EPRI

SUCCESS STORY

NEWLY QUALIFIED NON-WELDED PIPE FITTINGS TO SAVE CONSTELLATION TIME AND MONEY, AND REDUCE RADIATION EXPOSURE

EPRI research paves the way for the use of proprietary non-welded sleeve-coupled fittings in safety-related applications at nuclear plants.

After collaborating with EPRI, Constellation will have 680 safety-related fittings manufactured by Lokring Technology, LLC™ on its nuclear fleet shelves ready for use this year. The fittings—an alternative to socket-welded fittings—will reduce installation time, cost, radiation exposure and outage critical path.

Lokring fittings are compression type fittings that connect tubing and piping with no welding or grinding. The use of them reduce installation time, cost, radiation exposure, and outage critical path

EXPANDING THE APPLICATION OF LOKRING FITTINGS

Lokring's line of mechanical fittings for connecting small-diameter piping and tubing operate successfully in marine, power, and process piping systems. The company's products—including compression-type fittings that connect tubing and piping with no welding or grinding—previously were installed in several non-safety-related applications at nuclear power plants. However, the fittings had not been proved compliant with Nuclear Regulatory Commission (NRC) 10 CFR 50 Appendix B program requirements nor with the ASME NQA-1 Code requirements.

In 2014, Constellation tasked Maher Kassar, Ph.D., P.E., senior staff engineer at Constellation, with exploring the use of Lokring fittings in safety-related applications. The reason: Lokring fittings use a patented compression-type sleeve-coupled joint as an alternative to welding. With the fitting design requiring no welding, the installation time is shortened, and the related person-rem radiation exposure is reduced.

Kassar quickly realized his task was quite complex, since this non-standard non-welded fitting presents a unique set of regulatory and code requirements as they pertain to the fitting's design and procurement. In addition to the compliance issues, the proprietary fittings needed to be tested for structural integrity, including tensile, burst, torsion and bending. In addition to the static testing required by ASME B16.9, testing for high-cycle fatigue was necessary because most fatigue failures occur at the socket weld when dealing with small-bore piping. These tests are required to ensure ASME Section III and B31.1 Code design requirements are met and also to compare the reliability of these fittings and the safety margin against welded fittings under all loading conditions, including low- and high-cycle vibrations.

> *"I realized from the beginning of this project that I…needed help from various ASME Code and structural/vibration testing industry experts…I knew from the get-go that I needed a lot of coordination, planning, perseverance, and luck to get it done…I received help from many dedicated people inside and outside Constellation, including Steve Tate (EPRI, High Cycle Fatigue) and Ryan Wolfe (EPRI, FAC Testing)."*
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> – **MAHER KASSAR, PH.D., P.E.**
> *Senior Staff Engineer*
> Constellation Generation

RELATED EPRI PRODUCTS

Title	Product ID
Welding and Repair Technology Center: Implementation Guide for Use of Sleeve Coupled Proprietary Fittings	3002018435
Common Design Package Content for a Non-Welded Fitting Installation in Non-Safety Related ASME B31.1 Piping Systems	3002018349
Welding and Repair Technology Center: Evaluation of Small-Bore Mechanical Fittings: High-Cycle Fatigue Testing	3002021068
Structural Integrity Testing of Small Bore Mechanical Pipe Fittings: Tensile and Torsion Testing of Low Alloy Steel Couplings	3002020804

EPRI RESEARCH SPEARHEADS OUTCOMES

In addition to experts from Constellation and Lokring, Kassar turned to EPRI to help qualify the Lokring fittings. The high-cycle fatigue testing EPRI sponsored allowed validation of the product's ability to withstand the typical failure modes under operating conditions that include vibration environments. EPRI-sponsored testing on flow-accelerated corrosion (FAC) is in progress, and results so far have been favorable. In addition, common design package content has been published to help standardize modifications throughout the industry, enabling improved sharing of operating experience and reducing individual site costs for developing design change packages for non-welded fitting installation.

In addition, with EPRI's collaboration, Constellation was able to:

- Obtain ASME Section III Material Code Case N-879 and N-893 approvals including NRC's approvals of associated relief requests.
- Obtain ASME Section XI Procurement Code Case N-878 and N-880 approvals including NRC's approvals of associated relief requests.

Other utilities in the nuclear industry are beginning to realize benefits as well. For example, at a single-unit BWR site, implementation of Lokring fittings for the FAC program piping replacements has been estimated to eliminate more than 200 welds and save several hundred hours of labor during their next outage alone.

FOR MORE INFORMATION

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

Ryan Wolfe | *Technical Executive*
Program | Plant Engineering
Phone | 704.595.2611
Email | rwolfe@epri.com

Stephen Tate | *Technical Leader,*
Program | Welding and Repair Technology Center
Phone | 980.495.7417
Email | state@epri.com

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EPRI
3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com