

Xylem designed an engineered-to-order water injection pumping solution for a nuclear power plant

THE CUSTOMIZED EMERGENCY BACK-UP SYSTEM WAS DESIGNED TO UNIQUE TECHNICAL SPECIFICATIONS

Safety upgrades imposed by the United States Nuclear Regulatory Commission (NRC) several years ago required nuclear power plants across the United States to review operations and enhance safety protocols. As a part of this process, a nuclear power plant located in the northeast of the U.S. sought an emergency back-up solution to inject cooling water into the plant reactor in the event that all other means of cooling failed.

Challenge

Operators of the plant sought an emergency back-up pumping solution to use in the event of critical failure or an emergency, to comply with the NRC's "severe accident water addition" (SAWA) protocol. The back-up system was to inject cooling water from the condenser hotwell inventory, as well as river flood water from the floor of the turbine building basement, once the condenser water was depleted. The unique circumstances of this application also demanded a solution capable of pumping very hot liquids while fitting into a limited space in the reactor turbine basement.

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Solution

The distinctive requirements of this complex and critical application called for a customized solution. The Xylem team designed a portable system comprised of three Flygt 2201 SH submersible pumps with de-rated motors to prolong lifespan, and special trimmed impellers to optimize performance. These were loaded onto one pump skid, and were made accessible via a common manifold. As required, each of the pumps could operate at a high flow rate of 250 gpm and a low flow rate of 100 gpm.



Xylem designed a custom solution comprised of three submersible Flygt 2201 SH pumps positioned vertically on a common skid. Xylem altered the original pump design by changing the material construction of the seal faces and elastomers, which enabled the pumps and motors to operate in very hot water without sacrificing performance.

PROJECT HIGHLIGHTS:

- Customized pumps capable of pumping water at a potential temperature of up to 70 degrees centigrade were designed for this unique solution
- A common manifold was fabricated for all three pumps
- Flanges were included to allow easy access to the pump units, for convenient maintenance and servicing
- Components were assembled on a Xylem-manufactured portable skid, for easy manoeuvring into position

SOLUTIONS:

- Three Flygt 2201 SH submersible pumps
- Portable common skid for all three pumps

The Flygt 2201 SH is a durable two-stage hydraulic pump designed to resist abrasion and wear, with an adjustable dual impeller design. The signature Dura-Spin safeguards against wear, while the unique closed impeller and the suction cover with Dura-Spin grooves work together, sweeping abrasive particles away from the impeller neck.

Two of the pumps were designed to pump condensate from the hotwell, while the third was designed to pump water from the ground of the basement building in the event of flooding. A critical requirement of the pumps for this application was the ability to pump hot water with a temperature of up to 70 degrees centigrade, if necessary. The pumps also had to fit into a small area in the reactor turbine basement.

“Once installed, Xylem engineers provided the plant’s operation team with training to ensure the correct storage and maintenance for the solution.”

Greg Asselta, Business Development Manager at Xylem, said, “Each of our customers deals with unique challenges, so we understand the importance of working closely with them to design customized solutions to address the individual needs of a particular application. A one-size-fits-all approach is rarely appropriate. We draw on our broad portfolio and in-depth expertise to devise specific solutions for the job at hand. In this case, for example, the pumps had to be capable of pumping water much hotter than the usual maximum temperature of 40 degrees. To enable the pumps to operate in such conditions, without sacrificing performance, we changed the material construction of the seal faces and elastomers.”

Once installed, Xylem engineers provided the plant’s operation team with training to ensure the correct storage and maintenance for the solution. Being a back-up system, it is important to rotate the pump impellers regularly, so they’re primed for use in the event of an emergency. This led to another unique design element of this solution: custom flanges that enable easy access to the pump impellers, motors and other parts, for effortless maintenance.



Each Flygt 2201 SH pump underwent a five-point performance test at the factory, as well as a four-point customer witness test in the assembled custom manifold in Bridgeport, New Jersey.