Digital insights

- Turning pump data into dollars
- Rely on digital data for mass transfer columns
- Using digital technologies to create spare parts
- Big data in Sulzer’s factories
About Sulzer
Sulzer's core strengths are flow control and applicators. We specialize in pumping solutions and services for rotating equipment, as well as separation, mixing and application technology. Our customers benefit from a network of over 180 production and service sites around the world. Sulzer has been headquartered in Winterthur, Switzerland, since 1834. In 2017, we achieved sales of roughly CHF 3.0 billion with around 14'700 employees. Our shares are traded on the SIX Swiss Exchange (SIX: SUN).

Pumps Equipment
The Pumps Equipment division specializes in pumping solutions. Intensive research and development in fluid dynamics, process-oriented products and special materials as well as reliable service solutions help the company maintain its leading position in its focus market segments.

Rotating Equipment Services
The Rotating Equipment Services division provides cutting-edge maintenance and service solutions for rotating equipment dedicated to improving customers’ processes and business performance. When pumps, turbines, compressors, generators and motors are essential to operations, Sulzer offers technically advanced and innovative solutions.

Chemtech
The Chemtech division is represented in all important industrial countries and sets standards in the field of mass transfer and static mixing with its innovative solutions. The product offering ranges from process components to complete separation process plants. The customer support covers engineering services for separation and reaction technology and tower field services to perform tray and packing installation, tower maintenance, welding and plant turnaround projects.

Applicator Systems
Customers of the Applicator Systems division benefit from advanced solutions in the field of precise applications as well as two-component mixing and dispensing systems for adhesives, dental, healthcare and beauty applications. A global network ensures that local knowledge and competence help Sulzer to keep its leading position in its market segments.

Speeding up processes is the key to success and industrial agility. That is why most of the industries are in the midst of digital transformation. For all customers using pumps in their processes, Sulzer has developed a smart tool to make use of their operational pump data. The BLUE BOX™ software can process data from all pump manufacturers, not only Sulzer pumps. The main principle of the BLUE BOX tool is easy to explain: acquire data, analyze data, act on digital insights. We call it the “AAA principle.” By using BLUE BOX, customers can improve their operations and carry out better, targeted maintenance. The faster reaction times result in remarkable reliability and efficiency increases along with substantial energy and cost savings.

We also like to share our own experiences with digital transformation in our factories. Read how we gained speed and increased our productivity remarkably for our injection-molding machines around the globe.

**Dr. Marc Heggemann**, Head of Group Digital Solutions, Winterthur, Switzerland
Do you know which actions will optimize your pump installations and reduce operation and maintenance costs? You will if you acquire the right data in the field and evaluate it with Sulzer’s BLUE BOX™. The BLUE BOX software can analyze data from any pump or pipeline equipment — not only Sulzer-made pumps. BLUE BOX combines the available data with Sulzer’s pump expertise and presents valuable insights, so pipeline operators can target their actions to optimize the performance of their pumps and pipelines.

These days, everyone is talking about digitalization, big data, predictive analytics, digital twins, Internet of Things (IoT) and industry 4.0. The main idea behind these buzzwords is to optimize industrial workflows, performance and efficiency using digital data and to invent new business models. Digital solutions can even help industrial pumping and pipeline operations reach their sustainability goals by streamlining processes and, thus, saving energy and money.
Sulzer’s BLUE BOX is a software tool that captures essential process data. This data is used to improve performance, increase reliability and optimize system settings. The output of BLUE BOX supports managers in interpreting data quickly and making fast, fact-based decisions.

**Accelerate performance on the digital highway**

Pipeline installations can spread across continents, and the pumps are not always easy to reach, which complicates the data collection. To optimize the reliability, efficiency and performance of pumping equipment, operators must know the actual, real-time values.

The first move towards digitalization is to acquire data (Fig. 1). To gather data for BLUE BOX, there are several approaches:

- Instrumentation of the pump itself (integrated data collection)
- Installed supervisory control and data acquisition systems (SCADA)
- Data use from a data storage system (e.g. process historian for pipelines)

It is important to judge the overall efficiency of installations, and Sulzer’s engineers have emphasized the use of data from all possible sources. BLUE BOX is able to import all data — regardless whether it is from a Sulzer pump or a pump from another manufacturer.
The Sulzer team designed BLUE BOX to be implemented with a minimal footprint on a customer’s site and to collect data from their existing data collection systems. This allows customers to gain insights into the behavior of both Sulzer and third-party pumps. We support pump experts with BLUE BOX and make it easy for them to use the analyzed data. It enables them to act proactively instead of reacting to problems, thus gaining speed and efficiency. Just don’t expect a real box. BLUE BOX is a software tool.

Matthew Anderson, Data Analytics and Smart Technologies Manager, Winterthur, Switzerland

The second stage is to analyze and understand all data. There is no substitute for the years of expertise that real-life pump operators and OEMs have. BLUE BOX integrates the collective experience that Sulzer has accumulated throughout its rich history. Thanks to its automatic data collection and digital processing abilities, BLUE BOX has a broader information base. This ability is what makes BLUE BOX the digital advisor for the pump experts and allows them to see all data at a glance.

As a third stage — to take full advantage of BLUE BOX — customers have to act and optimize the pumps in real life. They might need to check the hardware, perform maintenance, improve settings, refurbish a piece of equipment, or request a personal consultation from a Sulzer service engineer.

Benefits of digitalization
Imagine the wisdom of all Sulzer pump experts — gained over decades — collected and transformed into numerous software algorithms. This artificial intelligence combined with the expertise of customers and operational data makes BLUE BOX such a powerful toolbox. That is why Sulzer calls it an advanced analytics engine: because it automates the analysis, giving fact-based insight into the pumps’ behavior.

With comprehensive reports, BLUE BOX enhances the interpretation of the vast amounts of gathered data for the operators. The reports highlight the critical points and enable the pump experts to focus on the pumps needing the most attention and allow them to plan their maintenance activities accordingly.
The information is tailored to the needs of key personnel. From senior management to maintenance supervisors to maintenance crews and operators, everyone receives customized, comprehensive information and reports. Targeted and predictive maintenance increases the reliability of the whole pump system and the pipeline. Of vital importance is the process safety gained through this preventive maintenance. Continuous surveillance of the installation by BLUE BOX quickly indicates where the operator needs to intervene and perform the exact, expedient actions to boost performance. In some cases, the throughput rate must be adapted to allow the pump to operate at the best-efficiency point (BEP). Another action could be to use a different impeller optimized explicitly for the pump throughput rate.

**Digitalization is paying off**

Over 90% of the operational cost over the lifetime of the whole pump is energy consumption. The use of BLUE BOX increases efficiency, which in turn reduces energy consumption and leads to significant cost savings (Fig. 2). Operators can run their installation more sustainably and help to reduce the energy consumption in our world thanks to big data and advanced analysis.

**Visualization gives a clear picture**

Executive management teams are responsible for looking at the bigger picture, ensuring that the business continues to operate with a profit by making carefully considered asset investments. It is essential for them to have accurate performance and efficiency data to allow them to identify those assets that will benefit most from additional funding.

It is often said that “a picture is worth a thousand words.” That is why the visualization of the entire pumping system is so important (Fig. 3). It highlights underperforming assets at a glance and can be the key to investing in upgrades or new equipment. Data on reliability, performance and efficiency illuminates the condition of assets in the field. Big data allows customers to determine key performance indicators (KPIs) for their installation or individual pumps. BLUE BOX makes it visible to customers if they consistently operate within the target KPIs.

BLUE BOX analyzes raw data from pumping assets in near real time. It generates informative visualizations for all those involved — be it for the management or for maintenance personnel. The information on each screen can be tailored to the needs of each user group.

The general overview focuses on the performance of the complete installation. Total throughput, energy consumption and potential savings can all be seen at a glance. Graphical representations of reliability, efficiency and throughput provide excellent visibility, highlighting exceptions helps to address the right issues (Fig. 4).

Fig. 3 Visualization of the pipeline productivity for the entire system.

Fig. 4 Analysis of optimization potential per pump and entire pipeline.
Secure data transfer for the industry
A new software system like BLUE BOX, which is going to read existing data, needs to be flexible enough to integrate with a range of data acquisition systems. In contrast to previous decades, not only mechanical and pump operation knowledge is required. IT knowledge is of relevance as well, and the customer’s IT department has to be involved in setting up data interfaces, data management and the network infrastructure. Data security is of the highest importance in the industry and plays an important role for all parties. It was an essential part of the software development at Sulzer to be able to guarantee no data loss or unauthorized access to the data.

Comparison of values
The storage of historical pump data is required for some pipeline operations and supports long-term analysis. With the BLUE BOX software implemented, operators can compare values from years ago with current data and use these values for fact-driven decisions.

Range of data used
In the field, each pump asset and pipeline installation provides data for pressure, flow, density, viscosity and power consumption. They also provide information for the maintenance department including vibration and asset temperature readings.

A car driver can quite often identify from a change in the sound of the engine that a car repair is needed. Pump experts also know that they have to listen to a pump to find out more about its status. A higher vibration level of a pump can indicate increased wear and tear, cavitation or bearing problems, for example. That is why the vibration data are important and fed into BLUE BOX for analysis. The experience of the Sulzer experts instilled within the program is used to determine the critical vibration level for the specific type of pump. If the vibration is over the threshold limit, BLUE BOX highlights this to allow the operators to investigate the root cause and avoid costly catastrophic failures (Fig. 5).

Data transfer in detail
Data is extracted directly from a variety of sources such as SCADA, programmable logic controllers (PLCs), process historians, databases and instrumentation. At this point and as required, Sulzer offers the installation of an industrial-grade computer, known as an edge device, equipped with firewalls that provide a secure one-way connection (secure data storage and transfer system) to Sulzer’s data lake. Customer data is transferred to Sulzer’s data lake using a secure file transfer protocol (SFTP).
The data is processed using proven algorithms and analyzed against known performance curves and displayed in a custom interface that offers the operator the greatest benefit. This cloud-based solution has a minimal impact on the customer’s IT environment and is designed to be easily scalable to suit a wide range of operations.

**Discovering the benefits**

Whatever the scale of a pumping installation, BLUE BOX has been designed to deliver optimized pump solutions. By using Sulzer’s centuries of expertise in pump design, manufacturing and maintenance to create the algorithms in the advanced analytics software, it is possible to make the best use of existing data.

BLUE BOX consists of a flexible and structured data analytics system that delivers a range of clear visualizations. A graphic is easier to understand than hundreds of numbers. That is why visualizations are so powerful. The pump or pipeline performance is shown as a near-real-time picture. The software quickly identifies under-performing assets and highlights it for the operators. Their quick action minimizes downtime, improving overall performance and process safety. Saving energy is an important additional benefit of the performance improvement and leads to cost savings. Reducing energy consumption in the industry while making customers more competitive is one of our most significant aims at Sulzer. With BLUE BOX, Sulzer is using big data to boost sustainability.
Sulzer had already developed a program for hydraulic design to support customers in column rating and design in the late 1980s. Sulzer’s expertise is available to customers with the SULCOL™ program.

The SULCOL program has helped many customers find the right column design for their applications quickly and accurately — regardless whether they are new or existing columns (Fig. 1). With SULCOL, users can rate or design their fractionating or absorption columns with Sulzer proprietary mass transfer products. Whether you are a process engineer in a design institute or a technologist working for a production plant, SULCOL will help you to:

- design a new column and compare the column sizes with different mass transfer components
- calculate the maximum capacity of existing columns
- determine the bottlenecks in the column operation, e.g. high pressure drop
- plan a revamp and explore the use of internals with higher performance, or
- simply learn about mass transfer and column design

Fig. 1 Practical use of SULCOL program for hydraulic design.
For more than 50 years, Sulzer has been bringing state-of-the-art mass transfer technology to the columns of our customers. SULCOL helped many clients to design new columns with just a few clicks. It also helps to identify hydraulic bottlenecks and determine the columns’ full potential.

Dr. Marc Wehrli, Director R&D and IP Management, Winterthur, Switzerland

Required input data for SULCOL
The minimal input to the program is the fluid data — mainly the vapor and liquid mass flows with their respective densities (see Fig. 2). SULCOL also supports the direct import of data from hydraulic loading of simulation programs (e.g. Aspen Plus® or PRO/II Process Engineering). Because packings and trays require different specifications for design, the data to be entered is different. Therefore, their graphic user interface (GUI) in SULCOL is also different. Upon selection of the mass transfer component, SULCOL calculates the predicted hydraulic performance of the column. A good hydraulic design ensures that the desired efficiency of the tray or packing is achieved.

Use SULCOL results to select packing types
During packing design, users can choose the most suitable packing type for their process from Sulzer’s wide range of packing products. If Sulzer Mellapak™ or MellapakPlus™ structured packing is selected, the default packing efficiency represented as height equivalent to theoretical plate (HETP, see Fig. 3) is shown. This reference value will help engineers in determining the packing height required for the separation.

The same fluid data processed with a different type of packing will show different HETP and capacity factors, which lead to different column designs. This information allows users to decide on the type of packing to be applied for their process.

Fig. 2 How the SULCOL program works.
Knowing how far you could go

Some users prefer a visual representation of the operating boundaries of the selected packing type. SULCOL has a built-in function to generate a capacity diagram with just one click. These diagrams, known in the industry as performance charts, display the design point as a red dot alongside the maximum flood curve and maximum capacity curve. Like a “you-are-here-dot” on a city map, you know where your column capacity level is, and you see clearly how far it could go. The diagram gives users an idea of how much more capacity they could achieve with the specified column diameter and the selected structured packing (see blue line in Fig. 4).

In addition to structured packing, generic rings, as well as the entire range of Sulzer proprietary NexRing™ random packings, are available in SULCOL. Sulzer NexRing is available in various sizes to meet different separation and capacity requirements.

![Fig. 3 Packing design section in SULCOL program.](image)

![Fig. 4 Capacity diagram in the packing section.](image)

Leading the internal tray technology and marketing task force, I am also responsible for ensuring that the SULCOL program is updated for our customers with the data of our latest tray products. These data, which form the basis of our hydraulic calculations, are the results from extensive testing in our Sulzer laboratories, led by our R&D Team.

ChewPeng Ang, Tray Product Manager, Technology Management and Process Innovation, Singapore
Let the SULCOL wizard help you with tray design

Tray design with SULCOL requires additional geometrical input such as the column diameter, tray spacing, number of passes and downcomer dimensions (Fig. 5).

If the users are designing a new tray section from scratch and are unsure how to start, SULCOL is the ideal tool. The “Initial Design” button automatically calculates an optimized column diameter based on the selected tray type. Pressing the “Optimize D.C.” button enables the user to calculate the downcomer size based on the liquid inlet velocity specified by users. These two wizards allow users to work up a preliminary tray design within minutes.

Fig. 5  Data available in the tray section in SULCOL.

SULCOL helps users to design columns with the Sulzer proprietary tray types, such as Sulzer BDH™ valves, V-Grid valves such as MVG™ and our latest valve products — UFM™ and UFM™ AF. The UFM is a mini floating valve that offers a high capacity and broad operating flexibility. The UFM AF is a larger, fixed valve bearing the same special “umbrella” shape, which provides both high capacity and great fouling resistance.

Additional wizards are available for SULCOL users. With a single click, users can quickly assess the hydraulic performance of the two Sulzer high-performance trays VGPlus™ and UFMPPlus™. The SULCOL program presents the extra throughput and operating range of these high-performance trays, which is achieved through the combination of enhanced downcomers and high-capacity valves.

Always at your service — the SULCOL help section

The comprehensive SULCOL help section contains a user guide to the program and product information on Sulzer’s mass transfer components. Thanks to SULCOL, many clients can easily design their new columns, identify hydraulic bottlenecks, and explore the potential of their columns.

SULCOL is updated regularly to provide our most advanced technology to our clients. For Sulzer customers the SULCOL program is complimentary. To apply for the SULCOL program, please visit https://www.sulzer.com/sulcol or contact your nearest Sulzer office for more information.
Digitalization, realized by a specialist parts manufacturer such as Sulzer, is the key to rapid, precise repairs. Repairing critical equipment can be a time-consuming task, especially if it has been in service for a long time and original parts are difficult to source. In West Virginia, US, Sulzer reengineers and produces new casting parts for a wide range of rotating equipment using additive manufacturing technologies.

Original equipment manufacturers (OEMs) will always do their best to provide a comprehensive array of spare parts for their products. However, after equipment has been in service for decades, the OEM may not be able to deliver this level of support. The manufacturer may have been acquired by another entity or ceased producing parts for this machine and have no further reserves on stock.

Laser scanning for precise manufacturing
Replacing and repairing parts is important to maintain the equipment and to keep efficiencies at the required levels. When larger pieces of equipment are involved, their role is often more critical. Making a timely repair is very important in terms of downtime. Sulzer had this scenario in mind when it acquired Sturm Machine Co. in Barboursville, West Virginia, a few years ago to form the Sulzer US Parts Manufacturing Center.
As a provider of turnkey solutions, Sulzer is equipped with the latest technology and facilities to reverse engineer exact replica parts or create upgraded parts using design revisions, modern materials and advanced machining techniques. From three-dimensional (3D) laser scanning to the on-site foundry and the computer-controlled machining equipment, the service center in Barboursville can deliver precision parts with minimal lead time.

Creating a set of 3D engineering drawings is now much less time-consuming thanks to handheld laser scanners that can measure items quickly and very accurately. Sulzer has invested in both FARO systems and the HandySCAN 700. The latter is a very compact device that is accurate to 30 µm.

When creating replacement parts for crucial pieces of equipment, speed is of the essence and the sooner the 3D drawing is created, the better. Using the latest generation of laser scanners enables Sulzer’s engineers to gather 480’000 points of data every second. Seven intersecting laser lines ensure that even the most complex geometry is captured accurately.

**Go and measure on-site**

For equipment that cannot be easily moved, on-site engineers can visit customers’ premises to offer specialist advice and take essential measurements to create new engineering drawings. Sulzer uses multiple portable coordinate measuring machines (CMMs) and laser scanners for on-site data acquisition (Fig. 1). These allow dimensions to be repeatable within 0.025 mm (0.001 in.).

Once they have acquired the basic dimensional data, design engineers can then fine-tune the design of the new component. For example, they can adjust the geometry of an impeller to avoid damage to the casing or make sure clearances are optimal. The designers can also make alterations to the original design to account for changes in the application or performance needs.

![Fig. 1 Precision data acquisition allows dimensions to be repeated within 0.025 mm (0.001 in.).](image-url)
Additive manufacturing for molds
Traditionally, casting a new component involved creating a wooden pattern of the original and putting it into a sand casting box. This is a very time-consuming process and it can take weeks to finalize it. It is also subject to considerable inaccuracies, especially if the wooden patterns are stored for any length of time and become distorted.

Now, designers can export the engineering drawings in a number of file formats, which can be utilized by a wide variety of machine tools and robots. One method is to utilize a 3D sand printer that uses the data to rapidly build a mold of the new component. Using layers of sand and adhesive, the 3D printer can create a mold that can withstand the high temperatures of molten metal that will form the new component (Fig. 2).

Speed up with patternless casting
During the mold creation process, Sulzer’s design engineers use computational fluid dynamics to predict the flow of gases within the mold as the molten metal is poured. It is essential that the gases have effective escape routes, or vents. Trapped gases would lead to weaknesses in the new component. The vents can be incorporated into the 3D CAD drawing and included easily in the sand printing process.

The 3D sand printer is one of Sulzer’s latest investments in state-of-the-art additive manufacturing technology that provides complete precision molds and cores. The process takes about 48 hours to complete, but depending on the size of the components, multiple molds can be printed at the same time, making it more efficient.

Another method of creating a mold, which is often used for making casings, involves two halves, known as the cope and the drag, which are brought together to create the finished shape. Today, the process starts with a solid block of sand that is machined using a multi-axis CNC robot milling tool to create a precision mold as laid out in the 3D CAD drawings (Fig. 3).

To produce a wooden pattern for the sand casting box the traditional way takes 2–6 weeks, depending on the complexity of the pattern form. Using a 3D sand printer does not need a pattern – the mold is printed directly and finished in 48–60 hours. Machining a precision mold from a sand block takes 2–4 hours.
The on-site foundry at Sulzer’s service center is central to creating new parts, and it is capable of pouring 100 different alloys for castings up to 450 kg (1’000 pounds). The designers determine the exact composite of the metal alloy by the component and its application; advanced metallurgy knowledge enables Sulzer to offer new components with better durability than the originals.

The right dimensions thanks to CNC machining

Once the basic building blocks for a new component have been created, the machine shop takes over to establish the final dimensions. The Sulzer management has recently invested over USD 2 million in machine upgrades and modernization, which enables the current facilities to deliver parts to precise, high tolerances.

The machine shop is equipped with CNC vertical turning lathes for impellers and bowls, horizontal shaft lathes, milling equipment and grinders. This makes Sulzer capable of delivering complex components (Fig. 4). The shop also provides extensive quality control procedures and equipment to ensure that every part is manufactured to the highest standards.

Quality control ensures highest reliability

In addition, the service center can provide heat treatment, certified material reports, chemical analysis, and a range of material tests and non-destructive testing (NDT). This ensures the reliability of the parts and compliance to customer specifications.

As a leading integrated maintenance provider, Sulzer offers a comprehensive range of services for electrical and mechanical equipment that can minimize downtime and improve reliability. Our facility in West Virginia is fully equipped to create new parts for any repair and retrofitting projects where speed and precision are essential.
Big data in Sulzer’s factories

The goal: optimizing processes in the factories based on data. The global operations team implemented a manufacturing execution system (MES). After acquiring and analyzing the data, the operational teams acted immediately to improve processes. The result has been an impressive 12% increase in efficiency in the first three years after the implementation.
According to publications of the United Nations, the world’s population in 2018 is 7'600'000'000 people. Sulzer Applicator Systems produces over 4'000'000'000 injection-molded plastic parts for its customers who use these applicators. Generating so many parts in the same quality is a demanding task for the complete operational team. From planning to purchasing, from machine setting to operating, from maintenance to quality control — all process steps have to be coordinated and work hand in hand. Digitalization enables Sulzer to acquire and analyze all required data, and to act in a targeted manner (Fig. 1).

Every single second of time saved counts, and the savings pay off in high-volume manufacturing enterprises. The solutions of Sulzer Applicator Systems are used for a vast range of products: for beauty, healthcare and dental use as well as for construction and industrial use.

Sulzer Applicator Systems develops one- and two-component precision mixing systems, including cartridges, mixers and dispensers for dental, adhesive and construction applications. Most of these products are manufactured in the plant in Haag, Switzerland.

**MES tool evaluation and data definition**

At Sulzer, a team of eight people was responsible for defining the required digital data, evaluating the right MES tool and introducing it in the factories. Interdisciplinary collaboration is an important part of such a complex project. Expertise from various areas is of particular importance: management analysis, business applications, operational workflows, machine setting and maintenance, quality limits, and IT knowledge.

Their first step toward getting the right tool was to define all key performance indicators (KPIs). From the KPIs that are relevant to running the operation facilities profitably and well, the team could deduce the detailed data needed. Some data could be captured easily, for example using the machine control of the injection-molding machines as a source.
For some data, the IT specialists had to set up special interfaces to gather the required values (Fig. 2). Defining the digital business structure and data structure is the most important preparation needed.

After defining the key features, the team evaluated three different MES tools in detail. Sulzer’s experts choose the MES that was able to integrate the data from the existing enterprise resource planning system (ERP) easily via a standardized interface. A smart decision — because it significantly saved costs and time for the implementation.

Superior parts quality
To generate sufficient return on investment from the high capital expenses for molds, injection-molding machines and automation lines, Sulzer runs them nearly 24 hours, 7 days a week. To run the machinery efficiently, the management, operation and maintenance teams need a high level of transparency about what happens in the plant around the clock. Data acquisition supports 100% transparency.

The most important tracking parameter is the quality of the parts, in other words the dimensional accuracy of the parts. Only the precision of every single part allows Sulzer to guarantee the product quality valued by its customers.

The precision of the parts is influenced by numerous factors: plastic raw material and homogeneity of the material mixture, temperatures, pressure inside the mold, mold quality and cooling process, to name a few. The highest quality is only assured if the production process runs consistently and without interruptions. When an error occurs, the machine is stopped and all parts are sorted out until the process parameters fit the given parameters 100%.

Quality-conscious mindset
Sulzer is proud to be a quality leader. The company implemented a 100% measurement control during the automated mounting of mixing tubes and applicators. The parts that don’t match the quality control are ejected automatically and removed. The MES tracks all these measurements and shows all involved parties in the plant where quality issues appear. These issues can be tracked back to the source with the help of all data.

Bidirectional communication to act faster
Any production stop leads to an enormous loss of time, quality and profitability because of the high productivity of the injection-molding machines. Sulzer implements all possible tools to help operational teams optimize and streamline processes. The bidirectional communication

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**Fig. 2** Steps for implementation of the manufacturing execution system (MES) at Sulzer Mixpac, Haag, Switzerland.
between the ERP system and MES is an important tool for this. The planning department can automatically transfer not only the number of parts to be produced but also the correct machine settings to the injection-molding machine. This also eases backtracking in case of any quality problems.

As in human exchanges, communication and exchange are very important. For example: The MES communicates with the planning department and feeds back the number of produced parts. Thanks to this bidirectional communication, Sulzer has been able to increase its on-time deliveries. If any problems occur, the operational team can switch the orders in short time to other machines to uphold deadlines for deliveries (Fig. 3).

### Implementation phase of MES

The operational excellence program, with the motto faster and better, started in the Sulzer plant in Haag, Switzerland. The MES as part of the operational excellence program, was first installed in the manufacturing facilities there. The MES installation included physically networked hardware, associated visualization, planning software and management software.

The company that delivered the MES to Sulzer adapted the visualization screens to the requirements of Sulzer’s team. It shows the key metrics (KPIs) at a glance on one screen in a clear, understandable way. Sulzer chose the overall equipment effectiveness (OEE) to compare the values before and after the MES installation and to easily compare different manufacturing units around the globe.
Everybody has the cockpit view

Because everyone contributes to the success of the manufacturing operation, it is possible for everyone to see the cockpit. The main visualization of the Sulzer MES is a speedometer-like view (Fig. 4). The color code is easy to understand — similar to traffic lights. Red is absolutely out of range and needs immediate action. The warning signal is represented in yellow. The green color code, similar to a green light, is ok.

An efficiency value over 100% would indicate that the planning values are not correct. That is why the efficiency cockpit has color order red-green-yellow in contrast to all other cockpits where the color order is red-yellow-green.

Key metrics

The manufacturing base includes around 170 installations, consisting of injection-molding machines and automation lines, as well as an inventory of 2'600 molds. During setup of the MES, each asset had to be recorded and tagged in the system, while each production sequence and its generic components was mapped and sequenced. Once this process was completed, the production figures for each machine and component could be recorded and compared.

The OEE value is a calculation made from the following key metrics: 1. performance, 2. availability and 3. quality. The performance is easy to measure — it corresponds to the number of parts produced compared to the targeted quantity in the same period of time.

As the second key metric, the availability of the machine itself is recorded. This value considers uptime, downtime for mold changes, inspection, maintenance, and any reliability issues. In injection molding, the productivity is correlated directly with the mold mounted in the machine. Downtime on a machine can be due to an issue with the mold or the combination of one specific mold on one individual machine.

Quality is the third key metric. Any rejected parts are recorded and associated with the precise combination of machine, mold, shift and various other operating parameters.
Benefits for Sulzer

The digital insights are extremely helpful for everyone in the operational team. The management could clearly see what happens and take long-term actions for investments. The maintenance team had a clear indication of which interventions were successful, and the operators could react much faster (Fig. 5). Knowing all figures exactly and not just estimating the running behavior is so helpful. It is quite hard to memorize the running behavior of 2'600 molds, but an MES can do it. The whole team together, supported by real-time figures, was able to improve the OEE by 12% in three years.

Customer benefits of digitalization

In line with the productivity gains, which have been substantial, there have also been significant customer benefits. The higher productivity has also raised the company’s on-time delivery to 98%. That means that Sulzer has been able to deliver 98% of the orders in the promised delivery times. Additional production capacity also means that production schedules have become more flexible, all of which are high on customer satisfaction charts.

Next digitalization steps

The MES implementation in Haag is part of a wider smart factory approach. This mission includes improved connectivity from the factory floor to management offices, lean manufacturing practices, and the introduction of innovative software systems. Based on the success in Switzerland, the management of Sulzer decided to roll out the program globally on three different continents and in five countries.
The new CPE ANSI process pumps are specifically designed to exceed the strictest energy regulations for all industries as well as the requirements of ASME B73.1. With revolutionary hydraulics and high efficiency, they offer low life cycle costs.

The new CPE pumps meet the process requirements in a variety of industrial applications, and are suitable for use with clean or slightly contaminated liquids, viscous liquids of up to 3’000 cSt, and fibrous slurries with a consistency up to 6%. The CPE pump range fits a wide range of industrial applications and will reduce operating costs.

When engineering the new range of CPE pumps, Sulzer considered numerous factors that can potentially influence the total cost of ownership of a process pump. The result is an innovative design that makes it possible for the user to achieve remarkable annual savings. The improved reliability of the CPE pump with optimized shaft sealing reduces the risk for unplanned shutdowns. Heavy-duty rigid bearing units ensure a long bearing life and further protection against unexpected shutdowns.

The new pump design brings higher efficiency that translates into lower energy consumption. Coupled with this, the high standardization, easy installation and robust construction also equate to lower maintenance and operating costs.

Saku Vanhala, Kotka, Finland
Chewing and crushing solids in sewage water

With the Muffin Monster® and the Channel Monster®, Sulzer has launched a new range of high-efficiency sewage grinders. As the composition of wastewater changes, with an increased amount of tough solids, wastewater operators need extra insurance against blockages for critical pumping stations.

The ever-growing rag content in today’s wastewater means that even the world’s best pumps may not be enough. When it comes to critical pumping stations, our customers may need more than just the best pump and impeller. Thanks to the acquisition of JWC Environmental, Sulzer is now able to offer a comprehensive range of powerful sewage grinders – the Muffin Monster® and the Channel Monster®. Together with our innovative pump technology, they form a complete solution for handling today’s and tomorrow’s tough wastewater challenges – ensuring trouble-free operation and maximum uptime.

For the toughest applications, the patented Channel Monster is a powerful, high-flow sewer grinder mainly intended for large pumping stations and headworks. This Monster uses rotating drums to capture solids and direct them into our proven dual-shafted grinders. The result is a high-flow capacity system that will shred the toughest debris into small pieces that can pass harmlessly through pumps, pipes and process systems.

The Muffin Monsters, available in three different sizes, are powerful and compact grinders that fit perfectly into both smaller and larger pump stations as well as within the sludge processing systems of treatment plants. The Muffin Monster dual-shafted grinder uses low speed and high-torque to shred through a wide range of difficult sewage debris. These sewage grinders are adaptable for installations in channels or for wall mounting in front of influent pipes within pumping stations. Muffin Monsters are proven to handle the toughest solids such as disposable wipe balls and first flush loading that can overwhelm even the best pump.

Our Muffin and Channel Monster sewage grinders feature the unique Wipes Ready® suite of patented technologies. The engineers developed the Wipes Ready technology to capture all wipes in the waste stream and shred them into small pieces that will not reweave into a ragball in sewage systems.

Upcoming events in 2018

Around the globe, Sulzer takes part in numerous events, exhibitions and conferences. Please check our event calendar to stay informed. Have you already booked your expert at the next exhibition? Check the contact form on the event website. For more details please visit www.sulzer.com/events.
Augmented and virtual reality at ACHEMA 2018

ACHEMA, the world’s leading global trade fair for the process industry, took place in Frankfurt, Germany. At the event, Sulzer Chemtech offered all stand visitors free virtual reality (VR) and augmented reality (AR) experiences.

Sulzer Chemtech, the leader in mixing and separation technology, provided a unique showcase at ACHEMA which took place in June 2018. The company allowed its visitors to jump into another exhibition — 100% virtually.

In this virtual environment, attendees were able to immerse themselves into a full-scale, accurate 360° experience of Sulzer Chemtech’s equipment — some of which can reach heights of over 50 meters. At the same time, they were able to interact and access relevant information about the products in the form of text, videos and pictures.

For this experience, Sulzer Chemtech supplied its visitors with a smartphone app and a VR headset. Although ACHEMA is finished, customers may still download the free app to access Sulzer Chemtech’s virtual exhibition at: https://bit.ly/2uvGeln

The app can also be used without VR glasses by using the smartphone screen for navigation. The app is not the only reality technology Sulzer Chemtech featured at its stand. Sulzer Chemtech also presented a VR experience of a complete process plant and an AR application for a hands-on experience of a chemical process plant. The AR application overlaid video and audio onto the physical world for a firsthand experience of how Sulzer Chemtech’s equipment fits into a chemical process plant. To intensify the experience in the real world, contact our industry experts from Sulzer Chemtech to discuss our separation and mixing solutions.

ACHEMA 2018
145’000 visitors
3’700 exhibitors

Dorota Zoldosova,
Winterthur, Switzerland
And the winner is …

The lucky winner of our contest is Samir Ghedjati, shift charge engineer in a power plant at Sonelgaz in Batna, Algeria. As an I&C engineer, he is responsible for commissioning and operating new turbines and inspections of turbines. The Apple Watch Nike+ will be in his hands soon.

Sonelgaz (Société Nationale de l’Electricité et du Gaz) is a state-owned utility in charge of electricity and natural gas distribution in Algeria. It was established in 1969 and was given a monopoly over the distribution and selling of natural gas within the country as well as the production, distribution, importation and exportation of electricity. In 2002, it was converted into a private, though entirely government-owned, company. Since 2010, it has been called Group Sonelgaz. As of 2017, it has an installed capacity of 19’321 MW, produces 69.7 billion kWh a year and employs nearly 89’700 people.

Contest for new subscribers

If you sign up by September 2, 2018, you will automatically be entered in our prize draw to win an Apple Watch (Series 3, GPS). The winner will be randomly selected and informed by e-mail on September 7, 2018.

Sign up under www.sulzer.com/str-newsletter

Terms and conditions
The prize is an Apple Watch (Series 3, GPS). The winner will be chosen randomly from all participants who subscribe to the STR newsletter between June 15, 2018, and September 2, 2018. The winner agrees to have his/her name published in the next Sulzer Technical Review. There is no written information concerning the contest. Limited to one entry per person. Sulzer employees and their family members are excluded and cannot participate in the contest. Exclusive place of jurisdiction is Winterthur, Switzerland.

News ticker
+ + + Sulzer is celebrating 70 years since it started operations in Brazil with its first manufacturing site in São Bernardo do Campo, São Paulo. + + + Sulzer has built an in-house test and development laboratory for high-voltage coils in the United Kingdom. + + + Geka produces mascara packaging with multicolor effect thanks to digital printing. + + +