

Avoiding Shutdowns

Cleaning of Mold Cooling Channels for PET Preforms

Hammann markets its own developed pulsed flushing process under the name Complex. The flushing technology is a purely physical process, which does not use any chemicals – just air and water. Its fields of application have been increasingly extended over time. The example of a preform manufacturer shows how well the process works in a practical application in plastics processing.

The patented Complex process stands for intensive mechanical cleaning of water-carrying systems. It works by the pulsed injection of compressed air into a defined cleaning section (Fig. 1). The systems and installations in which this cleaning process can be used include injection molds, pipes, heat exchangers or other equipment. They can be easily connected at the feed and return points to the mobile Complex unit via adapters.

In the defined pipe section, first water (or another aqueous medium) flows at low velocity, before it emerges again at the discharge point. Pulse-controlled, filtered compressed air then enters the system via the feed point. This creates packets of air and water blocks, which flow through the cleaning section at high velocity of 10 to 20 m/s. These highly accelerated packets generate enormous turbulence with strong shear and drag forces, mobilizing and reliably removing deposits. The preset air pressure remains below the maximum permissible system pressure, so that the systems are cleaned gently and efficiently.

In industrial applications, the Complex process has already been used for years for maintenance of cooling circuits, including heat exchangers. In recent years, injection molds have increasingly become the focus of this cleaning process. This article reports on its use in a company processing polyethylene terephthalate (PET).

Deposits in Injection Molds

In one of its factories, a corporate group produces preforms for PET bottles on sev-



Multi-cavity mold for manufacturing preforms for PET bottles © Hammann

eral injection-molding machines. The preforms are made from PET regrind and virgin material and subsequently supplied to the group's beverage plants, where they are blow molded into new bottles.

The injection molds hold between 72 and 128 cavities (Title figure). During the operating time, despite water treatment and chemical cooling water additives in the mold cooling channels, there were still deposits, which reduced the cooling

performance. As a consequence, the preforms made in the cavities with an impaired cooling performance no longer meet the quality specifications. In such cases, the cavities have to be deactivated. If more than ten cavities per mold are shut down, it is necessary to take the mold out of production.

Until now, these measures have resulted in high costs for reworking. For the company, it was essential to introduce a gentle but efficient cleaning pro- »

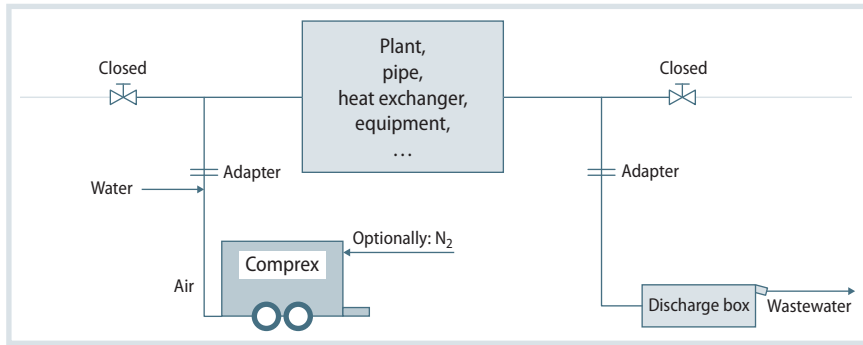


Fig. 1. Diagram of Comrex cleaning in the industrial field. The method works by the pulsed charging of compressed air into a defined cleaning section Source: Hammann; graphic: © Hanser



Fig. 2. A manufacturer of preforms for PET bottles used an MCU-300-series Comrex unit and a corresponding decompression box © Hammann

Fig. 3. The decompression box (here, without a filter fleece) separates the deposits from wastewater and compressed air © Hammann

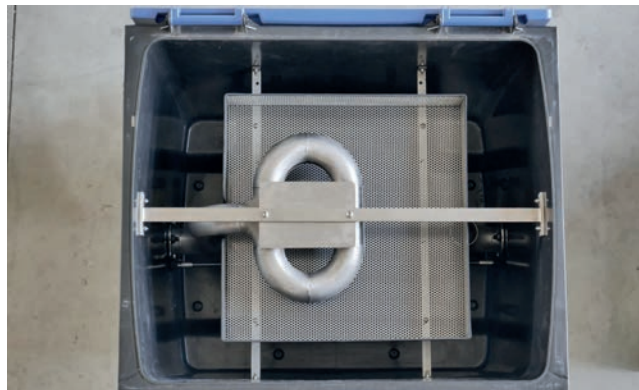


Fig. 4. Two filter fleeces loaded with removed particles. They can be disposed of without problems © Hammann



cedure. Comrex cleaning was ideal for this. This technology uses patented mechanical air-water pulse cleaning. It is suitable for basic cleaning as required and for regular preventive cleaning schedules for maintaining the systems as well.

Regular Cleaning at Short Intervals

Hammann GmbH located in Annweiler am Trifels, Germany, has offered Comrex cleaning as a service provider since 1997 for different applications. In recent years, it has increasingly concentrated on the industrial sector. A feature of the temperature control systems in the high-performance plants that manufacture preforms for PET bottles is regular cleaning at short intervals to keep the cooling as constant as possible and thereby avoid shutdowns.

For this purpose, a series MCU-300 Comrex unit has been successfully used (Fig. 2). It is always available on site and can be used at any time on the individual injection molding machines. The Comrex unit, together with the decompression box and user-friendly touch screen control can be readily coupled to the system in order to allow easy cleaning of the mold cooling channels when installed.

Compressed air, process water and electricity are available locally and can be easily connected to the Comrex unit. The decompression box (Fig. 3) effectively separates out removed deposit particles from the discharged waste water stream and the compressed air using a fleece filter (Fig. 4). These particles do not contain harmful substances and can be easily disposed of.

After a successful trial cleaning at the end of 2018, it was possible, in February 2019, to specify the requirements for operating the unit, and to draw up appropriate inspection, testing and maintenance schedules. An MCU-300 has been in routine operation at the above-mentioned plant since March 2019. Use of the Comrex technology soon proved its effectiveness in ensuring the mold cooling system retained its function. Shutdowns could be considerably reduced and even eliminated.

The number of shutdown cavities over the course of a year was compared. In 2018, before the introduction of regular Comrex cleaning, and once afterwards (from March 2019 to March 2020), a

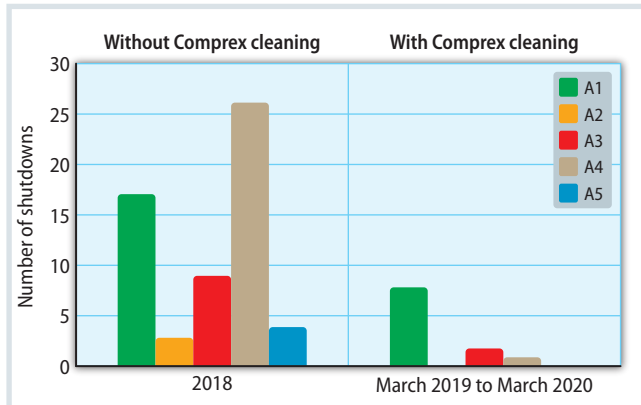


Fig. 5. Shutdown cavities per year before and after the introduction of Complex cleaning

Source: Hammann; graphic: © Hanser

significant decrease in the number of shutdowns on all five machines (A1 to A5) was recorded (Fig. 5). At two plants, the pulsed flushing process even resulted in no shutdowns being required at all (Table 1).

From the Service Provider to the Plant Manufacturer

The Complex technique was initially used to restore shutdown cavities. It was also used on demand. Its use as a preventive measure for maintenance of the mold cooling system meant that problems subsequently became ever less frequent. The aim is to optimize the use of the pulsed flushing process such that shutdowns due to disruptions or failure no longer occur at all.

According to the plant operator the purchasing costs for the Complex unit paid back in a short time. The flushing technology allows the cooling channels of the tools to be reliably cleaned at the machine, so that expensive tool changing is no longer necessary. The MCU-300 model is in regular use, but must be serviced by Hammann Engineering GmbH after a certain period of operation. The

partner company (see Box), founded in 2018, plans and builds Complex units especially for certain plants and according to customer requirements.

During service, the manufacturing company receives an equivalent backup unit. This procedure also runs smoothly. The Complex technology has been proving its efficiency and reliability at the preform manufacturer for more than a year now.

Summary

Manufacturers of preforms for PET bottles have high quality requirements. For this purpose it is necessary to keep the tools at a perfect temperature. Shutting down the molds due to deposits in the cooling channels and the resulting machine downtimes are cost-intensive and should be avoided if possible. The Complex cleaning system reduced the number of shutdowns at a preform manufacturer enormously. In some cases, shutdowns were even reduced completely, thanks to regular preventive cleaning. The purchase of a Complex unit customized to the operating requirements was amortized after a short time. ■

Plant	Shutdown cavities		
	Before Complex cleaning	After Complex cleaning	Decrease (%)
A 1	17	8	53
A 2	3	0	100
A 3	9	2	78
A 4	26	1	96
A 5	4	0	100
Total	59	11	81

Table 1. The figures make clear how the number of shutdowns of the individual plants were reduced after introduction of regular cleaning

Source: Hammann

Company Profile

Hammann GmbH based in Annweiler am Trifels, Germany, has worked on the efficient and sustainable cleaning of pipe systems for over 20 years. In this time, the applications have been continually expanded. Today, the company considers itself a competence center for mechanical cleaning and offers its service not only in the municipal sector, but also for drinking water installations in buildings and for industrial systems. The partner company Hammann Engineering GmbH, which was founded in 2018, plans and builds Complex units specifically for particular plants and to customer requirements, and thus extends the portfolio to include the service area around equipment construction.

» <http://complex.de>

» <http://hammann-engineering.de/>

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Service

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