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Cooling circuits and their components are very sensitive. Corrosion, deposits and biofilms have spread in many plants. The injection molding company Wefoba in Gaildorf relies on pulse flushing and continuous physical water treatment as a countermeasure. Gardena has equipped the water circuit of its first extrusion system at its Heuchlingen plant with a physical water treatment system - specifically without chemicals and right from commissioning. On-site impressions from two plants during the record-breaking summer of 2018 with an outside temperature of 38°C.

Text: Dipl.-Ing. Markus Lüling, Editor-in-Chief K-PROFI

"We have neglected the issue of water for decades. For as long as we've had injection moulding machines, we've run water in and cooled them - but not really professionally," says Albrecht Fritzsche, Managing Director of Wefo- ba GmbH in Gaildorf, criticizing his own approach to the issue of cooling media: "We've always improvised, which has only ever led to short-term success. Then we had expensive service providers here who made mistakes with flushing routines and lots of chemicals," remembers Fritzsche senior, "the dissolved dirt then got stuck in the heat exchangers. The result was that we couldn't get the flow temperature below 40 °C in warm weather and had to shut down part of our production."

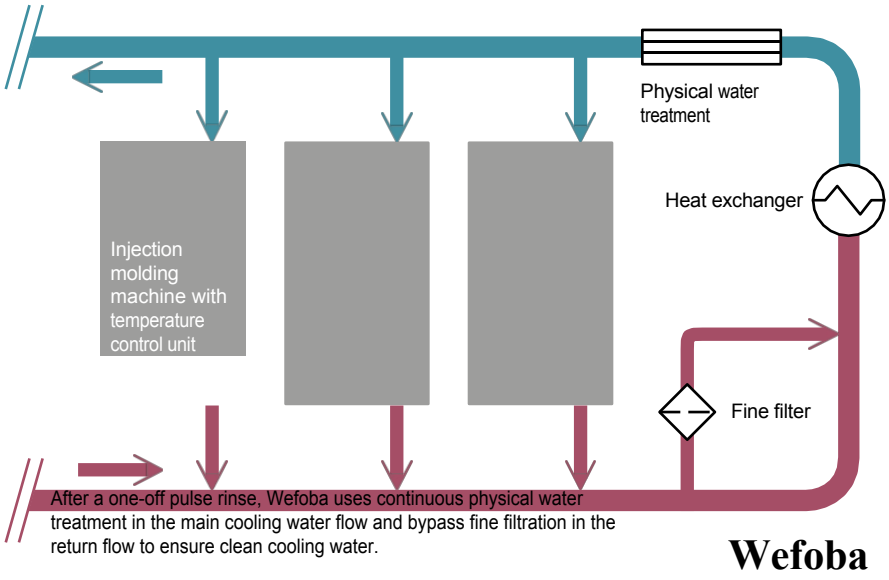
Wefoba junior manager Marcel Fritzsche:
"We are the ones who say no a little."

For the first time in 35 years, Wefoba Managing Director Albrecht Fritzsche is really satisfied with the quality of his cooling water.

All photos: Schneider/K-PROFI

Fritzsche's son Marcel studied plastics engineering and stayed on as a research assistant at Aalen University of Applied Sciences for two years after completing his master's thesis. There he came into contact with Joachim Hannebaum through project work. The owner of the engineering office of the same name in Aalen deals with thermal tool and process optimization as well as physical techniques for the long-term operation of cooling and temperature control circuits.

The analysis at Wefoba revealed that the existing fine filtration in the bypass on the free cooler was unable to remove the dirt from the cooling system. This gave rise to the idea of installing a physical water treatment system from Bauer.
"It wasn't cheap, but we realized that it made a difference, because the water basin quickly became
dirt had accumulated - dissolved dirt from the entire cooling system," Fritzsche looks back. "The water definitely became cleaner, there was no more rusty sludge, but clear water. Nevertheless, the amount of energy we provided for cooling was not enough to cool the water down sufficiently." Albrecht Fritzsche reports:
"We found that although some hot water was getting cold, the volume flow was insufficient. In the
machines, the temperature of the hydraulic oil rose to around 50°C and the machines switched to fault mode."



Impulse rinsing as basic cleaning

The reason was that the physically activated deposits had clogged the small fins in the heat exchanger, among other things. On the recommendation of Joachim Hannebaum, Wefoba therefore decided to use the Comprex impulse flushing process to clear the heat exchangers and all internals in the cooling circuit. Joachim Hannebaum: "The cleaning covers the entire piping system with heat exchanger and valves - in the circuit for machine cooling the path through water batteries, oil coolers and feed zones, in the circuit for tool cooling naturally through the temperature control system and tool." For new systems, he therefore recommends the precautionary installation of cleaning connections for rinsing processes as well as space for physical water treatment.

The one-off cleaning operation in May 2018 actually removed deposits from the heat exchangers at Wefoba, so that the cooling water temperature and volumetric flow increased to the level that Wefoba had calculated for full operation when it moved into the plant in 2013. "I am more than impressed with the mechanical cleaning," summarizes Albrecht Fritzsche. Cleaning the water cycle was the

Starting signal for the consistent improvement of water quality in his current injection molding plant, which is five years young. "For the first time in 35 years, I am really satisfied with the quality of the water. Physical water treatment in combination with bypass fine filtration is now the preventive measure for mobilizing dirt and deposits and protecting against corrosion and biofilms.

At Wefoba, a ring main supplies machines and tools with cooling water. Connections for water purification and the physical water treatment system are located in the central supply line. A free cooler relieves the load in winter.

The result: even with an outside temperature of 38 °C in August 2018, Wefoba had a maximum flow temperature of 25 °C and was able to produce at all times. "We now have regulated cycles and the quality is consistent. Many production batches that we used to have to question in warm periods were not a problem this summer. We are seeing many positive effects," says Albrecht Fritzsche, explaining the background: "With some critical parts, it comes down to five hundredths of a millimeter. In the past, we sometimes had to drive 20 or 30 seconds slower in summer to maintain the dimensions. This summer we are driving as fast as in winter. That was money well spent."

Left: Stefan Roginic, extrusion manager:
"We don't want any chemicals in the water here."

Harald Wöhrle, Head of Building Technology, Energy and Maintenance at Gardena in Heuchlingen, is satisfied with the physical water treatment.

The cooling water from the basement of the Gardena plant in Heuchlingen supplies 100 injection molding machines.

Two man-high separators in the central supply lines separate impurities without wear.

Right: Gardena labels the hoses directly behind the extruder nozzle using the inkjet process.

Below: Contamination can enter the water circuit relatively easily via the open cooling section of the extrusion system.

Bottom right: The extrusion line with the long cooling section is already very well utilized and runs in multiple shifts.

The system for physical water treatment (installed horizontally at the top) is integrated into the self-sufficient cooling circuit of the extrusion system.

The target product of the newly installed extrusion line is differently sized hoses for irrigation systems.

The hall at Wefoba is fully occupied with 12 injection molding machines ranging from 250 to 13,000 kN clamping force for injection weights from 20 g to 11 kg. In the past, there were mainly high-performance machines with a connected load of up to 190 kW, which drew 120 kW. In the meantime, the Fritzsche family has installed the fourth "energy-saving machine" - "it has the same connected load, but much lower power consumption." The four latest injection molding machines are from Haitian, the robots from Sepro, the peripheral technology from Shini. "The service is exemplary," says Marcel Fritzsche, who is happy with his suppliers. In 2015, Wefoba purchased its first Haitian with 4,500 kN. Albrecht Fritzsche: "They can build machines." With regard to the 13,000 kN machine, Fritzsche sen. remarks: "A comparable German machine is more expensive to buy."

We've always provided the best service," emphasizes Albrecht Fritzsche. "The customer gets what they want," he looks back, "we have been able to satisfy every customer. Our portfolio has allowed us to gain a lot of experience. I myself am a toolmaker with 35 years of injection molding experience as a freelancer, while my son is a master of modern technologies and has the theoretical background. We complement each other very well." Wefo- ba specializes in small and medium quantities of technical parts with two- and three-component technology or insert technology.

"I always say: we make the cool parts," grins junior boss Marcel Fritzsche,

"we are the ones who rarely say no." He is also satisfied with the success: "The water treatment works so well that you are constantly swearing at the beginning because it loosens and flushes out deposits and dirt everywhere. But today, all the problems with the cooling water are gone. I wouldn't want to give the system back. We can only recommend it."

The motivation is somewhat different 50 km away at the Gardena plant in Gerstetten- Heuchlingen, not far from Ulm, the production site for plastic components of the garden technology specialist, which belongs to the Swedish Husqvarna Group (for a portrait of the site, see K-PROFI 5/2016). The central cooling water supply feeds 100 injection molding machines. Garde- na had a large dirt separator installed in each of the two supply lines. The cooling system was implemented by Oni Wärmetrafo and the two dirt separators were retrofitted on the advice of Joachim Hannebaum. This installation continuously removes suspended matter such as boiler scale and corrosive products, which remain in the water despite

"We are not automotive-oriented, even though we build many tools for automotive suppliers, but are very broadly based.

the established chemical water treatment. Gardena is completely satisfied with this step towards continuously maintaining the quality of the cooling water, as Harald Wöhrle, Head of Building Technology, Energy and Maintenance, confirms.

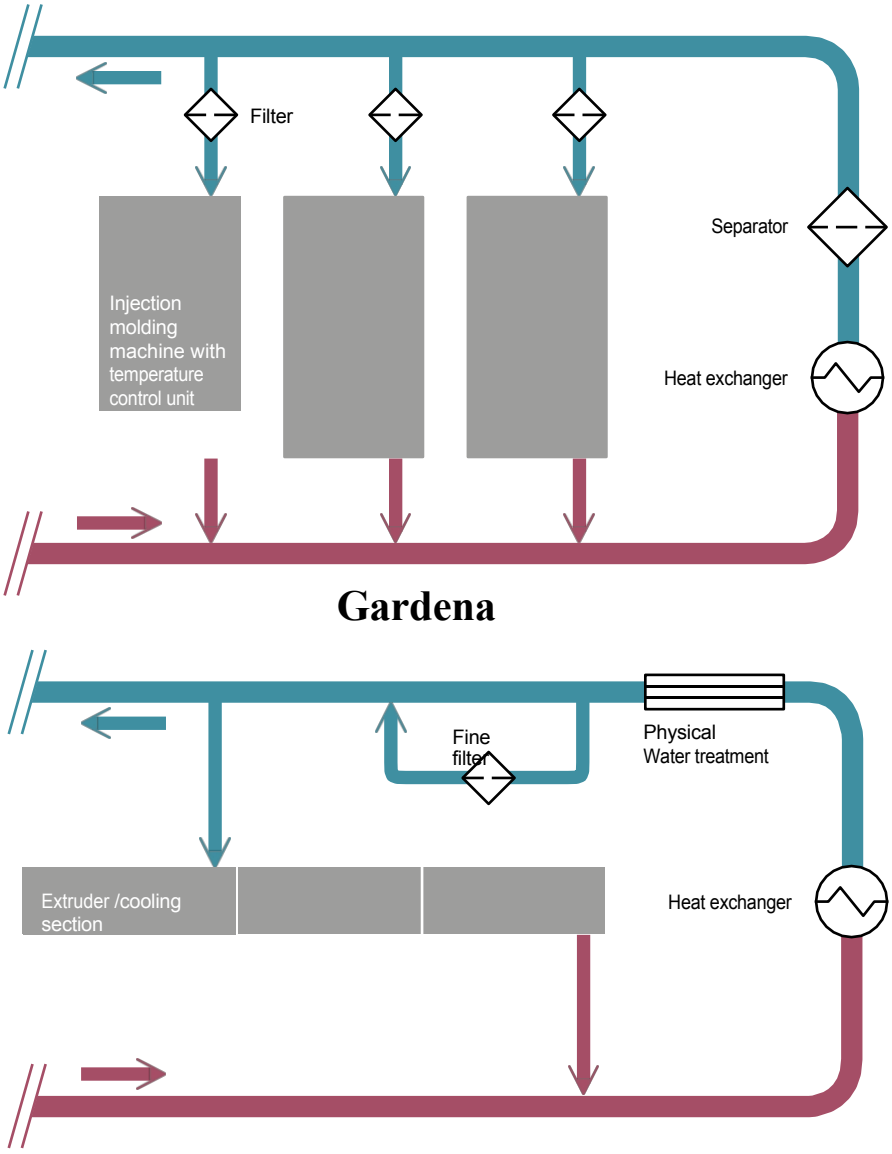
In addition to the 100 injection molding machines, Gardena has been operating an extrusion system for irrigation system hoses for some time. The MDPE hose is laid underground, the valves are controllable and the sprinklers are automatic

retractable. The Ext- rudex extrusion line can produce tubes from 6 to 32 mm in diameter, but only the ½" version with a diameter of 12.7 mm is c u r r e n t l y in production. At the end of the line, the tubes are wound up at speeds of up to 37 m/min, cut to lengths of 5 to 50 m, tied with strapping tape and stacked on pallets. At the Ulm plant, together with valves and accessories, they form installation sets for private and commercial customers.

When designing the extrusion system, those responsible provided a closed water circuit for temperature control of the cooling section. "The calibration disks, spray cooling and the quality of the water used are the most important tools for quality assurance," says Stefan Roginic, who is in constant contact with the cooling section. The circuit is specifically separated from the plant's central cooling water supply. "We don't want any chemicals in the water," says the plant manager, "food-safe pipes should not leave our premises contaminated with chemicals." Employees should also not come into contact with corrosion inhibitors or biologically active substances in the cooling section, which is accessible from both sides and is partially open. "These are generally not good for health," notes Harald Wöhrle. Garde- na therefore decided to start using physical water treatment for extrusion.

The small holes of the eight spray cooling units, each with a diameter of 1.5 to 2 mm, are particularly susceptible to deposits of limescale and dirt. "We are very satisfied," says Harald Wöhrle, summing up the operation of the water treatment system. The maintenance intervals have increased significantly since the installation. "We can run the system for longer," says Stefan Rogi- nic from his experience: "We used to have to clean the nozzles up to twice a shift, now they stay clear for two to three days."

Directly behind the nozzle, the tube is printed while still hot and then moved into the water bath with the ink applied. "The surface must not have any deposits, chemical, biological or otherwise, "because otherwise the inkjet ink will not adhere," as Harald Wöhrle explains. Only the printed tube is then placed in the water bath



drawn. "We don't want to pull the degree of hardness to zero, which would be very easy," explains Harald Wöhrle. "We need 5 degrees dH as a minimum," explains Stafan Roginic, which is due to the requirements of the vacuum unit and heat transfer.

The water treatment is installed on a cooling water basin in the cooling water inlet, fine filtration in a bypass. At the filters in the bypass, sensors measure the pressure difference between the incoming and outgoing water, which serves as an indicator of the filter status and signals the need for replacement. In addition to the need for cleaning, filter changes have also been noticeably reduced. "Problems in cooling circuits often lie in a 'triad' of corrosion,

In the central cooling water supply for the 100 injection molding machines at the Heuchlingen site, dirt separators continuously remove impurities such as scale and corrosion products in the flow, which occur despite the established chemical water treatment (above).

The chemical-free cooling section of the extrusion system, which is separate from the plant's central cooling water supply, has a physical water treatment system and a fine filter in the bypass (below). The pressure difference across the filters serves as an indicator of the filter condition.

deposits and biological growth," Joachim Hanne- baum is convinced, "cooling water is a complex, sometimes dynamic system with many interactions between the components, the operating conditions and the system components." He explains that he thinks backwards from a constant and reproducible production: the thermal optimization of an injection moulding process can only be guaranteed if the cooling works and the conditions in the cooling circuit are stable and favourable. Checking the temperature, pressure and flow rate reveals the necessity and urgency of the cleaning measure," says Hannebaum. He is also convinced that more and more plastics processors will want to do without chemicals in their operating technology and will therefore observe physical water treatment, filtration and cleaning techniques more intensively than before. He sees this confirmed by the first announcements from injection molding machine manufacturers, who are urging processors not to use chemicals to clean the machine in order to avoid risks to seals.

www.husqvarna.com;
www.wefoba.de; www.bauer-wt.com;
www.comprex.de; www.hannebaum.de

Joachim Hannebaum accompanied Wefoba during the cleaning process of the water cycle and the concept of water treatment.

Background
Continuous fine filtration of suspended solids

Filtration must be tailored to the company-specific conditions such as the degree of contamination, particle type and size, the amount of water to be treated and the throughput. Basically, disc filters, absolute filters or separators are available. Full and partial flow filtration as well as mixed installations are possible. While filtration requires a barrier, separation does not. It is based on purely physical forces, has no risk of clogging and does not require backwashing. The physical force in the separator is centrifugal force. There are no moving parts, the loss of liquid and the time required for cleaning and replacement are almost completely eliminated.

Mechanical cleaning by pulse rinsing

The pulse flushing process works without chemicals and instead on a physical basis using only air and water: fixed cleaning connections are integrated into an existing circuit. One connection serves as a feed point through which filtered air is introduced in pulses. This creates packets of air and water blocks that flow through the cooling channels at a speed of 10 to 20 m/s. These packets generate large turbulences. These packets generate large turbulences with strong shear and drag forces, which mobilize deposits and clean pipes and fixtures. The entrained dirt is discharged via the second cleaning connection. Calculations have shown 10 to 100 times the wall shear stresses compared to a water flush at 3 m/s. The inventor of the "Comprex" system is Hammann GmbH in Annweiler am Trifels.

www.comprex.de

Continuous activation with physical water treatment

Physical water treatment systems continuously excite the w a t e r in a system using alternating electromagnetic fields in a specific frequency band according to a mathematical algorithm so that 95% of all ions and substances remain in motion and are prevented from being deposited. The cylindrical activator integrated axially into the pipe system introduces radial energy into the water, acts on the water compound and leads to new ionic compounds and altered solubility, which affects all components of a water system: Pipes, tanks, filters and heat exchangers. In combination with automatic fine filtration, existing soiling and biofilms can also be dissolved, removed and discharged. The supplier is Bauer Solutions GmbH in Forchheim.

www.bauer-wt.com