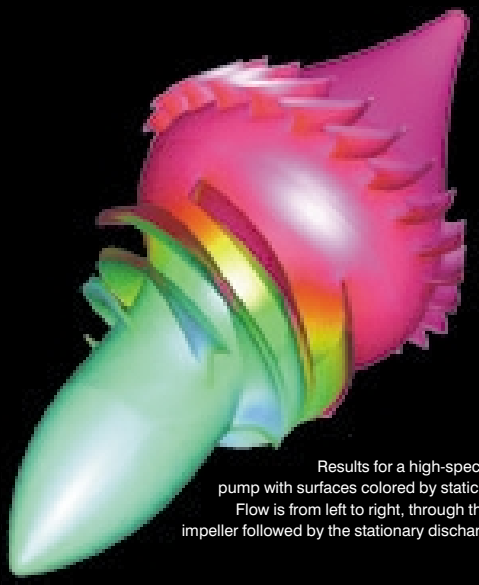


Results for a high-specific-speed pump with surfaces colored by static pressure. Flow is from left to right, through the rotating impeller followed by the stationary discharge vanes.

Design excellence at Ingersoll-Dresser Pumps

by Edward Graf, Timothy Luce, Leonid Margolin, Government Marine Business Unit, Ingersoll-Dresser Pumps, USA

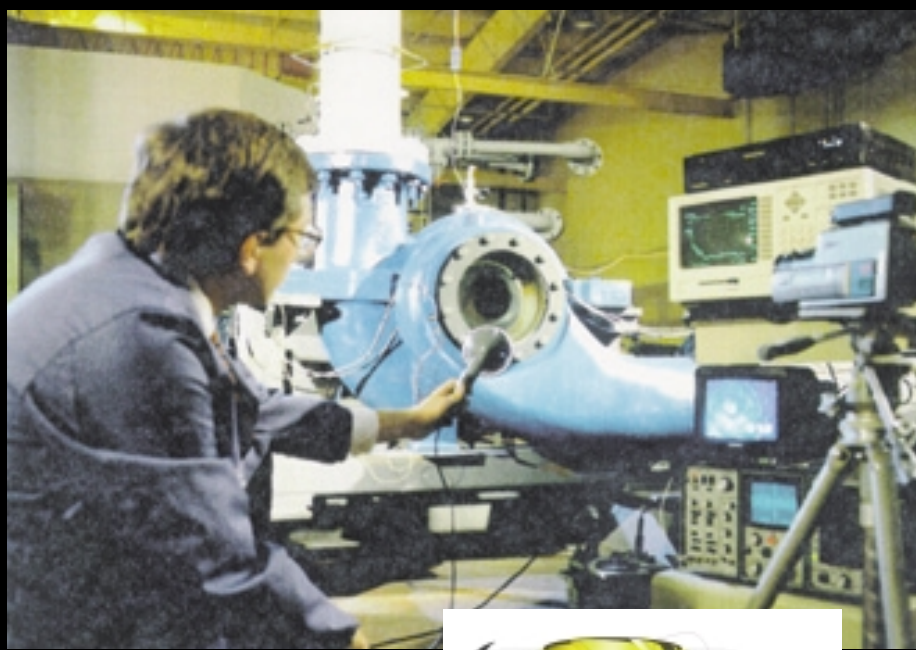
Ingersoll-Dresser Pumps (IDP) is a multinational heavy machinery manufacturer, whose pumps are found in applications as diverse as petrochemical and power generation plants, municipal water systems and on Navy submarines.

At IDP, advances in turbomachinery fluid mechanics have been made through a combined program of experimentation and numerical modeling. IDP has used CFX-TASCflow for over ten years for simulations of internal pump flows and external flows, as it provides the accuracy that our customers expect, both at the pump rated condition and at part-flow. The robustness and efficiency of CFX-TASCflow also allows us to review various design options before committing to expensive tooling or hardware.

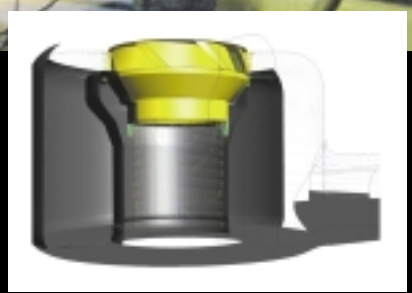
Our numerical simulations, which typically encompass the complete pump (inlet, rotating element and discharge system, as well as the primary leakage paths), have led to technological advances, such as cavitation-resistant designs. The reduced vapor generation of the computer-optimized designs is clearly observed in flow visualization rigs, while accelerated life testing further demonstrates reduced cavitation erosion damage, and serves to quantify the benefits of advanced analysis.

Similarly, advances in blade-shape design have consolidated IDP's leadership position in mission-critical naval pumps. As these must be able to operate at part-flow conditions for extended periods, an in-depth understanding of off-design flow phenomena is essential. Older pump design tools can't usually capture the complex three-dimensional flows that may occur at off-design conditions, so CFX-TASCflow analysis has played a primary role in the resolution of the stall behavior in these devices. The fine-scale details of the underlying flow structures in certain impeller/vaneless diffuser systems were first uncovered and understood with CFX-TASCflow. Subsequent analysis of nearly a dozen different impeller geometries, supported by testing, has resulted in a final manufactured unit which does not suffer from the large unsteady pressures associated with off-design stall.

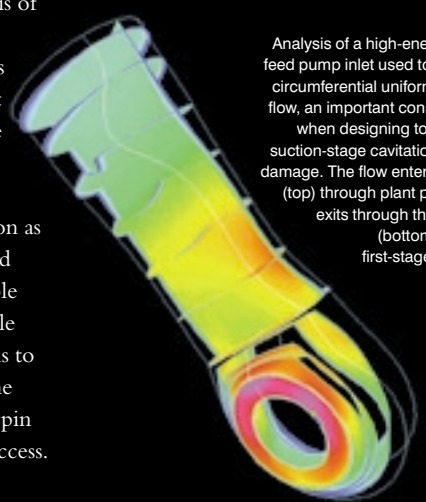
IDP's plan to maintain its position as a premier pump company is centered around talented and motivated people who will use sophisticated yet reliable tools to bring cost-effective solutions to its customers. CFX-TASCflow is one such tool that IDP will use to underpin new designs and insure first-time success.



Corporate R&D impeller cavitation test rig used to verify high-energy boiler feed pump hydraulics.



CFX-TASCflow allows analysis of complete End-Suction Pump features including inlet, front wearing ring leakage path, all seven blade passages of the impeller, and discharge.



Analysis of a high-energy boiler feed pump inlet used to examine circumferential uniformity of the flow, an important consideration when designing to minimize suction-stage cavitation erosion damage. The flow enters the inlet (top) through plant piping and exits through the annulus (bottom) into the first-stage impeller.