

Reactor Vessel Nozzle Plugs

Background

During a 10-year in-service inspection (ISI), a reactor vessel has to be flooded to a level above the inlet and outlet nozzles. Since the nozzles and reactor coolant loop piping are not isolated, work on other loop components (reactor coolant pumps) is precluded during the 10-year ISI effort. In order to work on other loop components, reactor vessel nozzle plugs can be used to isolate the reactor from the rest of the loop.

Westinghouse reactor coolant loop nozzle plugs have been demonstrated in the field in pressurized water reactors (PWRs) and under similar situations at boiling water reactor (BWR) plants in their main steam lines (MSLs). Specifically, MSL plugs have been supplied to various utilities for use during refueling. The MSL plugs are installed to permit fuel movement while services are performed on the MSLs.



Description

The reactor vessel nozzle plug system consists of aluminum and stainless steel plugs that can be inserted into the inlet and outlet nozzles. Westinghouse provides its customers with a functional specification for approval to define design requirements of the reactor vessel nozzle plugs, docking tool, installation/removal tools and the installation nut-torquing tool. This is prepared prior to design work to verify that the reactor vessel nozzle plugs meet your requirements.

The nozzle plug design includes the following features:

- Reactor vessel nozzle plug design and function for PWR plants (non-inflatable seal design) is based on the successful design used in BWR plants (noninflatable seals).
- Reactor vessel nozzle plugs are non-safety-related with no safety analysis requirements. Sufficient analysis, including structural analysis, is performed to verify safe operation.

- Reactor vessel nozzle plugs are designed to resist a hydrostatic head of 35 feet.
- Reactor vessel nozzle plugs are qualified and tested per Westinghouse operating procedures.
- O-rings, seals and materials are approved plant materials, but will not require certified material test reports. O-rings and seal material are not safety-related and require no quality assurance.
- Reactor vessel nozzle plugs are installed using the manipulator bridge interfacing with a docking tool, installation tools and an installation nut-torquing tool.
- Plugs are installed one at a time.
- Plugs do not float, but will include a safety lanyard for tie-off.
- Constraints are not needed beyond those required by the ISI tool.
- No prototype plug is required, and no proof-of-principle testing is required, nor performed.

Deliverables

Westinghouse supplies two inlet and two outlet reactor vessel installation/removal tools, nozzle plugs, along with a docking tool and an installation nut-torquing tool. In addition, a Westinghouse field procedure, a spare parts list and normal maintenance data sheet are also supplied.