and sizing of circumferential and axial cracks
- Leak path identification with straight beam ultrasound probe
- Water supply and water collecting system

Automated surface repair (ASR) module
- Removes flaws discovered by eddy current examination from J-groove weld surface
- Supported by EddyOne Mending
- 3 axes of movement
- Definition of the grinding area based on the surface probing and UT inspection results
- Built-in safety features with respect to grinding depth
- Grinding does not affect originally designed structural integrity
- Depth verification with the second probing
- ASR is a non-welding process – no additional source of intensive heat
- Excellent ALARA results

Additional modules
- Module for ECT/UT inspection of vent pipe with small diameter probe
- Module for the visual testing (VT) inspection of the penetration tube outside surface and thermal sleeve
- Module for the VT inspection of the latching tool mechanism of CRDMs