



alternating
temperature
technology

Variotherm liquid-operated temperature control of injection molds with near-surface cooling channels

- Injection molded parts without sink marks and warpage
- Thick-wall and optical parts with homogenous structures
- Immaculate surfaces without flow marks and flow lines



Alternating Temperature Technology: Variotherm mold temperature control

Alternating Temperature Technology (ATT) is a complete system for particularly efficient variotherm liquid-operated temperature control of injection and injection compression molds by means of a near-surface arrangement of heating/cooling channels. ATT combines a customized alternating temperature system with specially designed and manufactured cavity inserts and mold components.

Variotherm mold temperature control involves heating the cavity wall prior to injection of the melt to a temperature that exceeds the glass transition temperature of the melt. Mold cooling starts as soon as the cavity has been filled and lasts until the part has reached the required temperature for demolding.

The heating/cooling channels are filled alternately with cold and warm thermal fluids. The thermal fluid temperature is controlled by the alternating temperature system. With ATT the heating/cooling channels are neither lathed, drilled or milled into the metal but introduced to the cavity wall by means of Lasercusing, a generative manufacturing method that builds up layers of steel powder to form contour-aligned mold heating/cooling channels very near the surface of the cavity wall to be cooled.

Signals for the switch-over from cooling to heating are transmitted by the machine control via programmed I/O according to process requirements.

Benefits of variotherm mold temperature control

Lower costs

- ATT homogenizes the required cooling time across the entire mold
- ATT cuts cycle times thanks to longer wall contact of melt agglomerations with the result of a more intense cooling action

Better strength and structure

- ATT ensures a more homogenous orientation of glass-fibers in industrial components
- ATT increases the welding time for melt front and reduces the occurrence of weld lines
- ATT reduces the risk of warpage caused by shrinkage
- ATT improves the dimensional stability and consistency of injection molded parts

High-quality optical and surface properties

- ATT decreases internal stress during compression molding of optical components
- ATT promotes surface properties such as self-cleaning or antireflection coatings, microstructures and nano-structures such as molded channels and fillets in micro-fluidic applications
- ATT allows the production of particularly smooth surfaces and high-grade glossy surfaces with piano finish
- ATT avoids flow marks and silver streaks that may occur during foam molding

More reliable processes

- ATT helps reduce injection pressure and clamping force
- ATT prolongs the holding pressure even in areas that are away from the gate

STWS Alternating Temperature System

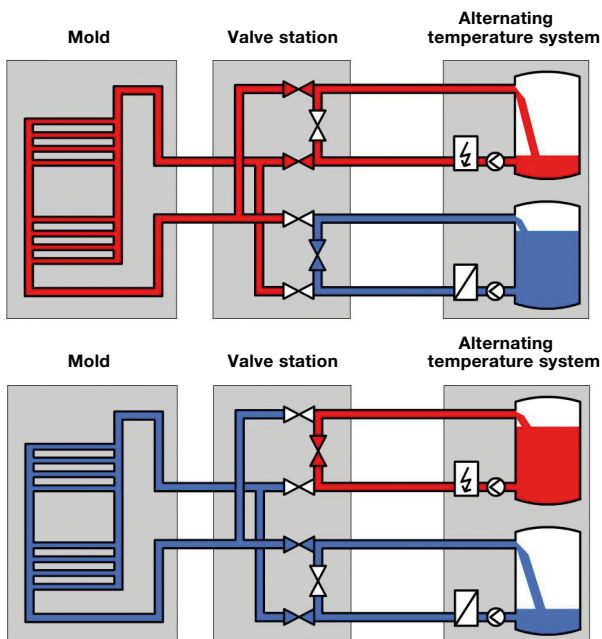
SINGLE's STWS alternating temperature system operates with two separate circuits that contain thermal fluid with a different temperature. The required temperatures of each circuit can be adjusted to suit the process.

Both STWS circuits contain the same fluid. Water is recommended for temperatures of up to 200 °C, while oil is suitable for very rare applications that operate with temperatures of up to 300 °C. The system is equipped with an external valve station for switching the two circuits from bypass mode to mold temperature control mode.

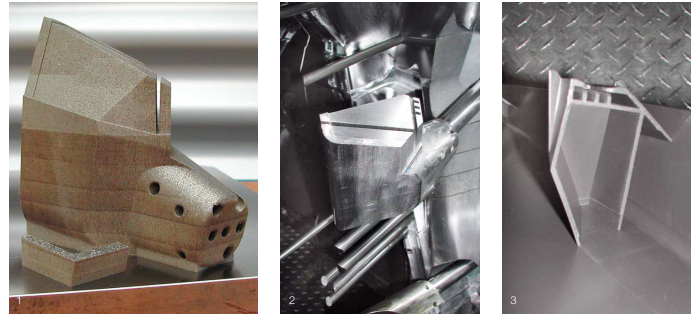
Signals for the switch-over from cool to warm fluid are transmitted by the machine control via programmed I/Os according to process requirements.



STWS alternating temperature system with valve station



Warm fluid heats the mold during the filling phase while cold fluid cools it during the cooling phase



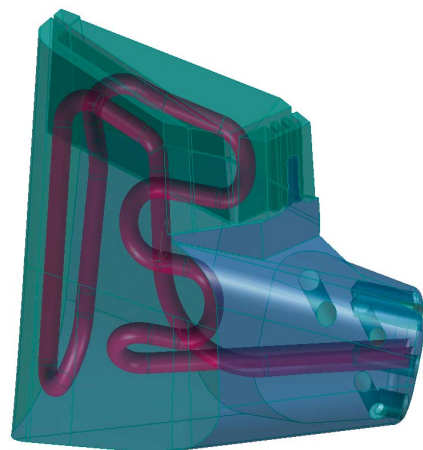
- ¹ Mold components produced by Lasercusing can be machined to suit the application
- ² Molds cooled by alternating temperature technology provide an accurate reproduction of surface detail and intense cooling
- ³ Viable and reliable production of critical areas in molded parts such as the example shown above would not be feasible without ATT

Lasercusing for mold inserts

In order to promote fast temperature changes, molds using ATT should have an effective thermal conductivity and ensure good heat transfer to the cavity. Therefore, ATT is ideally used in combination with mold inserts made from stainless steel or hot worked steel with contour-aligned heating/cooling channels.

During a special laser process, these inserts or components are built up layer by layer from steel powder. This process is referred to as Lasercusing. It is used to manufacture metallic components from data supplied by a 3D-CAD volume model. Mold components manufactured by Lasercusing can be machined with conventional methods such as milling, drilling, lathing or grinding.

One of the first to use this method in industrial applications, Sauer Product has several year's experience with Lasercusing technology. Lasercusing allows the quick, cost-efficient and highly accurate production of cooling inserts with even highly complex geometries.



Lasercusing allows the random arrangement of heating/cooling channels close to the cavity wall

Alternating Temperature Technology is a joint project

SINGLE Temperiertechnik and Sauer Product present ATT as a joint product. SINGLE is responsible for the design and supply of the alternating temperature systems while Sauer focuses on the construction, design and production of suitable mold inserts.

Both partners cooperate in the development of complete solutions for customer projects. The individual products and services can also be ordered independently from either one of the partners.



SINGLE has been developing, producing and selling high-performance temperature control systems for more than 40 years. The company's product portfolio consists of water-operated temperature control units, heat transfer units, water-to-water chillers, as well as customized solutions. In addition to plastics processors and manufacturers of plastics processing machines, SINGLE caters to customers in the chemical and pharmaceutical industry as well as to the metal plating and food production segment.

SINGLE uses only high-quality components and materials. Long-standing customers testify to the ease-of-use and the reliable operation of SINGLE units even under high stress.

The company works with an international network of sales and service points. Services and after-sales support on all temperature-control related problems, training, commissioning and on-site training complete SINGLE's portfolio. SINGLE provides technology and manufacturer certification that meet the European Pressure Equipment Directive (PED).



Sauer Product's competence as a provider of end-to-end products and services for the complete process chain from initial product conception through to the finished injection molded part is based on decades of experience in mold engineering. Sauer provides product development, computations, rapid prototyping and rapid tooling, Lasercusing, mold engineering, mold trials, special facility engineering, mold management and mold engineering project management.

The specialist's core competence lies in the development, design and manufacture of injection and injection compression molds. The company's process and application-oriented activities specialize in automotive applications, with a particular focus on engine compartment applications involving multi-component as well as gas-injection (GIT) and water-injection (WIT) processes and car interior components involving in-mould decoration technology. The specialist caters to the automotive industry as well as to customers from electronic and medical engineering.

A subsidiary of Sauer & Sohn KG, a third-generation family-run company, Sauer Product is currently employing about 100 people at its headquarters in Dieburg/Germany.



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