Nuclear Services/Field Services

Instrument Tube Tie Rod

Background

Certain fuel assemblies with thimble tube sleeves that are manufactured from 304 stainless steel are susceptible to intergranular stress corrosion cracking (IGSCC) in the bulge joint region, just below the top nozzle. This corrosion could result in the top nozzle separating from the fuel assembly when the assembly is lifted. Even though the fuel containing the IGSCC-susceptible grid sleeves has not been manufactured for more than 20 years and, therefore, is not used in reactors anymore, utilities still need to move these assemblies. Currently, utilities must visually inspect these assemblies prior to handling. If the inspection is unfavorable, the assembly cannot be handled by normal means. Also, if dry storage is being considered for these assemblies, the current U.S. Nuclear Regulatory Commission (NRC) guidance could be interpreted in such a way that these assemblies could be classified as "damaged," making special handling and storage requirements necessary. Westinghouse has developed a component and method to repair these fuel assemblies, allowing the utility to reevaluate the fuel assembly classification against NRC Interim Staff Guidance Document-1 (ISG-1), reducing the costs of special storage and handling.

Description

The instrument tube tie rod (ITTR) is a component that was designed to address the issue of potential sleeve cracking and IGSCC. Westinghouse's ITTR solution returns and provides continued structural integrity of an IGSCC-affected fuel assembly (FA) while stored in either the spent fuel pool or in a dry cask. The ITTR also allows most core components to be stored in the fuel assembly after the ITTR is installed.

The ITTR is only applicable to 15x15 and 17x17 fuel types because the center location of the instrument tube provides a central passage to allow the ITTR to be evenly loaded. Tie rod materials were chosen for longterm compatibility with both the spent fuel pool and dry cask storage environment. The ITTR was also developed to accommodate normal anticipated irradiation-induced growth with enough adjustment for the range of growth encountered for fuel stored in the spent fuel pit. The ITTR was designed to carry the entire weight of the fuel assembly during handling. The ITTR was also designed so that the fuel assembly inserts can be stored in the assembly.

The bottom portion of the ITTR is an expanding tip that goes through the bottom nozzle. The top portion contains the locknut. This design allows the fuel assembly to be handled with the standard spent-fuel handling tool and procedures.

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The maximum outside diameter of the ITTR can pass freely through the instrument tube. The sizing allows for easy installation in the event of FA bow or twist. The installation process is a two-stage procedure, using electrical discharge machining to create a through-hole in the center of the top nozzle above the instrument tube, followed by installing the tie rod into the fuel assembly. The machining process also utilizes an underwater vacuum to minimize the presence of any fines in the spent fuel pool. Once the ITTR is installed, it is staked in place to prevent it from backing off.

Benefits

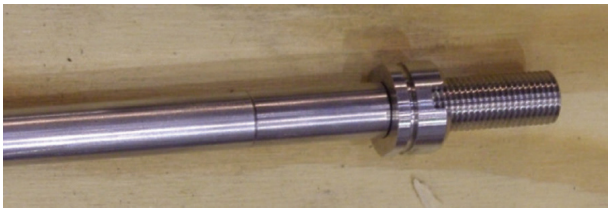
The ITTR has been field installed and is a proven solution that allows fuel handling with site tooling and storage of core components. It is also designed to allow cask storage for an unlimited time period.

Westinghouse provides the documentation, ITTRs, a qualified crew and equipment to perform the service as described, including a final report after completion of the service.

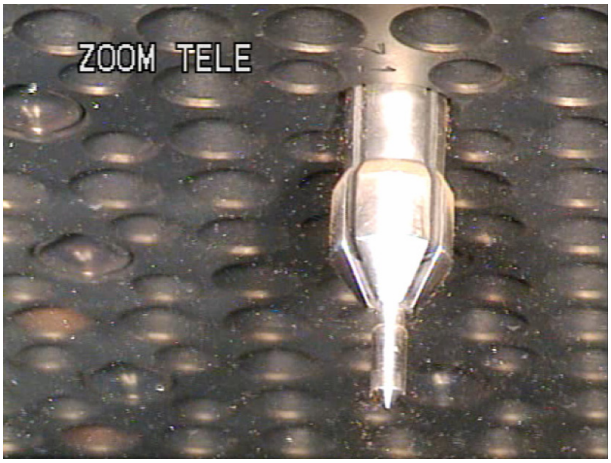
Experience

Westinghouse has successfully installed more than 3,800 ITTRs at various sites.

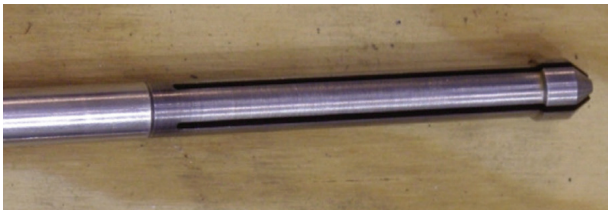
Completed instrument tube tie rod installation



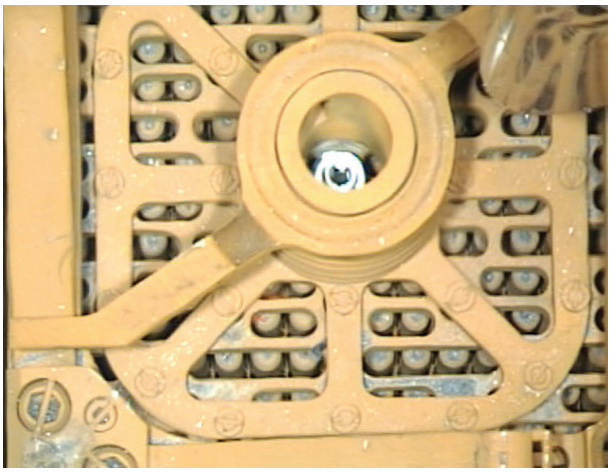
Instrument tube tie rod top with nut



Bottom portion of the instrument tube tie rod
(instrument tube tie rod and expansion rod are visible)



Instrument tube tie rod bottom expansion tip



A completed installation with thimble plug assembly installed
(instrument tube tie rod is visible in the center of the hub)

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