

Importance of Reverse Engineering in Obsolescence

By Faisal Salman and Nick Dagues, Hydro, Inc.

Faisal Salman

Faisal Salman serves as director of nuclear services at HydroAire, a Division of the Hydro Group of companies. Salman has been involved in aftermarket pump refurbishment and troubleshooting for 28 years. He is a graduate of the University of Illinois with a Bachelor of Science degree in mechanical engineering.



A Western European Nuclear Power Plant Faced Safety Concerns with an Obsolete Pump

With the nuclear market supply shrinking and plants closing, it's become harder for existing manufacturers to maintain the proper quality certifications to support safety-related equipment.

A nuclear power plant in western Europe was caught in a dilemma with their single stage boron injection pumps. The plant was struggling, trying to find spare parts for the leaking and vibrating pumps. The existing pumps were installed for boric acid service. This service injects borated water into the reactor to kill nuclear fission—a critical service.

Until HydroAire's Nuclear Division, was introduced, the nuclear plant, it had struggled for years to find spare parts and help with an existing problem of leakage and vibration.

HydroAire met with their engineering and maintenance teams to develop a solution that addressed their issues.

The plant was hard pressed with a decision, either buy new pumps, or find an aftermarket engineering solution:

After the initial engineering study, HydroAire proposed that the plant create a replacement pump that would be completely supported by HydroAire. A revised Bill of Materials, 2D and 3D solid models, and all general drawings of the proposed components were delivered to the plant. The plant reviewed the prepared documents, and accepted HydroAire's solution.

Plans and Complications:

HydroAire reverse engineered the pump piece by piece and reviewed the design to incorporate the modifications to address the vibration and seal leakage, while congruently keeping pump equivalent to the OEM design. The new pumps would fit the exact specifications as their original supplied pumps, and be fully interchangeable. This also ensures that the pump could rely on an entity to support the pump. By working with HydroAire, the plant would get new pumps at a fraction of the cost of buying new pumps through the OEM and the modifications necessary.

HydroAire sent two field technicians to Europe to execute the reverse engineering of the pump. Various challenges were encountered during the production of the project. First, Hydro had to make sure that the manufactured



Reverse Engineering Using ROMER Absolute Arm.

reverse engineered components are interchangeable with all the other pumps. At this power plant, there were over 24 of these small volute pumps, so to be able to interchange an impeller or a casing as needed would save the company thousands in repair.

A major challenge presented, the pump parts were contaminated by radiation. Equipped in a full nuclear biohazard suit, Hydro technicians scanned the volute case and its single stage impeller. To reverse engineer the pump, Hydro utilized an Coordinate Measuring Machine to laser scan the impeller and volute. Hydro then created a Computational Fluid Dynamic analysis to insure the geometry met the OEM performance characteristics.

Safety compliance was strictly adhered to. Reverse engineering in these conditions is a challenge. The technicians being suited in biohazard suits challenged them to physically work with every component the way they are used to, and many small parts made this process harder. The other concern was contaminating the equipment that was used to reverse engineer. By moving slowly, Hydro successfully scanned the entire pump, in and out.

Final Repair:

This was a Class III pump based on ASME Boiler and Pressure Vessel Code section III. Compliance in the nuclear sector is very closely monitored and was strictly adhered to.

The new pump being manufactured by HydroAire has an upgraded cartridge mechanical seal without any change to existing flushing piping plan. Additionally the material specification for parts revised is also obsolete (not available in market). The change in material was technically justified, and readily available.

Parts were manufactured at HydroAire, who now serves the plants needs in the exact same way as the previous OEM. The new pump is completely manufactured by Hydro, but 100% interchangeable with all the other pumps of the same size at the plant.

In addition to supplying the parts, HydroAire has performed all the technical equivalency documentation that the Nuclear industry requires. We have provided technical evidence that all the components are physically and metallurgically equivalent. And we supply all the general drawings for all the components.

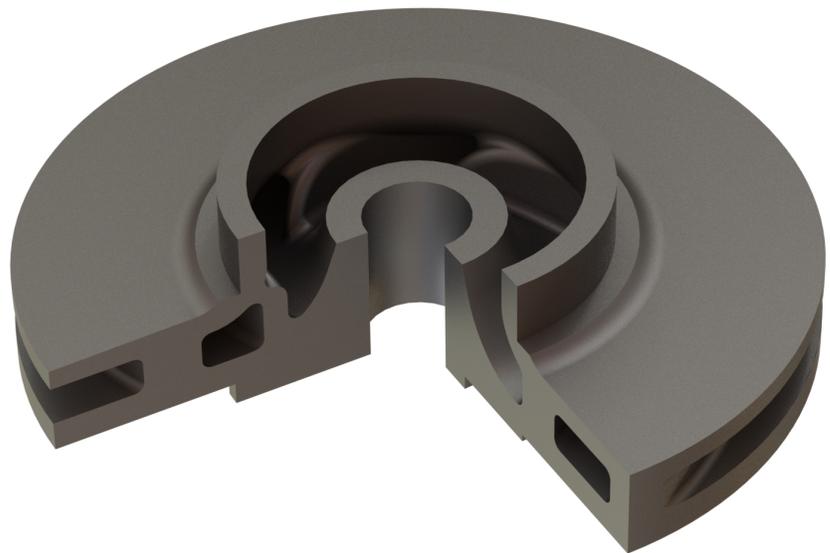
The pressure boundary components are now Stamp ASME Section III. The new pump performs safety function and all components were manufactured to Nuclear Grade Quality standards, the standards follows US Code of Federal Regulation 10 CFR App B Part 21. This is a quality program that ensures the highest quality of components to the actual design data of the pump.

Nick Dagres

Nick Dagres is the Vice President Nuclear Operations at HydroAire Service Inc., Hydro, Inc.'s nuclear certified facility in Chicago, IL. A mechanical engineer, Nick has been with Hydro for 29 years. He is responsible for the overall operation of the nuclear facility and specializes in overall pump repair and manufacturing.



first time in several years the plant has a manufacturer to support parts, troubleshooting, and to provide further engineering. Hydro has become the new OEM with full support from an Organization, 100% committed to the Nuclear market.



Using a ROMER Absolute Arm, a 3D replica of original impeller was created for manufacturing.

When working in a nuclear industry that has many safety systems, obsolescence becomes a major issue. All the components now have a HydroAire part number attached to them. For the

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