Reactor Coolant Pumps Advanced Sealing Technology: Pure Hydrodynamic Seals

Ensuring the primary circuit leaktightness to guarantee plant operation and safety

The challenge
In case of Station Black-Out, Reactor Coolant Pumps (RCP) stop, leading to the leakage of significant quantities of water through the seals (typically several cubic meters per hour for each pump). The primary circuit leaktightness function is therefore key to preclude Loss Of Cooling Accidents (LOCA) that could ultimately lead to core melt.

The solution
A new technology of RCP seals that can withstand high pressure and temperature profiles in case of Station Black Out (SBO) has been developed by AREVA, taking into account the high expectations from our customers and from Safety Authorities. This RCP Seal aims at withstanding extended SBO (ultimate qualification in progress).

This technology can be implemented on both operating RCPs for installed base, and new RCPs for new builds projects.

Key technical features
- A three stage shaft seal
- Reactor coolant system pressure equally divided through each stage of the seal
- Each stage is conservatively designed to withstand the full primary pressure
- All 3 stages are identical
- Increase resistance in case of failure: the RCP can operate until the next outage in case of failure of one stage and during 24 hours in case of failure of two stages
- Lifetime estimated to 10 years

Hydrodynamic shaft seal
Strong expertise and solid references

JSPM has 40 years of experience in the maintenance of shaft seals. Indeed, AREVA JSPM teams take part in the maintenance programs of over 400 RCP’s worldwide. Every year over 100 leak tightness systems are assessed and repaired in SOMANU’s hot workshop. The considerable experience thus built up has enabled AREVA JSPM engineers and technicians to acquire outstanding know-how that they have turned to good account by increasing the reliability of the seals and reducing their impact on the scheduling of outages. To check the behavior of shaft seals under normal and incidental operating conditions and to perform their qualification, AREVA has several testing means. This applies both to seals at the development stage and 100% of seals in production. A dedicated seal test bench enables to test seals and reproduce their behavior in operation in order to provide better expertise. Furthermore a static test bench in Karlstein – AREVA Technical Center – enables to test the seals in SBO conditions.

Your benefits at a glance

• Better resistance to SBO compared to other solutions: improved robustness in incidental or accidental conditions
• “Pure” hydrodynamic seal: instantaneous hydrodynamic effect
• Easily applicable to existing plants
• Improved reliability in operating conditions (possibility to operate a full cycle with one damaged stage and 24 hours in case of 2 damaged stages, easy restart of the pump in case of short loss of power supply)
• Optimized maintenance programs management and costs thanks to easier installation and inspection, easier inventory management and reduction of worker’s radiation exposure