# New impeller developed and tested in four weeks

**Allweiler recently found it necessary to increase the performance of a cooling water pump by 20 percent within a short period of time in order to meet the significantly elevated performance of the "8000" MTU diesel motor. To meet this challenge, they employed advanced 3D software to simulate liquid flow within the pump. Known as computational fluid dynamics (CFD), these tools made it possible to develop a new impeller prototype within just four weeks.**

The traditional way of designing a new pump with a larger impeller (and therefore a larger volute casing) was inadequate due to space limitations. And since the motor drives the pump directly, it was not possible to produce the needed pumping pressure simply by increasing the pump speed. The solution lay in optimizing the vane geometry so that Allweiler could achieve the needed pressure without changing the diameter of the impeller.

The 3D CFD tools were the only way for Allweiler to achieve the unusually high vane loads and power density without performing a large number of costly and time consuming experiments. Once they calculated the most ideal impeller geometry, they used this data directly in their 3D CAD system forwarding them to rapid prototyping processes to very quickly produce experimental parts and verify the characteristic curves.

Director of Design, Manfred Fleckenstein, describes it this way: "We have been using these CAE processes for more than six years. Our experience shows that these programs can precisely simulate pressure distribution and flow conditions in a pump even with impeller geometries near to the design limits. As a result, we don't need to produce a large number of prototypes, nor do we need to perform experiments to test the imprecise results of traditional configuration processes." And since Allweiler has been working closely with MTU for a number of years, they were able to develop the pump and motor at the same time (parallel engineering), which shortened the development time even further.

The pumps of the "Mega" series (size 125-250) are specially designed for use with the "8000" MTU ship diesel engine. Its maximum capacity is 273 $m^3$/hour with a pump head of up to 53 meters. The drive gearwheel and impeller are connected to the shaft by means of a high-strength cone press-fit, which could be disassembled only with an oil pressure of 2400 bar! As a result, the pump set is extremely insensitive to the motor's high vibrations. Allweiler has delivered about 30 "Mega" pumps to MTU over the past three years.

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Founded in 1860, Allweiler AG is the oldest German pump manufacturer and the European market and technology leader for centrifugal, propeller, screw, eccentric spiral, rotary lobe, macerator, and peristaltic pumps. Allweiler AG owns a foundry and produces ready-to-use fuel skids and rinsing-water facilities. Allweiler AG has their main German headquarters in Radolfzell on Lake Constance as well as a major subsidiary in Bottrop, Germany. Since 1998, Allweiler AG has been part of the Colfax Pump Group, a global leader among pump manufacturers. In 2003, Allweiler achieved sales of 144 million euros with 900 employees.

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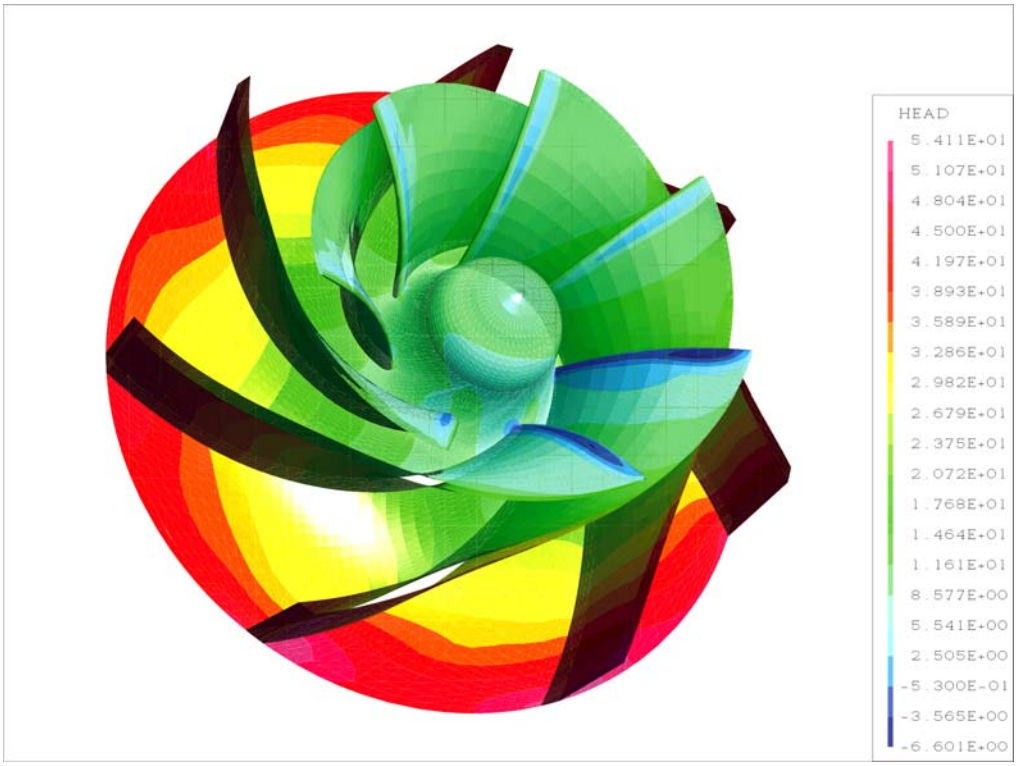


Caption:

Within just four weeks, Allweiler was able to redimension this impeller, optimize it with CFD, generate a design in 3D CAD, and then successfully verify its performance data in experiments. It was necessary to increase the pump's hydraulic performance because the output of the MTU diesel motor that it cools had increased by 10 percent to 9000 kW. Allweiler AG was able to produce the impeller so quickly only because they employ advanced CAE methods in their development process. The use of 3D flow-simulation methods (CFD) makes it possible to properly dimension impellers within a very short period of time. The figure shows the pressure distribution on the surface of the impeller as calculated by the CFD tools, whereby red indicates high pressure and blue represents low pressure.

Photo: Allweiler AG, Radolfzell

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