

International Conference on Fast Reactors and Related Fuel Cycles: Next Generation Nuclear Systems for Sustainable Development (FR17)



Contribution ID: 325

Type: ORAL

Design of Sleeve Valve mechanism for Primary Sodium Pump of future FBR

Thursday, June 29, 2017 11:20 AM (20 minutes)

Future FBRs in India with 600MWe capacity are designed with three Primary Sodium Pumps (PSP). As the PSP are operating in parallel, failure of one PSP will result in a significant reverse flow through it, thereby reducing the flow through the core. Minimizing or arresting the reverse flow will in turn increase the flow to the core and the power operation of reactor can be resumed with two pumps. Hence, an active system called sleeve valve mechanism is conceptualized in PSP, to facilitate the power operation of reactor in 2/3 mode. The mechanism contains a sleeve shell (outside the PSP shell) for closing the suction passage. It is designed to withstand the pressure surge by taking accidental closure into account, under all operating conditions. The sleeve shell will not perfectly seal the suction passage due to provision of gap for movement of sleeve shell outside the PSP shell, thereby leaving an annular gap resulting in a leakage. The leak flow rate and leak flow velocity are reduced by increasing the leak path resistance with a labyrinth, which is optimized to give the maximum possible pressure drop.

The sleeve shell can be raised or lowered using three tie-rods, which are designed with galling resistant screw threads for converting the rotary motion from drive motor to linear motion of sleeve shell. A universal coupling is provided in the tie-rods to accommodate the tilting of the PSP. The synchronous motion of the tie-rods is ensured by a planetary gear drive type arrangement provided above the roof slab. The drive arrangement is designed with manual and electric drives for diversity. Safety interlock systems are designed, which prevents any unwarranted operation of the mechanism. The primary cover gas is sealed with dedicated seal systems for each tie-rod, with provisions for monitoring interspace argon. The tie-rods along with the sleeve shell are designed to be an integral part of pump, thus facilitating handling them as a single unit. It is planned to validate the design of the sleeve valve mechanism by experimental simulation and testing.

Country/Int. Organization

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Session Classification: 5.9 Large Component Technology II

Track Classification: Track 5. Fast Reactor Materials (Fuels and Structures) and Technology