

Satisfying a Thirst for Process Optimization

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Humans are a thirsty species. Visitors to the Krones AG factory in Bavaria would never think otherwise. Here, beverage bottling and packaging machines are developed and produced for clients all over the world. These machines handle millions of bottles with consistent precision, or they fill bottles with an array of beverages. Given an export share of about 80%, people all over the world stand a good chance of being served drinks bottled using Krones machinery.

A Neutraubling-based team of dedicated researchers and designers with the latest technology at their disposal works diligently to ensure that Krones' equipment conforms to the highest standards of quality and production. The scope of products and services includes stretch blow molding equipment, fillers, mixers, labeling and inspection machines, control systems, and transport and regulatory devices. The company oversees the planning and installation of turnkey bottling and packaging lines for breweries and soft-drink manufacturing plants involving cans and bottles made of PET and glass.

The path that an empty bottle follows along a filling line begins with the removal of old labels in lye baths. The bottles are then rinsed inside and out using a disinfectant solution and water. After passing a final optical inspection, the actual filling process takes place, followed by closure and sealing, the application of new labels, and packaging. The time consumed for this entire process amounts to only a few seconds per bottle. However,

each fluid presents a new set of challenges. Thus, the filling process and all downstream processing needs to occur in close cooperation with the client on an individual basis so that the fluid behavior can be controlled and the process optimized. With a few exceptions, the processes are transient and include the following components, among others:

Cleaning: Cleaning baths are optimized so that the dissolved labels are collected and removed appropriately.

Purging: A nitrogen purge is used to partially evacuate air from the bottles prior to filling. The purge must occur steadily and quickly.

Filling: The design of filling valves and bends or transitions is optimized for each fluid so that the quickest possible filling time can be achieved.

Transport: During the transport of bottles from the filling equipment to the closing/sealing machines, unavoidable changes in direction and speed must be understood so that sloshing is minimized.

Stretch blow molding: During the production of PET bottles, heat transfer





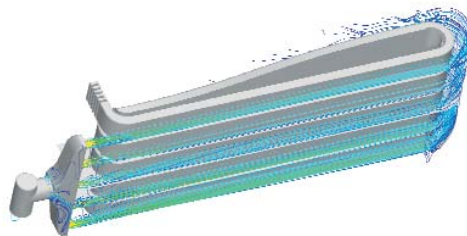
The sensometric VPG (opposite page) and the load cell (top) filling systems are both designed for still liquids; the filling pipes do not touch the bottles

is critical. Tubes need to be pre-heated to prepare them for the stretch blow molding process, but certain other components should never be heated so as to prevent warping.

To address these and other challenges, engineers import geometries from CAD packages and run CFD simulations on a Linux cluster. The simulation findings have resulted in many direct and indirect technical advantages. For example, sales engineers can react to specific customer queries and offer solutions regarding the design and layout of the equipment for a particular installation. Inter-disciplinary and enterprise-wide cooperation has helped the CFD simulation process contribute substantially to the achievement of the overall corporate goal: ensuring that the organization remains on top, both technologically and economically. ■



Simulation of bottle transport and sloshing for optimum machine configuration



In cleaning baths, the carefully calculated liquid flow guarantees the optimum removal of labels



When flushing a bottle with hydrogen peroxide, it is essential that the air (red) be removed completely, as fast as possible