



## CASE STUDY

### Design experts recommend top-mounted cooling units

#### Clever design and functionality in machine and plant engineering

*When it comes to electric components, machine and panel builders are very keen on cutting costs and on space-saving design.*

*Other aspects such as reliable operation, easy maintenance, energy efficiency and an appealing design are equally important.*

*The industrial design experts at ma design in Kiel, Germany, encounter these requirements on a daily basis and therefore know exactly what makes the grade. For the thermal management of electrical enclosures, they recommend to machine and plant builders a product with an innovative design which meets these requirements in a unique way: DTT series top-mounted cooling units from Pfannenberg.*

ma design is a think tank for innovative products, processes and business models. Awarded the “Grand SME Prize” (Großer Preis des Mittelstandes) in 2014, the company is one of the most successful design businesses in Germany. Around 50 employees based in Kiel and Dresden develop concepts and strategies, visualise ideas and approaches, and design process and function models, prototypes and complete physical and digital products. The company’s philosophy is to ensure that the solutions it develops are simple, intelligent and consistent down to the last detail.

The DTT series top-mounted cooling units from Pfannenberg fulfil these functional industrial design standards. They combine the optimum use of space and attractive, ergonomic design with high functionality. The experts at ma design were persuaded by this concept and recommended the machine and plant builder BHS Corrugated\* to integrate the DTT in a new machine design.

## Rising temperatures

Floor space is now more than ever a valuable asset in the manufacturing industry. The aim is to use existing space as effectively as possible in order to maximise its yield per unit area. This constraint means that greater demands are now made of machine and plant manufacturers in terms of design. Their products must be designed to be as compact as possible and to combine a maximum of functions in the smallest space. It is not just a matter of the area that the machines occupy; space for escape and traffic routes are also important.

The trend towards compact solutions applies in the same way to industrial automation. Electronic control components are becoming smaller and smaller. At the same time, they are increasing in number and are more powerful because of the multiple functions of modern machines and plants. As a result, the packing density in switch cabinets is very high which presents a challenge to designers as they must protect each electrical component effectively from overheating and remove the dissipated heat.

## Clever design

Traditionally, thermal management is undertaken by active side-mounted cooling units. However, this approach can obstruct escape or transit routes. Furthermore, projecting components can present a risk of injury to the operating personnel and do not enhance the visual design of the machine. The logical consequence to be drawn from this and from the increasing pressure on space in the manufacturing environment is to use top-mounted cooling units.



The design experts at ma design recommend top-mounted cooling units: they save valuable space in manufacturing environments, harmonize visually with the machine or plant design and allow the operating personnel more room in which to move around.

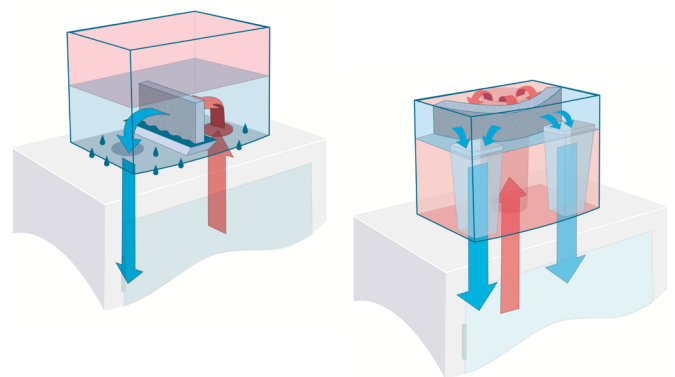
Placing DTT cooling units on top of the machines improves work safety by creating more corridor space and more room in which the operating personnel can move around freely, allowing the mandatory emergency escape routes to be kept free. It also removes unpleasant draughts from the direct vicinity of the operating personnel.

The clever design of the DTT cooling units has impressed Michael Arpe, CEO at ma design: "The top-mounted cooling units reduce the footprint of machines, plants and panels and the space gained around the switch cabinets can be used for other components."

Furthermore, functional design is important to German machine and plant manufacturers. This means that components from other companies should not interfere with the brand look of the products used by the customer. Arpe explains: "A thermal management solution should be visually integrated in the overall design of the machine or plant. Top-mounted cooling units merge with the background and do not compete visually with the machines and plants."

## 100% condensate protection

In the past, top-mounted thermal management solutions presented many users with problems, as the lower cold side of the cooling unit rested on the upper warm side of the electrical enclosure, causing condensation to form on the top of the electrical enclosure which could drip into the interior. If this happens, the moisture can seriously damage the electronics – with very costly consequences.



The repositioning of the cooling circuits (traditional top-mounted units on the left, DTT on the right) means that there are no thermal bridges on the top of the electrical enclosure and condensation is prevented from forming.



Users of top-mounted cooling units from Pfannenberger, such as BHS Corrugated or Hermle\*\*, do not have this problem, as DTT devices combine the benefits of top-mounted thermal management with 100% condensate protection. This is achieved mainly with an ingenious arrangement of the cooling circuits. Positioning the cooling components in the upper section of the cooling unit prevents the formation of a thermal bridge to the electrical enclosure and allows the condensation to drain harmlessly. A wide thermal separation of the air intake and the evaporator also prevents the formation of droplet swirls. The integrated air exhaust nozzles make it unnecessary to fit traditional condensation-prone air hoses. Thanks to the high circulation speeds even electrical enclosures with densely packed components receive optimum cooling.



BHS Corrugated Wet End



BHS Corrugated Dry End



BHS Corrugated Rotary Shear KQ-M

Tests at the Thermodynamics Department at the University of Stuttgart, Germany, have proved this. "We have achieved very good results in thermal management with experiments on the top-mounted cooling unit DTT 6201. The temperatures in both, the free flow area in front of the components and in the hotspot zones, were consistently at an uncritical level," explains Dr. Ing. Wolfgang Heide-  
mann, Deputy Head of the Institute for Thermodynamics and Heating Technology at the University of Stuttgart.

## Focus on user benefits

Machine and plant manufacturers also benefit from above-average energy efficiency and simple installation and maintenance. Compared to previous models, the developers have improved the energy efficiency in the latest generation of devices by another 10%. The heat exchanger and the geometry of the air outflows have been optimised. Energy-saving mode also reduces the operating costs because the internal fan switches off automatically. The integrated multimaster function allows several devices to be linked for parallel cooling via a simple two-wire connection. The latest generation of DTT devices also offers remote monitoring for the operator's convenience.

The user-friendliness of the DTT series is particularly apparent in commissioning and maintenance. For example, snap closures make installation of the top-mounted devices quick and easy. The fans and the electronics are easily accessible as the robust metal cover can be removed completely by pulling it forwards. There is a service flap on the front through which the service technician can replace the pre-filter in a simple process that takes just seconds. This maintenance-friendly approach ensures a minimum mean time to repair and very short replacement times.

## The facts at a glance

<b>Task</b>	<ul style="list-style-type: none"> <li>• Cooling units that optically blends with machine design</li> <li>• Reduce of footprints of machines</li> <li>• High functionality for users: energy efficient and low-maintenance</li> </ul>
<b>Challenges</b>	<ul style="list-style-type: none"> <li>• Ergonomic design with simultaneous high level of functionality for machine and plant engineers</li> </ul>
<b>Products used</b>	<ul style="list-style-type: none"> <li>• Top-mounted cooling unit of the DTT series</li> </ul>
<b>Success factors</b>	<ul style="list-style-type: none"> <li>• Space-saving through compact design</li> <li>• Easy to integrate into existing machinery design</li> <li>• Energy efficient</li> <li>• Low-maintenance and mounting-friendly</li> <li>• 100% condensate protection</li> </ul>

## Summary

ma design is not the only company to be impressed by the functional design of the DTT: there are already more than 1,000 top-mounted cooling units from Pfannenberger in use, i.e. in the automotive sector, in Germany as well as in other countries. They are available in three sizes and six power levels from 500 W to 4,000 W. Thanks to an extensive range of filter media, such as aluminium filters for air contaminated with oil and aerosols and fluted filters for environments in which dust poses a major problem, they can be used for almost every application.

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## About BHS Corrugated

BHS Corrugated Maschinen- und Anlagenbau GmbH (BHS Corrugated) has been building corrugated cardboard machines and manufacturing corrugating rolls for over 50 years. Thanks to these many years of experience, the company is now the world's largest provider of solutions for the corrugated cardboard industry. [www.bhs-world.com](http://www.bhs-world.com)

## About Hermle

Maschinenfabrik Berthold Hermle AG is one of the world's leading manufacturers of milling machines and machining centres. With their excellent quality and precision, Hermle machine tools are used in sectors with specialist requirements, such as medical technology, the optical industry, energy technology, aviation, the automotive and racing car industries and by their suppliers. [www.hermle.de](http://www.hermle.de)

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