



Technical Paper

Wastewater pumps

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Computer based development of sewage water pumps for extreme operating conditions and high power consumption

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Summary

This contribution focuses on a design procedure for sewage water pumps for extreme operating conditions and high power consumption utilizing numerical simulation methods, advanced manufacturing methods for prototypes and experimental verification of the design data. Based on the required main operating data an elementary meridional contour of the impeller and an initial blade geometry were deduced from the data of other pumps which were designed for different applications. Using numerical methods for solving the Reynolds Averaged Navier-Stokes equations (RANS) for the flow in the pump an iterative optimization process was accomplished considering certain criteria such as hydraulic efficiency, cavitation performance, shape of the head characteristic curve and the maximum free ball passage. After creation of a volume model from the final data of the fluid wetted impeller geometry using the 3D-CAD-method ProEngineer the generation of a scaled impeller prototype with the method of selective laser sintering of loose powder of polyamide was possible. A certain treatment of the impeller prototype surface gave the opportunity for operation in a volute casing at the test bed of our company in order to validate the requested operational characteristics.

By the means of the advanced methods applied for the design of a sewage pump a cost-efficient model pump has been developed in a very time saving way. The model pump satisfies all demands concerning specific speed, efficiency, cavitation performance and free ball passage in its entirety. It can be expected that the behaviour of the full scale pump can be reliably derived from the test data of the model using the affinity laws. The procedure described in the paper enables the employment of an unerring and efficient design method for pumps even for extraordinary applications and extreme operating conditions.