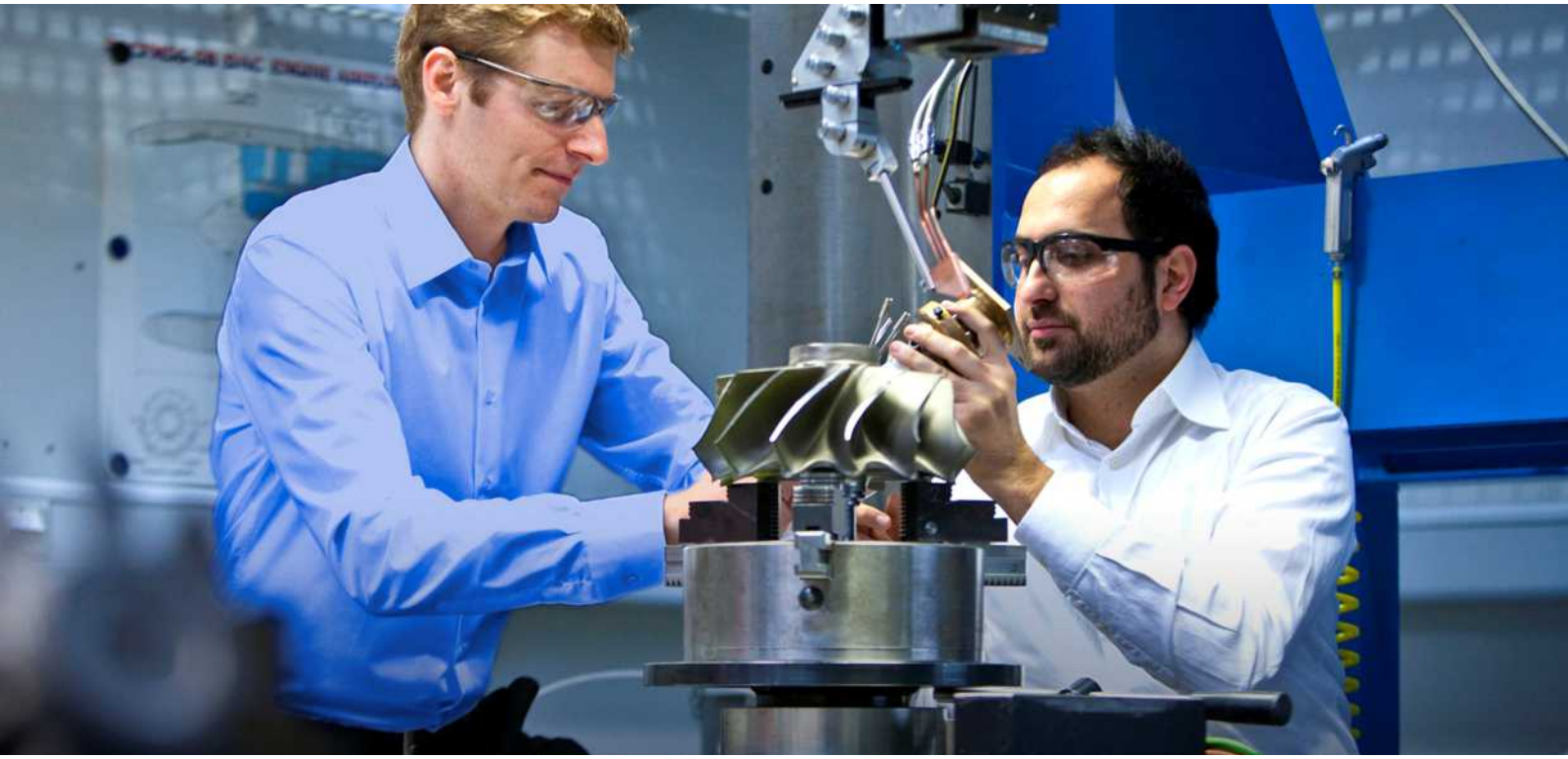


The next generation of impeller manufacturing

Sulzer and a well-known compressor manufacturer are co-developing an innovative manufacturing process for closed impellers. Thanks to the new process, Sulzer will be able to offer high-quality parts with radically low lead times. The ambitious goal is to offer closed impellers within 48 hours to our customers.

An impeller is the rotating component of a pump. It transfers the energy from the motor to the fluid and accelerates the fluid to build up pressure. In contrast to an open impeller, a closed impeller additionally has a front shroud attached to it.

Because of the unique geometry of closed pump impellers, the only way to produce these components to date has been to use casting technologies. However, with these technologies there are risks of small internal and surface defects, fair-but-limited surface quality, and slight geometrical inaccuracies. These issues not only affect the overall performance of the part but also determine how much post-processes – like surface treatment and balancing – are necessary.

Another factor, even for so-called rapid casting technologies, is the relatively long lead time to produce a finished part.

Combining additive and subtractive technologies

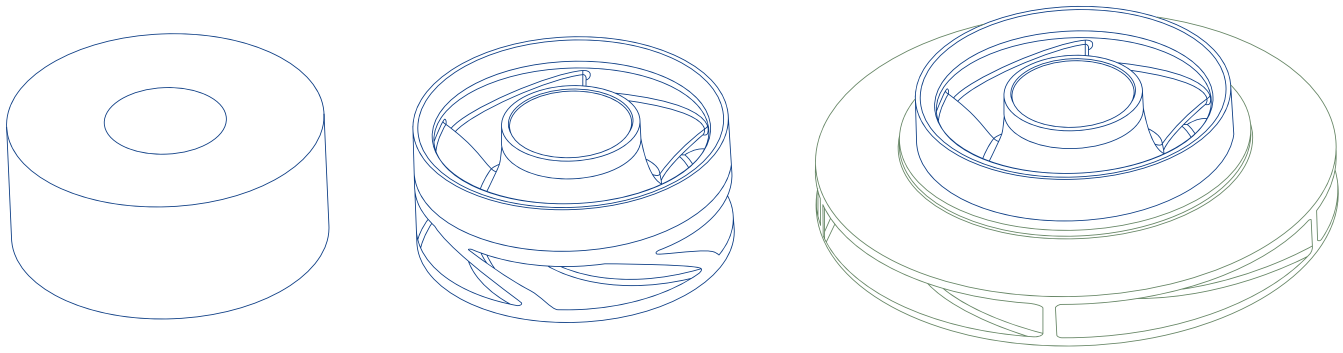
The solution to much faster and better impeller production lies in a technology that has been used by Sulzer for many years already – laser metal deposition (LMD). The key is to use LMD to build up 3D geometries additively, then to use classic 5-axis milling to achieve high-quality surfaces and accuracy.

The hybrid process brings even greater advantages than the widely known selective laser melting process (SLM) – often referred to as 3D metal printing – to certain industries, including the pump industry. The deposition rate is about one magnitude (5–15 times) higher than classic SLM. At the same time, the amount of additive material within a component can be significantly reduced, which keeps the overall process cost reasonable. Further, support structures for additive buildups can be avoided. The state-of-the-art 5-axis milling process achieves high precision and surface quality. Hybrid manufacturing also makes our product development cycles faster because we can produce prototypes and get feedback from customers much faster.

Closed pump impellers in 48 hours

To improve the process, all involved parameters like laser power, powder feed, speed, focal position, etc. need to be optimized. In addition, CAM (computer-aided manufacturing) software tools need to utilize the capabilities of such hybrid manufacturing processes. Most CAM software is programmed to fulfill subtractive manufacturing tasks. The additive generation of more than just a coating layer – especially in the way the LMD process adds material – only recently became a requirement.

To optimize the parameters and to automate the toolpath programming, Sulzer joined forces with a well-known compressor manufacturer. With the dedication and experience of both companies, the teams are convinced that they will be able to achieve their ambitious common goal of offering high-quality closed impellers within 48 hours to customers starting in mid-2018. This is a radical drop from the current standard of 25–35 days of production time using traditional casting methods.



The development of a closed impeller through hybrid manufacturing: (1) wrought billet; (2) impeller core machined to final geometry; (3) completed impeller achieved through additive manufacturing and subsequent milling steps.

Applying hybrid manufacturing to other parts

Hybrid manufacturing is neither limited to impellers alone nor to single materials. Therefore, future developments aim to use hybrid manufacturing for other pump components or to use different materials within one part. One example of the use of different materials is the application of a wear-resistant coating via LMD during the manufacturing process. This coating can be applied in the respective impeller area to replace an impeller wear ring.

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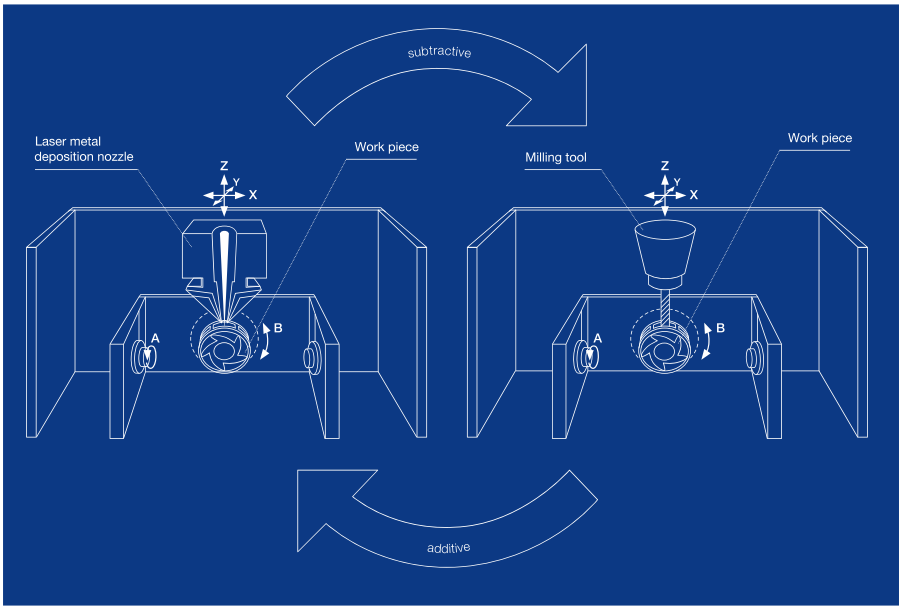
How hybrid manufacturing works

In the conventional machining process, also called subtractive manufacturing, material is removed from a bar, forging, or casting. In additive manufacturing, also known as 3D printing, layers of material are formed one by one under computer control to create a three-dimensional object. Hybrid manufacturing combines additive and subtractive production technologies.

Additive and subtractive manufacturing are combined in one machine tool. The patent-pending hybrid production process for a closed impeller starts with a small wrought billet, which is machined to its final geometry with 5-axis milling operations. This milling step is only possible because the radial dimension of this core part is smaller than the size of the final impeller. Thus, all channels are accessible with milling tools. When the impeller core is finished, the remaining geometry for the final impeller is radially built up via laser metal deposition (LMD). The added material is then milled to the final geometry and surface quality. Depending on tool accessibility, this additive step with subsequent final machining can be repeated several times in order to grow the impeller radially to its final diameter.



Functional principle of hybrid manufacturing, the combination of subtractive and additive manufacturing.

Additive manufacturing for unusual sizes and features

Sulzer has created small-scale static mixers using additive manufacturing. In this way, the company was able to make design adjustments and to produce unusual sizes and features more efficiently.

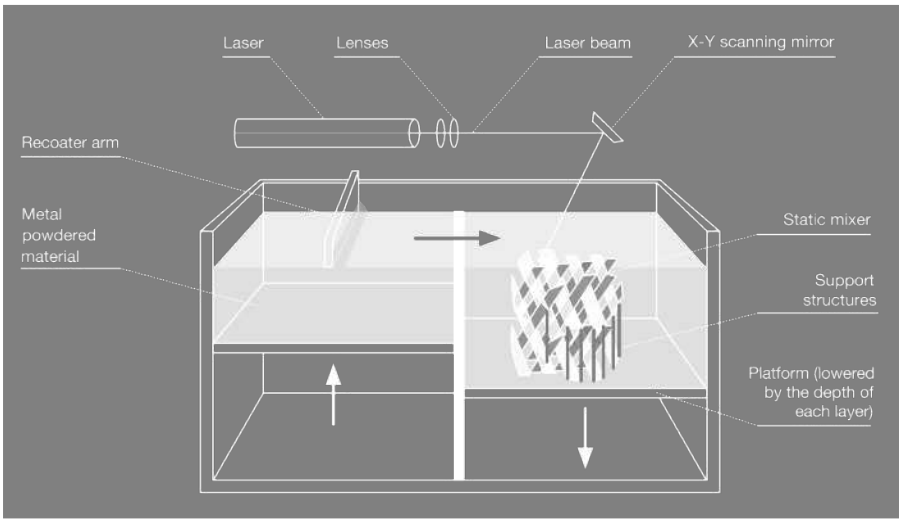
Static mixers are mixing elements installed in a pipe or duct. They function without moving parts and are used to achieve specific mixing and dispersion in continuous processes. Sulzer produces mixers for the fiber production, polymer technology, water treatment, chemical, or food production industries.

Long-time experience with additive manufacturing

Already ten years ago, the Chemtech division used selective laser sintering for small-scale static mixers. Additive manufacturing was, for example, used a lot for the development process of the SMX plus mixer and the SMR plus heat exchanger. Static mixing elements made by selective laser melting (SLM) have been and still are occasionally manufactured and sold to customers for cases requiring unconventional sizes or features. The main application area of SLM is for prototyping, to produce support parts, small batch size parts, or tools. At the moment, it is still too expensive for mass production.

How selective laser melting (SLM) works

A laser melting machine distributes a thin layer of metal powder onto a build platform. The powder is melted layer by layer with the help of a laser that is directed with a flexible scanning mirror.



Functional principle of the selective laser melting process, also called SLM.

Speeding up the development of mascara brushes

The development of mascara brush prototypes usually takes up to 18 weeks. By using a new plastic powder for the production process, Sulzer's Applicator Systems division was able to develop a prototype within one week.

Time is money, and the world of beauty is no exception to this rule. Before a new mascara finds its way into the stores, it goes through an extensive development process. Although they may look similar, all mascaras are different. Eyelashes are individual, and different cultures prefer different styles. Therefore, it is important to conduct tests under real conditions once the R&D department has designed a new model.

Too stiff to use for tests

So far, mascara brush prototypes have been produced from a hard plastic material using a 3D CAD (computer-aided design) drawing. This could take up to 18 weeks because the manufacturer had to make a drawing, create visual patterns through 3D printing, adjust the drawings to customer needs, and create a pilot tool for the injection molding process. For every single mascara bristle, a small hole – called a cavity – needed to be milled into the injection mold. With the prototype, customers had the opportunity to evaluate the brushes visually. However, the bristles were too stiff to actually test them under real conditions. Further, the production process took a long time and was expensive.

Experimenting with new materials and technologies

Researchers constantly uncover new materials that can be processed using 3D printing. Today, the processes are still cost-intensive and are used primarily for the production of prototypes or components in small quantities. Geka has used 3D printing technology for mascara brush prototypes since 2007.

Thanks to the new material and method, our product designers were able to accelerate the development process of mascara brush prototypes. We can introduce products to the market more quickly, and they meet customer requirements even better.

Amaury de Menthiere Division President Applicator Systems

To speed up the development process, the teams were looking for alternative methods and materials for the production of prototypes. Eventually, they were successful: A new type of plastic came onto the market. This specific material ensures that each individual bristle is stable enough to separate the eyelashes yet elastic enough not to hurt the eyes.

The material was set but the process not yet. The teams made many attempts to find the best manufacturing process. The solution was an additive manufacturing technology called selective laser sintering (SLS).

Cutting production time by 17 weeks

Thanks to the new method, Sulzer accelerated the development process considerably. The customer now receives a prototype within one week instead of 18 weeks. Thanks to the new material, the customer can actually test the prototypes. In the case of customer-specific adaptations, the drawings can be immediately adjusted and new brushes produced through 3D printing.

Today, there are still quality differences between 3D printed and injection-molded prototypes. The surface of the 3D printed brushes and the amount of the mascara mass that is applied to the eyelashes may not be exactly the same as with injection molding. However, customers are able to gain sufficient information from the prototypes to make decisions.

The development process is faster, products are introduced to the market more quickly, and the final product meets customer requirements even better.

With technology progressing fast, additive manufacturing processes will not only be used for prototypes but be introduced into Sulzer's factories in the foreseeable future.

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"In short: we want to grow profitably"

Sulzer is expanding its applicator business. Amaury de Menthiere, Division President of the new Applicator Systems (APS) division, explains why mascara and co. fit in well at Sulzer and where he wants to take the new division.

Amaury de Menthiere, Division President Applicator Systems

Sulzer's acquisition of Geka surprised many people. How do mascara, lipgloss, and co. fit in at the Swiss industrial company?

Amaury de Menthiere: Many know Sulzer as a pump manufacturer for the oil and gas, power, and water markets. But Sulzer is a lot more than that. With its Mixpac business, the company has been delivering applicators for the adhesives, dental, and healthcare markets for a long time.

How does Geka fit in? You just need to have a look at the shop floors; Mixpac and Geka use almost the same production machines. Both businesses manufacture their products through injection molding processes. We use the same type of equipment for the assembly of the molded parts. We also have the same approach to assess quality and operational excellence. The markets may be different but the production process is essentially the same.

What are the advantages of the new setup?

Through the combination of Mixpac and Geka, we can bundle the sourcing of machines, injection molds, and plastics. This saves money. Another advantage is our geographical footprint. Geka is mostly active in Europe as well as North and South America. Mixpac has a strong presence in Switzerland and China. Thus, the two companies complement each other well in terms of locations. From the Geka location in Brazil, employees of Mixpac are beginning to gain access to the local dental market. And Mixpac's China site is being used to source injection molds for Geka in China.

In a nutshell, our new Applicator Systems division is the largest in its industry and the only one that is globally active. This meets the demands of our customers who want the same products around the world.

What does the portfolio of the new Applicator Systems division include?

We offer products and services for liquid application, and we offer mixing technology for the adhesives, dental, healthcare, and cosmetics markets. These products include precise applications systems as well as one- and two-component mixing and dispensing systems. For example, we manufacture the applicators for adhesives that are used to mount windshields in cars. We also produce applicators that your dentist uses when applying a dental filling. And we develop and manufacture cosmetics products such as mascara, lip gloss, and eyeliner.

What are your plans for APS?

In short: we want to grow profitably. Our sales were roughly CHF 420 million in 2017. Our goal is to bring these up to CHF 800 million to CHF 1 billion in a few years. How will we achieve this? By acquiring companies but also by developing our existing business further. For our beauty business, we are expanding our manufacturing site in Bechhofen, Germany, and doubling its size. Further, we are building a new factory in Poland to drive our industrial business. We plan to stay in niche markets with high requirements to preserve our healthy profitability.

What is important for customers in the applicator business?

The method of applying the material is becoming more important. Nowadays, it is more common that the customers choose the application system first and buy adhesives, sealants, and fillings based on this. Therefore, the expediency, quality, and performance of the application systems are becoming an important selling point. But in the end, being able to choose the right system for the content and the application is what makes us successful. This is the reason why APS is constantly improving its capability to test the different combinations and solutions and to recommend the best application system to its customers.

Sulzer is investing in additive manufacturing (AM) technologies. What role does AM play in your division?

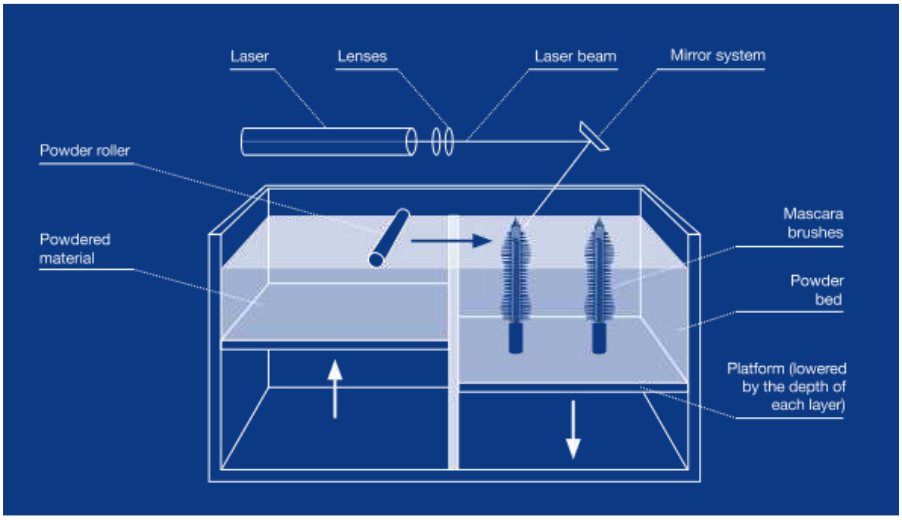
Additive manufacturing is becoming more and more important. We have produced prototypes of mascara brushes by 3D printing technologies for some years now. As new materials and methods enter the market and the technology becomes more affordable, we will be ready to use AM for actual products in due time.

How selective laser sintering works

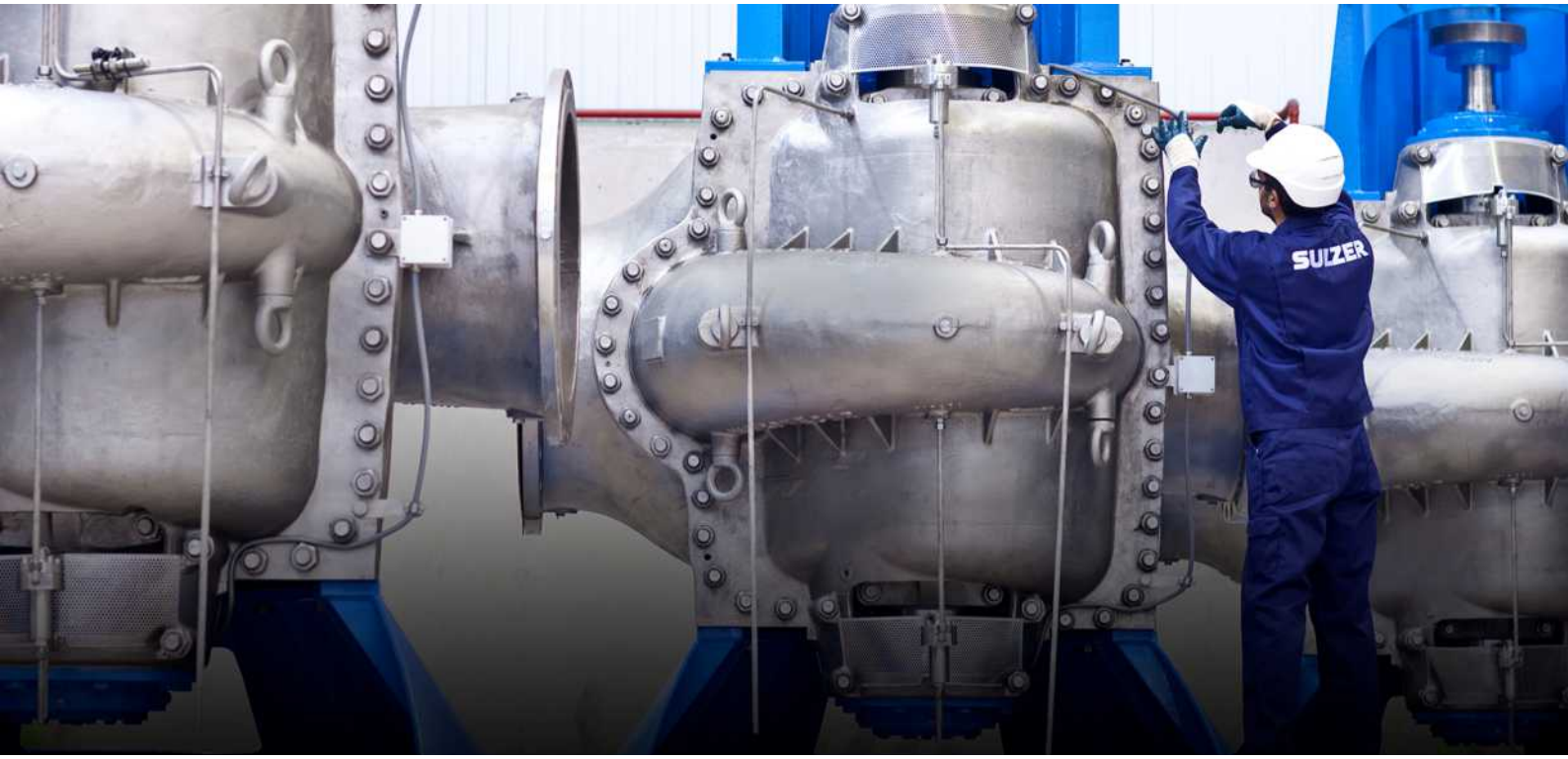
Selective laser sintering (SLS) is a relatively new technology within additive manufacturing. So far, it has mainly been used at Sulzer for rapid prototyping and to produce small series of components. As the commercialization of additive manufacturing continues, companies are discovering SLS for more and more production purposes.

A laser sintering system applies a thin layer of powdered material to a construction platform. By means of a laser beam and a movable mirror, the material is selectively fused. After lowering the construction platform, the next powder layer is applied.

This process is repeated until the component has been built up in the powder bed – layer by layer. The slight drawback to this technique is that the components do not have the same surface structure as parts made using injection molding.



Functional principle of the selective laser sintering process, also called SLS.



Turning pumps into smart devices

Whereas monitoring systems are common for big, engineered pumps in critical applications, smaller process pumps rarely come with such a feature. Sulzer is developing a smart sensor for process pumps. The sensor can measure the temperature and vibration of pumps in the field and transfer this information wirelessly to a cloud database.

It is 5 p.m. on a Wednesday afternoon. You have done your work as plant engineer in a pulp and paper factory for the day and are looking forward to spending the evening with your family. On your way out, your phone vibrates. You look at the screen: “High vibration on the bearing unit of process pump 11! There are 250 hours of life remaining. Click here for details.”

You open the Sulzer app on your mobile phone. A dashboard appears. You check the performance measurements of your pump. They confirm that the bearing unit needs to be replaced. You click on the Webshop icon. The correct spare part is indicated by the system. You order the component. Sulzer will now deliver your spare part. It is 5:15 p.m. You have just avoided an unplanned outage that would have taken you days and cost your company a lot of money otherwise. Now it’s time to go home and enjoy the evening with your family.

Closing the gap

Thanks to a sensor in the pump and an automatic warning system, the employee in the example above was able to quickly solve an arising problem. Whereas such control features are common in complex pumps in high-risk areas such as the oil and gas industry, configured pumps rarely come with this option.

As technology becomes more affordable, sensors for medium-sized pumps are delivering tangible benefits to the customer. It is especially worth monitoring equipment in pulp and paper factories, as well as the sugar, food, and fertilizer industries.

Many pumps in the field run until they fail. Because Sulzer knows that reliability is key to saving costs for our customers, we are changing this situation.

Connecting pumps to the Internet

Sulzer is developing a new device that connects non-instrumented pumps to the Internet and enables data collection.

With Sulzer's sensor solutions and applications, we turn your pumps into smart devices. You will be in control of your installed pumps base – anytime and anywhere you need.

Ralf Gerdes Head Global Technology

Sulzer's smart sensor is attached to the pumps, and it registers the pumps' temperature and vibration values – without any wiring. It then transfers this data to a cloud. The data is displayed on a dashboard – either on a desktop or mobile app.

Sulzer customers have all the information they need about their pumps in one place: the bill of material, analytics of temperature and vibration of the pump, and a Webshop where they can directly order spare parts. There is no need to spend time looking up a pump's specification. Everything is available in the app.

Finland and Switzerland – a team effort

The idea for such a device came up at Sulzer in Finland and Switzerland at around the same time. By listening to customers, the teams soon recognized the vast potential of smart sensors for process pumps. They joined efforts and worked out the manifold specifications for such a sensor – from sourcing to material to IT requirements.

In 2018, the sensor will be tested at customer facilities. Afterwards, it will be ready to use in the field. In the near future, Sulzer's goal is to deliver its new process pumps with the integrated sensor so customers benefit from the entire package.

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Making order out of data chaos with BLUE BOX™

See how Sulzer's intelligent software solution BLUE BOX makes your energy efficiency visible and identifies pumping challenges in near real time.

In industries such as oil and gas and power generation, a large amount of data is gathered for the day-to-day operation of a pumping installation. Bringing order to this data chaos is complex and time-consuming. However, there is a lot of benefit in analyzing that data and taking actions based on the insights gained: It delivers significant savings, optimizes the asset's lifespan, and reduces operational risks.

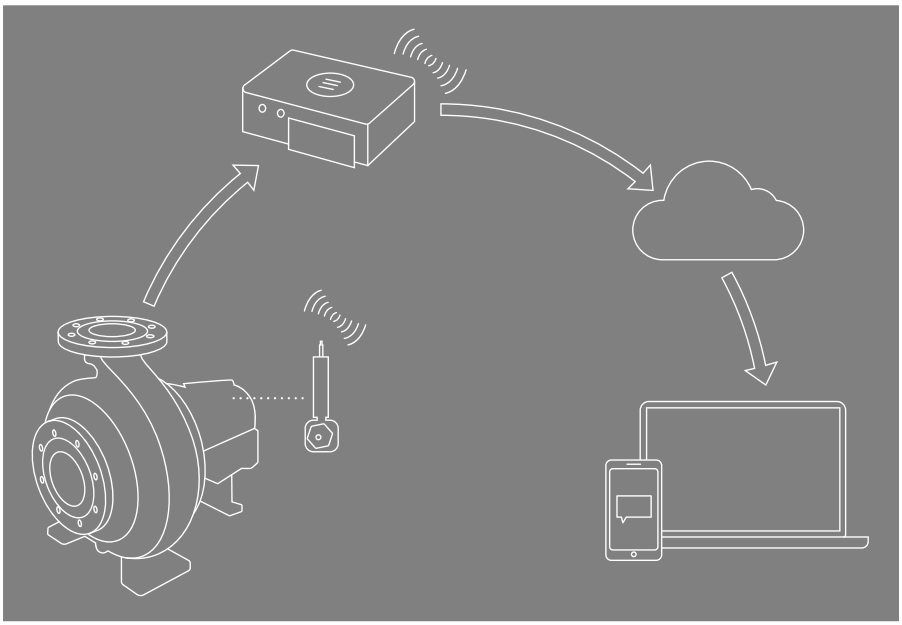
Sulzer has developed an innovative, integrated, and intelligent software solution called BLUE BOX. It identifies unreliable and inefficient pumps in near real time and helps customers optimize their pumping systems.

Learn more at www.sulzer.com/bluebox.

Listen to what your pumps have to say

Have you ever wondered how your pumps are performing in the field? With Sulzer's IoT-ready device that collects data you will have all the information you need about your pumps.

Sulzer's smart sensor is attached to the pumps in the field. It registers the pumps' temperature and vibration values – without any wiring. The gateway receives the data from the sensor and transfers it to a cloud. You can access all the data on a dashboard – either on your desktop or on your mobile app.



A sensor transfers the information about the pump's performance via gateway to a cloud. Customers can directly access this data on their computer or mobile device.

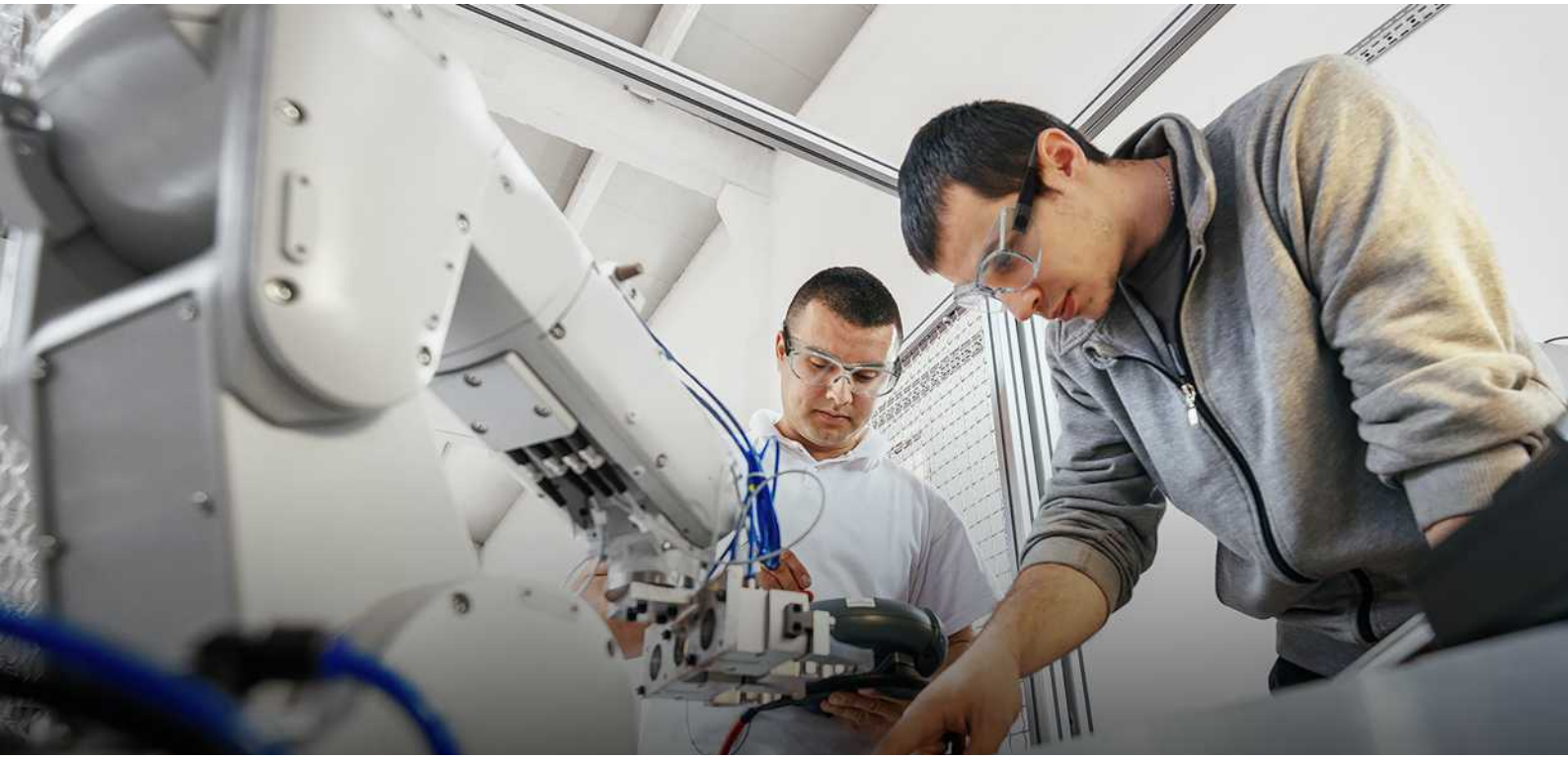
Diagnosing your pumps – optimizing performance

DOC BOX by Sulzer is a set of services to help you optimize your pumps' reliability, efficiency, and performance.

Pumping systems may suffer from various issues throughout their operational lifespan. Often these problems are hidden. High vibration, temperature, pressure pulsations, and other factors may affect the equipment and cause it to run problematically. The pump or pump system may even have undergone several interventions, yet no solution is apparent. Performance issues with any single pump can have a big impact on overall productivity.

Ultimately, it takes a specific combination of technology, expertise, and experience to resolve the situation. Sulzer's DOC BOX is able to precisely diagnose the issues of your critical assets.

How does it work? DOC BOX is temporarily deployed to "problem pumps" that are insufficiently instrumented. It collects data while in operation and transforms it into insights. In this way, DOC BOX has the potential to deliver significant savings and improve the overall profitability of customers' applications.



Sulzer’s future factories: smart and learning

The fourth industrial revolution is not only about new technologies, it is about changing the way of doing business and winning through information. Sulzer has reorganized its pumps engineering, manufacturing, and supply chain into an integrated global factory network. Each element of the network will be smart and contribute to constant learning. In this way, we will be able to cut delivery times and offer Sulzer’s recognized quality at competitive prices at the same time.

Through the ages, the world has seen many technological revolutions. We are living in the digital age, and markets are changing faster than ever before. Companies are reinventing their business models for tomorrow.

Sulzer is reorganizing and digitally enabling its global pumps manufacturing and supply chain network.

Four virtual factory families

In the past, each Sulzer factory manufactured several different pump types. It worked more or less autonomously and had its own order pipeline, supply chain, and processes.

Digitalization is changing the way we do business. It influences our products, our fabrication, and our business processes. And this is just the beginning.

Robert Laflamme Head Global Operations

We have now organized our factories around the world into factory families according to our four different delivery models: standard, configured, pre-engineered, and engineered pumps. One factory family consists of all factories that manufacture the same pump types and work to the same processes. The four families can be managed in real time and on a global level – virtually like four factories.

This allows us to fulfill the different customer needs in an ideal way: speed (reduced delivery time), competitive prices, customer proximity, and traceability of products and components. All factories around the globe will fully live up to common Sulzer quality standards.

Furthermore, the new setup allows us to balance the workload among the factories, to stimulate help and exchange within each factory family, and to roll out new improvements quickly around the world.

Bringing digitalization to the shop floors

Digitalization is not only vital when it comes to managing the factory network, it will also bring improvements on the shop floor level.

With smart factories, we will be able to flexibly adapt our products, our suppliers, our technologies, and our manufacturing network to better satisfy customer and market demands.

Enno Danke Head Global Manufacturing Technology

Especially in the engineered pumps business, which has low volumes and high variance, the traditional way of manufacturing with only limited automation still predominates. Each project is tailored to the customer. Hence, the process steps are not usually repetitive, the tools used are not typically connected, and issues are typically resolved through direct interaction of experts from different departments. So, improvements rely on singular analysis and suggestions of our employees who cannot tap into a regular pool of structured information.

Making data accessible and understandable

The foundation for fast learning and improvement is the right information. So we can have structured real-time data available at every process step, we are connecting our machine tools, deploying connected manual tools, and setting up touch screens at the different workplaces on the shop floors.

The paperless factory gives real-time feedback on the work center status because the production orders are digitally started, routed, and confirmed. Our technicians can easily record the reasons and amount of time they spend solving issues and waiting. They can access digital models and work instructions to overcome ambiguities. Also, they can easily connect to experts in other functions without always having to call for a physical meeting.

All the data collected needs then to be aggregated, put into context, and analyzed for us to continually improve. Thus, analytical and creative capabilities are becoming more important. We are investing in our Sulzer Production System team to stimulate and support the organization with this.

Interested in more stories about our products and services? Check them out at www.sulzer.com/stories.

From isolated shops to a network of focused factories

Digitalization has enabled Sulzer to set up a connected factory network.

Sulzer has converted its network from insular factories that all operated fairly autonomously to a connected factory network that can be managed virtually. This change brings many advantages both for customers and for Sulzer:

- Speed: We can prevent local bottlenecks in the network and, thus, reduce our lead times. It takes considerably less time from the beginning of a project to its completion, and delivery of products is faster.
- Cost: We can offer our products at competitive prices because we can tap into regional cost advantages within the customer sourcing restrictions.
- Proximity: We are close to our customers and can manufacture products regionally because we have at least one factory for every delivery model type in every region.
- Traceability: When required, we can trace back every detail about the pump: where its components came from, where it was assembled, who the suppliers were, and so on.

Humans and robots working together side by side

Better fulfilling our customer demands and becoming more competitive to grow our business are at the core of Sulzer's digital strategy. Pump manufacturing has many complex steps, but many are also simple and repetitive. With the advances in sensors, collaborative smart robots ("cobots") are gradually becoming cost-effective.

This is also true for our industry, especially with regard to small pumps. The cobots are designed to work in line or even side-by-side with humans. So, we can selectively enhance our production to offload simple tasks or to assist with non-ergonomic tasks. These cobots are connected to our central systems.

To globally manage all the information for operations and for improvements, Sulzer is aligning and integrating the software tools that are used around the world. From requirements management to computer-aided design (CAD), computer-aided engineering (CAE), computer-aided manufacturing (CAM), and planning to manufacturing execution system (MES) – everything is managed in a seamless digital toolchain.

Our smart and learning factories will make us a faster and better partner for our customers. They will create exciting new opportunities for our employees. They will drive growth and increase cost competitiveness for our shareholders.

Faster than ever: delivering pump spare parts within 48 hours

In a world where everything gets faster and faster, delivery time becomes a decisive success factor in the service business. Sulzer's Rotating Equipment Services division was able to cut our average delivery time from ten weeks to eight days – and we aspire to be even faster.

Outages at a customer's site are costly. Equipment that fails needs a fast replacement. Thus, lead time is a decisive success factor in the service business. Early in 2016, Sulzer initiated Project JUMP.

The name says it all; the goal was to make a significant jump in the speed of delivery. Accordingly, the team set a quite radical target: manufacturing and getting certain types of pump spare parts (simple, turned, and consumables) ready to be shipped within 48 hours – down from a historical average of more than ten weeks.

If you do the math, this means that Sulzer aspires to be 35 times faster than in the past. Such acceleration not only requires a lot of motivation from everybody involved, it requires new ways of doing things.

Thinking in days instead of months

Not only was the target radical, the implementation was, too. The teams in all locations around the world where pump parts are manufactured initiated new processes. Visualization played an important role. Every department received a monitor that displays their orders on a real-time basis and shows the project status as well as targets for the transactions.

Project JUMP has brought us a huge leap forward and has opened other great opportunities for future improvement. Rotating Equipment Services is getting faster and better for our customers.

Daniel Bischofberger Division President Rotating Equipment Services

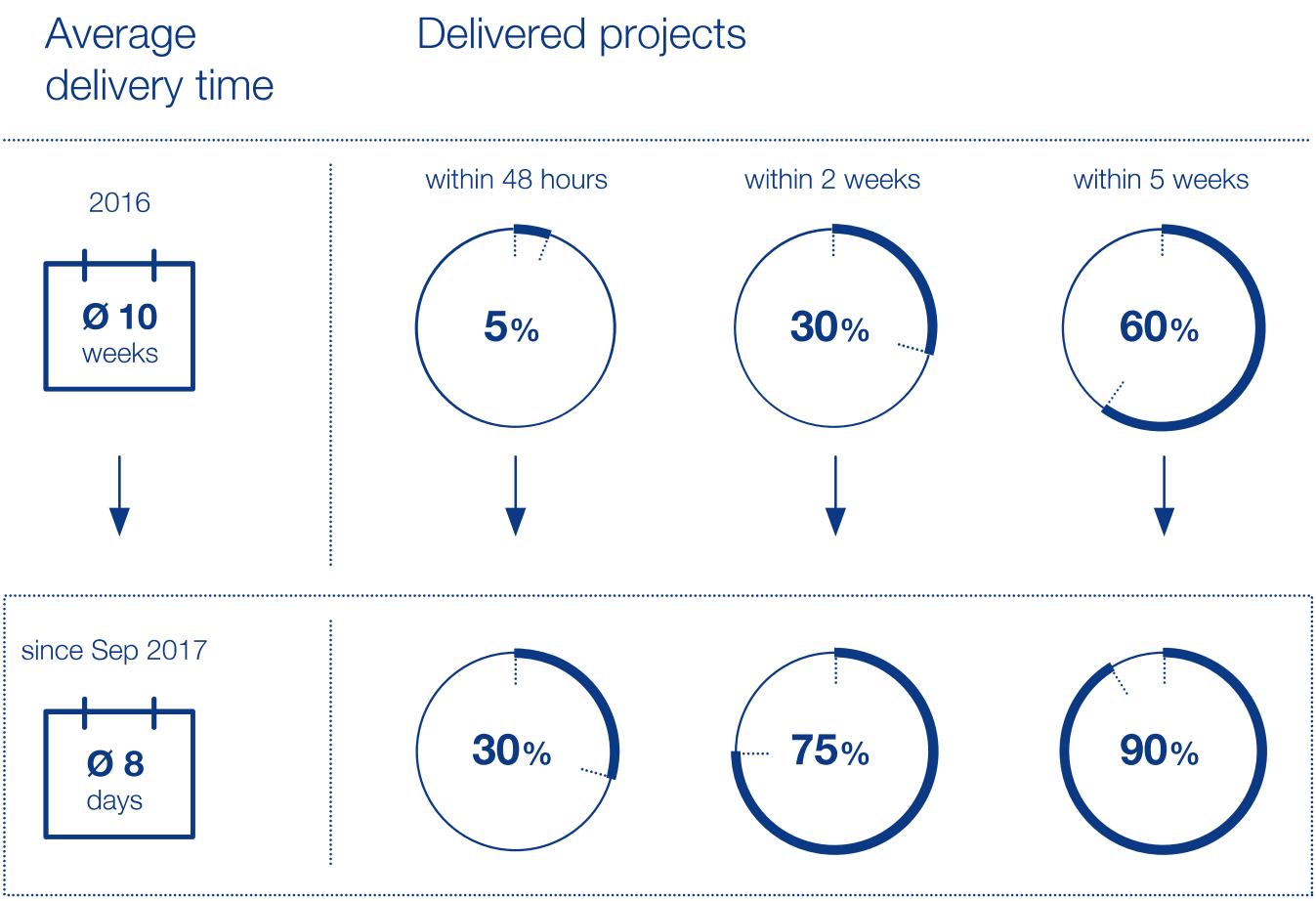
Other measures included speeding up deliveries from partner companies, standardizing raw materials, establishing new machines in cell layout, and introducing a new production planning and scheduling software.

However, one of the most important things was a change of mindset. Employees are now starting to think in hours or days instead of weeks or months.

From ten weeks to eight days

By the end of 2017, we were able to reduce the average time in which our parts were ready to be shipped to eight days. A third of these orders were delivered within 48 hours. “We are proud of this achievement. However, we are not done yet,” says Daniel Bischofberger, Division President Rotating Equipment Services. The next step is increasing the percentage of spare parts that can be delivered to the customer within 48 hours. Moreover, we want to apply the project to more and more categories of parts. “We’ll continue to implement Project JUMP on a global scale. Our teams work relentlessly to get our products to our customers faster than ever,” Daniel Bischofberger says.

Project JUMP



Thanks to JUMP, Sulzer managed to reduce the average time in which pump parts were ready to be shipped from ten weeks to eight days.

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Faster and better with an online ordering tool for coils

With the development of an advanced ordering service for electromechanical coils, Sulzer was able to significantly improve the way that designs for high-voltage coils are shared with Sulzer engineers and customers alike.

The electric motor has been with us for almost 200 years. Very little has changed regarding the complex engineering calculations necessary to build or repair the modern day electric motor. In addition, the skills required to perform a successful repair on a motor or generator are still predominantly manual.

How can you transfer something that is perceived as being “old technology” to the digital age? How can digitalization help speed up the quotation process for the customers? The answer was an advanced ordering service for coils that Sulzer developed. It is an online database of 3D designs for high-voltage coils.

In the past, a customer sometimes had to wait days for a quotation that included drawings because the production of high-quality technical drawings was often a bottleneck in the company. With the new online tool, customers can now access a full suite of drawings as well as generate a quotation online within minutes. All they have to do is enter their specifications into the online platform – much like a car configurator.

The new process has significantly improved efficiency. The team is now able to create the quotation as well as a full suite of drawings within hours instead of several days.

Design your own mascara

To satisfy customers’ needs for design flexibility and cost-effectiveness, Sulzer is developing an online configurator for our beauty offering.

Longer eyelashes? Thicker lashes? More volume? The requirements for mascara brushes are manifold. Likewise, design requirements for the bottle and caps are customer-specific.

Though big cosmetic firms have the means to create new designs and to pay for the tools to produce the mascara, independent brands often lack these financial means. At the same time, they appreciate a certain design freedom.

Sulzer’s Applicator Systems division is developing an online configurator for our beauty offering. Customers can select from a range of standard components and packaging options and combine them into an individual product.

In this way, the mascara is customized at an affordable price. The product does not have to be developed from scratch and does not require extra tools in the manufacturing process. This also shortens the development process and thereby drives speed to market.