



Nuclear power plant cooling water pump upgrade

Industry: Power - nuclear
Region: Europe
Territory: France
Category: Hydraulic re-rate
API Type: BB1

ClydeUnion Pumps Aftermarket Technical Services team has experience across a range of services on critical rotating and reciprocating equipment to improve operational safety, reliability and efficiency. The hydraulic re-rate of the NP2 cooling water pump for the nuclear market is one of our success stories documented in our library of case studies. These case studies highlight the requirement from the customer, how we achieved the goal and the process we followed to deliver the improvements.

Image left: Cooling water pump

Situation

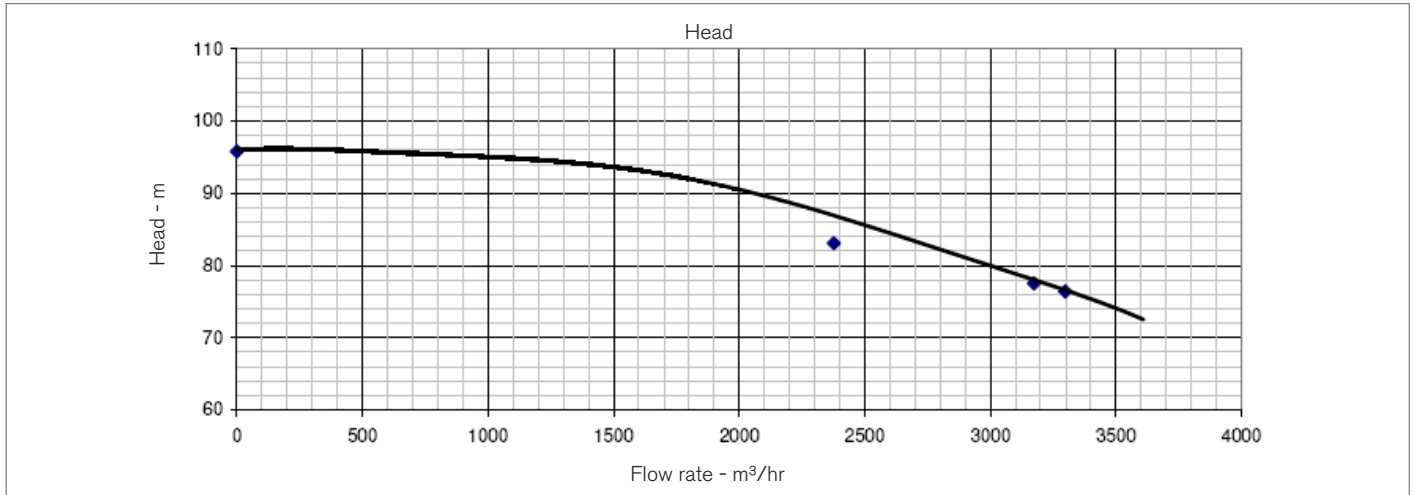
A nuclear power plant in Western Europe required an increase in their pump performance of the component cooling pumps. Contractual guarantees were met and independently verified at site using a third party thermometric test provider. The scope of supply was limited to spare rotors using modified impeller hydraulics.

Challenge

The re-rate consisted of a less than 5% increase in head. Strict conditions were in place that meant removal of pumps from site was not an option and potential outage was to be minimized. Factory testing was therefore not possible.

	NORMAL OPERATION	SHUTDOWN	LOCA
	Guaranteed Values	Expected Values	Guaranteed Values
Flow Rate - USgpm	14,057	14,601	10,593
New Impeller TDH (kg/cm)	7.65	7.52	8.38
Required Power (kW)	770	785	679
Present TDH (kg/cm)	7.42	7.22	7.88
CPL Committed TDH after evaluation	7.71	7.57	8.21
Percentage Head Rise from current TDH	3.96%	4.78%	4.16%

Predicted Performance Chart



Contractual duty guarantees were in place in accordance with ISO 9906 Grade 2 and were to be validated using an independent thermometric test site service company.

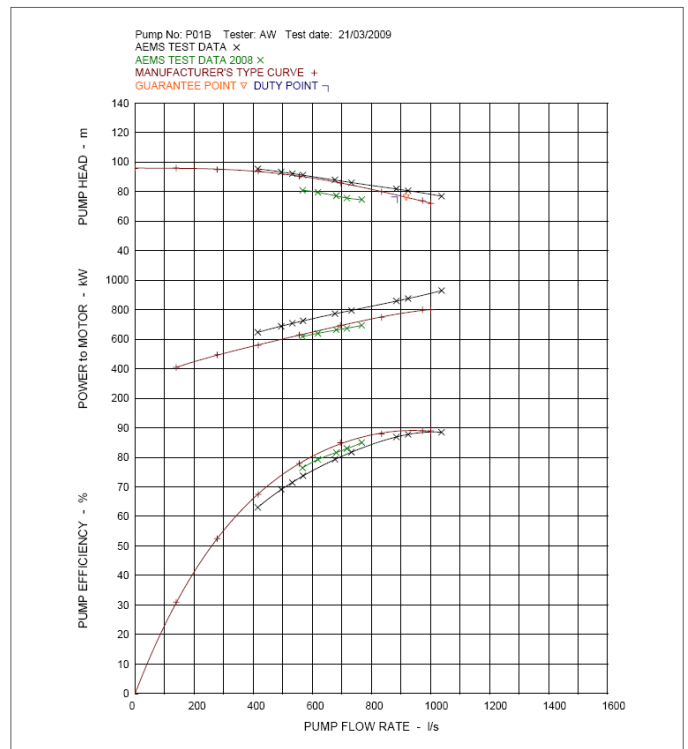
Although 'no negative' test tolerances on efficiency were not in place, the practical limitations on motor rating required engineering teams to adopt a similar approach. The low increase in pump performance meant that existing pump performance would meet the contractual tolerance on head for the re-rate, this would not be beneficial to the customer, and as such ClydeUnion Pumps aimed to meet re-rated contractual tolerance encompassing a no negative tolerance on head.

Solution

A pre-contract acceptance site test was performed to establish a baseline performance, pre-upgrade, and provide confidence in the abilities of the independent thermometric testing service provider. Rapid pattern manufacture techniques were employed, allowing 5-Axis machining of pattern equipment directly from the 3D CAD model of the modified hydraulics, reducing lead times, minimizing risk, and improving geometrical accuracy.



Site Test Data



Successful pump performance characteristics were shown through the thermometric testing, with pump performance within the positive tolerance band of the contractual duty.



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