

SERVICE EXCELLENCE THROUGH INNOVATION

Service Fields

Sulzer offers a variety of services for rotating equipment and equipment used in separation technology.

▢ 8

Customer Benefits

Sulzer's one-stop services help customers save time and money, and they increase the reliability, performance, and efficiency of their equipment.

▢ 14

Core Competencies

The company's professional service team, global footprint, and one-stop offering make Sulzer a reliable and fast service partner.

▢ 22

GLOBAL FOOTPRINT

Sulzer is present with over 180 production and service sites in more than 40 countries around the world. The company generates 38% of its sales in emerging markets. Sulzer ensures that all the locations fulfill its high quality and safety standards. The company is constantly investing in state-of-the-art machine tools, packaging, and test facilities.

Sulzer's global manufacturing and service network combines the advantages of a global company with the flexibility of a local partner.

CLOSE TO CUSTOMERS

 **>180**

production and service sites around the world.

EMEA

EUROPE, MIDDLE EAST, AFRICA
AROUND 7 500 EMPLOYEES



AME

AMERICAS
AROUND 3 800 EMPLOYEES



APAC

ASIA-PACIFIC
AROUND 2 700 EMPLOYEES



SERVIC FIEL

A detailed technical line drawing in yellow on a dark teal background. The drawing depicts a complex mechanical assembly, likely a part of a turbine or engine, featuring multiple cylindrical components, bolts, and a large circular housing. In the lower-left corner, there is a separate, exploded view of a rectangular component with two circular holes on its top surface and a textured, possibly serrated, edge.

E DS

 **100**

Sulzer operates 100 service centers for rotating equipment in 25 countries.

 **> 200**

Sulzer offers services for more than 200 pump models.

Interview with Daniel Bischofberger

Daniel Bischofberger, Division President Rotating Equipment Services, provides insight into the world of service and outlines current trends in the industry.

Service Portfolio

Sulzer offers services for different types of rotating equipment and applications in separation technology.



Daniel Bischofberger, the new President of Sulzer's Rotating Equipment Services division, talking about customer needs and trends in the service business.

“The service business is becoming increasingly innovative”

Interview with Daniel Bischofberger, Division President Rotating Equipment Services

Having been in office for a few months, Daniel Bischofberger explains what customers expect from a service supplier, why a global network and a professional team are critical, and how the service business is changing.

In today's service industry, what are customers looking for?

DANIEL BISCHOFBERGER | The needs of customers in our industry do not differ much from what every one of us demands from a service supplier. When people buy a product, they want it to run when they need it to run, and they need the product to work the way it is supposed to work. And the costs should be as low as possible. Customers are looking for service providers who possess the tools, equipment, and expertise to make sure that their machine is running reliably and efficiently at optimized costs.

How does Sulzer differentiate itself from other competitors?

DB | Sulzer combines the best of two worlds: The company has the technical expertise of an original equipment manufacturer (OEM) and the competencies of an independent service provider (ISP). We are flexible and fast. With our network of roughly 100 service centers in 25 countries, we are close to our customers. In addition, our product and service portfolio is exceptionally broad.

Can you give an example?

DB | One of our customers relocated the gas and steam turbines of two different plants to a new combined-cycle

power plant at a different site. However, the performance of the steam turbines was not compatible with that of the gas turbine. Hence, the steam turbines had to be rerated, which means that the performance had to be adjusted. This requires know-how you would normally expect from an OEM but not from an ISP. Thanks to the competence of our team in Houston, we completed the job to the customer's fullest satisfaction. This example shows that we are able to provide services for a broad range of products, and we have the technical expertise to do more for our customers than they normally expect from an ISP.

“We combine the best of two worlds: the world of the original equipment manufacturer and the world of the independent service provider.”

Sulzer has consolidated its service business. What does that mean?

DB | We are becoming a one-stop service supplier. We are establishing service centers where we can repair a range of different products under one roof. That way, operators have one access point for the service of all their rotating equipment. Now that the service and new equipment businesses are in different divisions, we have to ensure that the close collaboration and knowledge exchange remain as strong as they were when they were both in the same division. For example, the pumps service teams need to share their field experience from our installed pumps base with our colleagues in product development to further optimize our pump designs.

What trends do you see in the service industry?

DB | New players are entering the market, which results in growing competition but also in growing innovation. On the customer side, we see that operators are increasingly optimizing their maintenance and operation costs. This does not necessarily mean “the same but cheaper.” It also includes services enabled by digitalization, such as monitoring and maintaining equipment proactively, prolonging maintenance intervals, reducing revision time, and developing innovative repair technology to extend the lifetime of products and components. Because some customers are streamlining their organizations, they expect their service partner to take over activities they cannot perform in house anymore.

Based on your extensive experience, where do you see Sulzer’s potential?

DB | We have a strong regional footprint, but we can improve in our exchange of skills and knowledge among these regions. We have to leverage the best practices of a global company and copy from each other with pride. We are working on a global growth strategy for our service ranges—turbo services, pumps services, and electromechanical services. Further, in order to be even closer to our customers, we plan to establish more multipurpose service centers where we provide a variety of different services under one roof. We still have some work to do when it comes to collecting data from our installed pumps base more systematically, reducing the leadtime of pumps spares, and better integrating the motors and generators business. Regionally speaking, I see growth potential for our service business in Asia.

“We are becoming a one-stop service supplier. We are establishing service centers where we can repair a range of different products under one roof.”

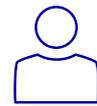
Which skills do you expect from a service employee?

DB | Service is a people business. A professional service team is essential for us. There are three skill sets that I—and our customers—expect from a service employee. First: customer focus and entrepreneurship. You have to be able to listen to customers, to ask the right questions, and to find the right solution with them. Second: flexibility. As a service supplier, you need to be available around the clock, and you need to be fast, reliable, hands-on, and pragmatic. Third: technical competence and practical experience. Because every product behaves differently in the field, theoretical knowledge is required but usually not sufficient.

Are there women in the service business?

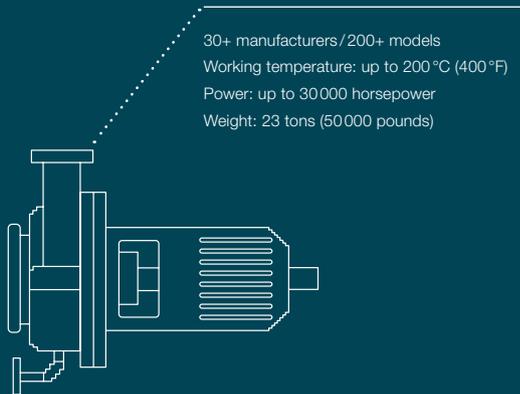
DB | Far too few [laughs]. Unfortunately, the industrial service business—we are active in markets such as oil and gas, power, or mining—attracts fewer women than other markets. In addition, many of our employees work on the shop floor as mechanics and on customers’ sites as field service engineers. These kinds of jobs traditionally have a lower share of women. Fortunately, there are many women in functions like sales, HR, finance, or engineering at Sulzer. Despite the difficulties in attracting more women, I truly believe in the power of diversity. We continue to strive for a higher share of women in our businesses, be it in white- or blue-collar functions.

Daniel Bischofberger



Daniel Bischofberger joined Sulzer in September 2016. Most recently, he ran the Power Products division at ABB Switzerland. Daniel Bischofberger has extensive experience in rotating equipment service, having previously led the ABB/Alstom (now GE) gas turbine service business out of Switzerland. He started his career as a commissioning engineer for gas turbine power plants in the US and Libya. He holds a Master’s degree in industrial engineering from the Swiss Federal Institute of Technology (ETH), Zurich, Switzerland, and a Master of Business Administration (MBA) from Insead, Fontainebleau, France. Daniel Bischofberger is Swiss, married, and has three children.

**PUMPS—OVERHUNG,
VERTICAL, AXIAL MULTISTAGE**

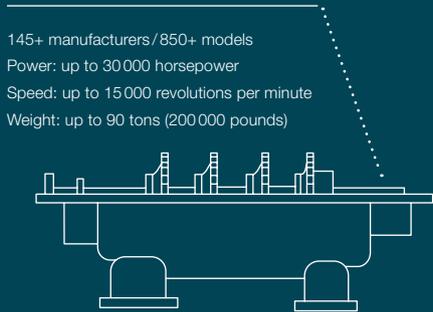


30+ manufacturers/200+ models
Working temperature: up to 200 °C (400 °F)
Power: up to 30 000 horsepower
Weight: 23 tons (50 000 pounds)

SERVICE PORTFOLIO

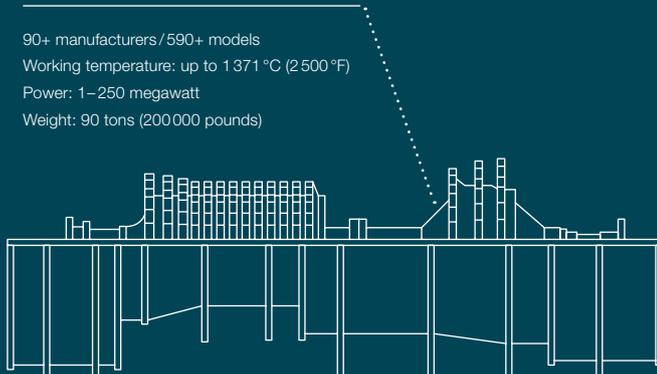
Sulzer offers a comprehensive service portfolio for different types of rotating equipment: pumps, turbines, compressors, motors, and generators. As an independent service provider, the company takes care of rotating equipment of any make and model. Sulzer's business unit Tower Field Service provides installation, repair, welding, and turn-around services for offshore platforms, oil refineries, and the petrochemical industry.

**COMPRESSORS—CENTRIFUGAL,
AXIAL FLOW, SCREW, GEARED,
RECIPROCATING**



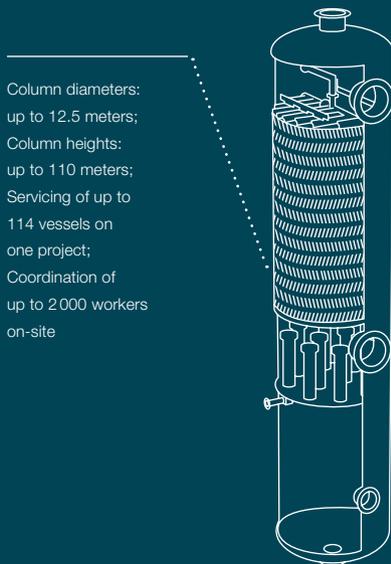
145+ manufacturers / 850+ models
Power: up to 30 000 horsepower
Speed: up to 15 000 revolutions per minute
Weight: up to 90 tons (200 000 pounds)

**STEAM TURBINES, GAS TURBINES,
AND HOT GAS EXPANDERS**



90+ manufacturers / 590+ models
Working temperature: up to 1 371 °C (2 500 °F)
Power: 1–250 megawatt
Weight: 90 tons (200 000 pounds)

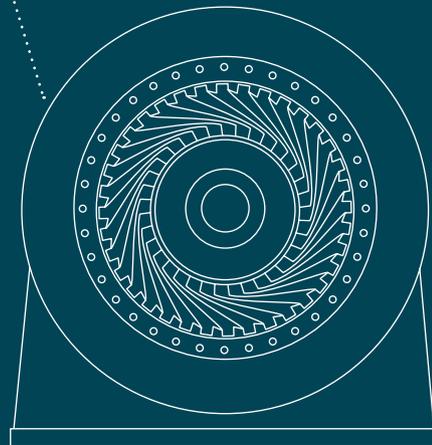
TOWER FIELD SERVICES



Column diameters:
up to 12.5 meters;
Column heights:
up to 110 meters;
Servicing of up to
114 vessels on
one project;
Coordination of
up to 2 000 workers
on-site

MOTORS AND GENERATORS

20 manufacturers
Power: 10–50 megawatt
(13 400–67 000 horsepower)
Voltage: 6.7 to 13.8 kilovolt
Weight: 45 tons
(100 000 pounds)



CUSTOMER BENEFITS

Consulting

Monitoring

Inspection

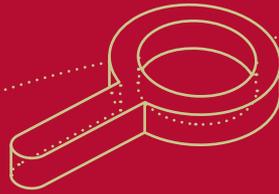
DIAGNOSTIC
AND CONSULTING
SERVICES

MAINTENANCE
AND SUPPORT
SERVICES

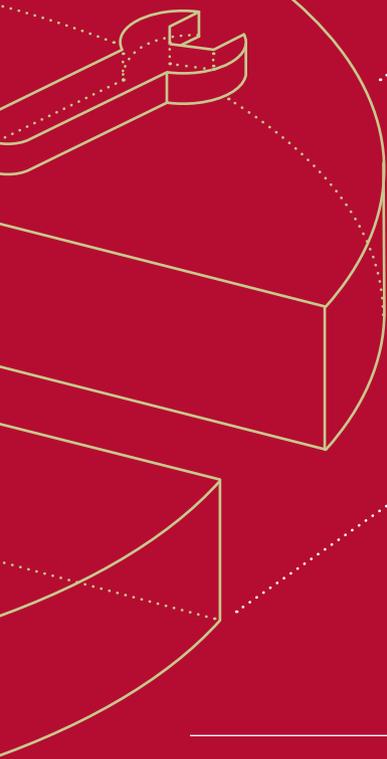
TECHNICAL
AND ECONOMIC
OPTIMIZATION

Technical improvement

Reliability increase



ER ITS



On-site services

Spare parts

Workshop services

Economic optimization

One-Stop Services for Separation Columns Minimize Shutdown Time

Sulzer's one-stop services to upgrade and protect a separation column of an oil refinery in Spain helped the customer save time and money.

16

Using the Power of Data

Sulzer's data management toolkit identifies unreliable and inefficient pumps in near real time.

20

Dedicated Service Solutions for Rotating Equipment

Sulzer provides manifold services such as diagnostics and consulting, technical and economic optimization, and maintenance and support.

21



In oil refineries such as the Repsol Tarragona facility, crude oil is separated into its many components.

One-Stop Services for Separation Columns Minimize Shutdown Time

In Repsol's Tarragona refinery in Spain, one of the main separation columns needed to be modernized during a shutdown. Sulzer was able to provide the complete solution to upgrade and to protect the columns from corrosion. The comprehensive service from a single source saved the customer a significant amount of money and time.

The massive size of oil refineries is a contrast to what happens inside the columns: finely built trays and other internals separate crude oil and natural gas into heating oil, gasoline, and other valuable substances. Oil consists of up to 17 000 components; separating them is a complex undertaking. Distillation columns play a central part in this process. They consist of many separation stages, where trays and other internals are used.

Separating oil into its many components

The oil is pumped into a furnace and then heated to 400°C. The various components of the oil evaporate and rise in the tower. The component parts, called fractions, are collected and extracted at the same level as their condensation points. Because heavy oil consists of relatively large molecules, it already condenses at high temperatures and can be drawn off in the lower part of the column. Light distillates and gases made up of much smaller molecules only condense with decreasing temperatures. They are extracted at higher levels of the column.

The same process is used in the petrochemical industry. After the crude oil is separated in the refinery, the oil and gas components are once again separated. The results are chemicals and base materials for the plastics industry.

Keeping up with industry standards

Refineries are continuously undergoing modernization to keep up with industry standards and to improve energy efficiency. Being able to offer the latest technology and to perform on-site work safely and on time is the foundation for a good and long-lasting cooperation with customers. Tower Field Service, a business unit within the Chemtech division, performs turnarounds on customer sites.

Sulzer supported Repsol Tarragona in their major refinery upgrade. The customer decided to award the service contract to Sulzer because the company was able to provide the complete solution—modernizing the separation column and protecting it from corrosion. The revamp was performed during a planned maintenance shutdown in summer 2016.

Every day counts

During the shutdown, Sulzer's Tower Field Service team worked inside the columns. The service representatives dismantled the existing separation trays and packings. Afterward, they applied an upgraded metallurgy to the shell—a so-called weld overlay—and installed the new, Sulzer-manufactured equipment. Weld overlay is a welding process where one or more metals with specific characteristics are applied to a base metal. In this way, it protects the column against corrosion and erosion. In 2015, Sulzer acquired InterWeld, a specialized automated weld overlay company, and it has recently developed state-of-the-art equipment that can operate in extreme conditions.



Rodolfo Amezquita talking to his team at a customer's site.

“Planning and executing large projects is a fascinating job”

Rodolfo Amezquita comes from Mexico and has been working with Sulzer for seven years. He is Sales Manager in the Tower Field Service team within Sulzer's Chemtech division. In his job, he carries out large turnaround projects for the oil and gas downstream and the chemical industry in Latin America. In these service projects, he coordinates thousands of workers on-site:

“One of our recent projects was a large turnaround of a refinery in Latin America. We performed an extensive refurbishment of two catalytic units and were fully responsible for all the equipment: towers, heaters, exchangers, fin fans, piping, and drums. We even did some civil engineering by building a small overhead walkway in one of the units.

The biggest challenges in this project were the lack of local supplies and equipment as well as the coordination of over 1 000 workers. We had to find vendors in larger cities to meet the demands of the project. We coordinated the employees by dividing the work by units and tasks. Lead supervisors were responsible for the day-to-day tasks and for updating their progress daily. We were all happy in the end. We managed to successfully finish this project with a magnitude of more than 400 000 man-hours on time and without a safety incident. For me, it is really a fascinating job to plan and execute such large projects.”

A shutdown is cost-intensive and every day counts. Because the timeframe was tight, detailed planning and control were required. During the shutdown, the customer asked the team to clad additional sections, which resulted in a surface area that the team needed to protect that was twice as large as planned. Despite the additional scope, the team completed the service within the time schedule.

Saving energy, cost, and time

Thanks to weld overlay technology, corrosion of columns can be slowed down. This enhances the operational reliability of the plant and ultimately saves costs for maintenance and new investments. Not only is the lifetime of the columns extended, but the processes are also more energy-efficient. Since distillation towers consume a large portion of the energy demand of a plant, the development of energy-saving mass transfer technologies is essential.

Sulzer is market leader in the technology for fractionation columns used in separating oil into various hydrocarbon compounds. Over the last few years, Tower Field Service has completed work on many major plant-wide turnarounds around the world. In the past year, it performed over four million man-hours, with projects ranging from 30 000 to over 500 000 man-hours.

Design of column internals is essential

Minimizing shutdown time and costs is not only about the speed of the service team; the effort already begins during the product design phase. The design of column internals can influence how quickly the service team is able to isolate, open, inspect, modify, repair, and close columns. A refinery turnaround has to be performed at intervals of two to five years because the equipment wears down during operation.

This is a good opportunity to replace column and separator internals with the newest technology.

Sulzer integrates several features into its tray designs that can reduce column shutdown time. For example, removing and replacing separation trays can take a long time. In fact, the larger the tray, the longer it takes. This is not only because of the enormous size of the trays but also because the different tray panels need to be connected to each other. Sulzer offers boltless panel-to-panel connections called Lip-Slot™. The interlocking tray panels can be quickly secured to each other with a click system instead of having to bolt the panels together. The special design reduces the time needed to install the equipment by up to 50%. This means that service representatives can install two Lip-Slot trays in the time it normally takes to install one conventional tray.

Another time-saving factor is the design of the tray manway panels. There can be as many as 100 separation trays inside a column. They are typically installed at a distance of 400 to 600 millimeters from each other. For inspection purposes, the service team needs to climb all across the tower and access each tray. To access the individual trays, they climb through a small opening in the tray: the manway. To open a conventional manway, service employees need to unbolt several screws. Depending on the size of the column or the tray, it can take up to 10 to 15 minutes to access one tray. Sulzer provides quick-opening manways that allow access to the tray in less than ten seconds. The manways come with handles and special locks that allow them to be opened and closed without losing tightness between the manway panels. The panels can be opened or closed from either the top or the bottom of the tray. Imagine that service employees need to access 20 trays. With conventional manways, it would take



Data can support customers in identifying unreliable and inefficient pumps.

them about five hours. With a quick-opening system, the same can be done within one hour. This time-saving technology leads to significant cost savings in turnaround projects.

Equipment in over 100 000 columns all over the world

Sulzer offers more than 200 innovative and high-performance products for separation and mixing technology. They are installed in over 100 000 columns, 40 000 gas/liquid separators, and 100 000 mixers around the world.

In addition to separation, reaction, and mixing technology, Sulzer supplies pumps for refineries and petrochemical plants. The company also provides comprehensive repair and maintenance of gas and steam turbines as well as compressors, which increases reliability and equipment availability.

Using the Power of Data

In a pump station, everything comes down to efficiency, performance, and reliability. For customers throughout the industry, optimizing their pumps is a priority. Sulzer offers a data management toolkit that identifies unreliable and inefficient pumps in near real time.

In today's fast-paced environment, oil and gas, power, and water companies are constantly pressured to reduce costs and increase throughput. However, many face a challenge: they do not know how energy efficient their pumps really are. Collecting and analyzing data is a complex and time-consuming process. Nevertheless, unless it is done, there is no way to be able to identify and improve energy efficiency. Besides, the farther away a pump operates from the best efficiency point, the higher its vibration and the more frequent the outages are.

Sulzer has developed a data management toolkit called Blue Box™. Blue Box helps customers optimize their pumps' productivity and reliability. It consists of three modules:

- 1) Data acquisition: Data is collected to be able to evaluate the actual efficiency and reliability of the equipment.
- 2) Data analysis: A customized dashboard enables customers—with the help of Sulzer experts—to analyze the data. In this way, they can identify unreliable and inefficient pumps.
- 3) Targeted actions: Based on the analysis—which includes information about payback time—the customers can decide if they want to modernize the equipment through a retrofit.

An example from a North American pipeline company illustrates to what extent energy efficiency directly affects costs. Data, mastered by Blue Box, revealed that the efficiency of the pipeline pumps suddenly dropped by 5% from one day to the next. This resulted in an increase in energy costs of half a million US dollars every year. Only if these efficiency gaps are visible can customers make well-informed decisions and initiate measures.

www.sulzer.com/bluebox

DEDICATED SERVICE SOLUTIONS FOR ROTATING EQUIPMENT



DIAGNOSTIC AND CONSULTING SERVICES: Taking informed decisions and maintaining control

Monitoring

- On-site monitoring
- Remote monitoring

3

The three modules of Blue Box™ help customers optimize their pumps' productivity and reliability.

Consulting

- Training programs
- Shutdown planning

100

Average number of days of customer training sessions in 2016

Inspection

- Mechanical inspection
- Performance analysis
- System analysis



Inspection helps identify improvement potential.



TECHNICAL AND ECONOMIC OPTIMIZATION: Getting the most of customers' assets

Economic optimization

- Life cycle management
- Asset management



Life cycle management reduces operation costs or process running costs.

Technical improvement

- Mechanical upgrades
- Hydraulic upgrades
- Retrofits
- Relocation
- Aerodynamic rerates
- Rotordynamic analysis (RDA)
- Coating services

80

Number of major pump retrofits performed in 2016

Reliability increase

- Predictive maintenance
- "Bad Actors" program
- Performance-based contracts
- Long-term service agreement (LTSA)

5%

A 5% efficiency drop of pipeline pumps can result in increased energy costs of USD 500 000 every year.



MAINTENANCE AND SUPPORT SERVICES: Maintaining equipment to industry best practices

On-site services

- Commissioning
- On-site repairs
- Troubleshooting
- In-situ repairs
- 24/7 support

15%

of sales in 2016 were field services that were performed on customers' sites.

Spare parts

- OEM parts
- Inventory management
- Reverse engineering
- Coil manufacturing
- Replacement parts
- Non-OEM parts

20 000+

Number of coils Sulzer delivered in 2016

Workshop services

- Refurbishment
- Repairs
- Rewind
- Balancing
- Contract maintenance
- Weld repairs

100

Service centers for rotating equipment

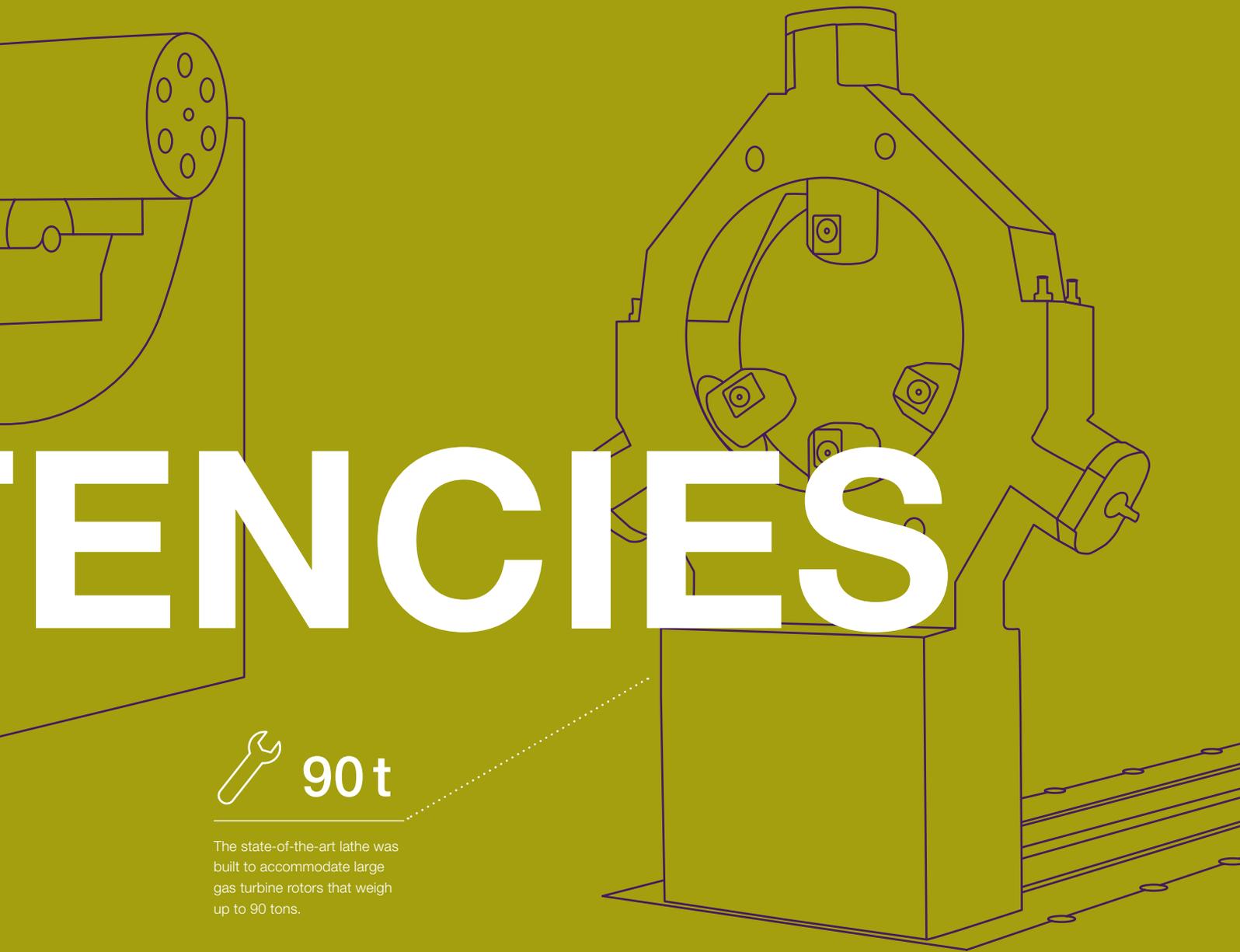


CORE COMPET



25 700 m²

The massive size of modern, industrial gas turbine rotors means that a repair facility must be equipped with cutting-edge machines. In Sulzer's Houston Service Center, all makes and models of turbomachinery can be repaired on a floor space of 25 700 m².



90 t

The state-of-the-art lathe was built to accommodate large gas turbine rotors that weigh up to 90 tons.

Repairing the World's Largest Industrial Gas Turbines

Sulzer is one of a few service suppliers with the expertise, precision, and equipment to repair the world's largest industrial gas turbines.

📄 24

Boosting Energy Efficiency by up to 50% in 36 Hours

With its fast-track process, Sulzer is able to replace turbocompressors for wastewater plants within 36 hours and to boost energy efficiency by up to 50%.

📄 26

The Key to Success

Sulzer provides high-quality, fast, and cost-effective service solutions. The key to this is the company's professional service team, its global footprint, and its one-stop offering.

📄 29



When they need to be repaired, the latest and largest turbine rotors are placed in this new lathe. They can weigh up to 90 tons.

Repairing the World's Largest Industrial Gas Turbines

Big Bay 3 is Sulzer's largest facility for rotating equipment repair. The company is one of a handful of service suppliers with the expertise, precision, and equipment to repair the world's largest industrial gas turbines.

Imagine a hall the size of one and a half football fields. After stepping through the giant gate and looking inside, you see a massive crane that can lift compressor and turbine sections 50 meters into the air. Looking around, you see a balancing machine, capable of balancing rotors that weigh up to 82 tons. In comparison, a five-ton African elephant, the heaviest living land animal in the world, is a lightweight. There is another impressive machine that spans across more than 20 meters. It is a state-of-the-art, versatile lathe that was built to accommodate large gas turbine rotors with a capacity of 90 tons.

The plant where all this is set up is called Big Bay 3. Big Bay 3 is part of Sulzer's Houston Service Center located in La Porte, Texas, USA. At 25700m², it is the company's largest facility for rotating equipment repair. The Houston Service Center specializes in maintenance and repairs of all makes and models of turbomachinery.

Bigger turbines to satisfy increasing demand

The global energy demand is increasing. This puts the power generation industry under pressure to produce more energy in a more efficient way. As a result, industrial gas turbines are becoming bigger and bigger, and their technology has significantly developed over the last 50 years. Manufacturers

are compelled to develop much larger turbines designed for uninterrupted operations.

From natural gas to energy

Gas turbines are used in power plants to convert natural gas into mechanical energy. This energy drives a generator that produces electrical energy. Power lines then transport the energy to homes and businesses.

In a gas turbine, air enters the compressor section that is made up of numerous blades. As the rotor turns, the air runs through the blades and is compressed. This compressed air then enters the combustion section and is mixed with a fuel such as natural gas or fuel oil. It is then ignited in the combustion section, and travels as hot gas into the turbine section. The hot gas moves through blades in the turbine and causes them to spin. Because the turbine is coupled to a generator, this rotation drives the generator. The generator then converts the mechanical energy into electricity.

Suitable equipment to handle large refurbishment projects

Industrial gas turbines that operate in these environments require periodic repairs. Turbine operators need a one-stop service facility where maintenance providers are able to deliver a complete repair. The massive size of modern, industrial gas turbine rotors means that a repair facility must be equipped with cutting-edge equipment capable of lifting, balancing, and machining a fully assembled rotor. Having the appropriate large-scale equipment to handle these turbine rotor refurbishments is critical to the processes and workflow involved in the repair process. In the past, cranes and lathes that could accommodate approximately 55 tons were adequate, but as the output capacity of industrial gas turbines has increased, so has the weight of the rotors. With Big Bay 3, Sulzer is one

Boosting Energy Efficiency by up to 50% in 36 Hours

Many wastewater treatment plants are aging. Hence, operators not only experience growing operating costs, but also face the risk of equipment failure. The failure of a single blower or compressor may jeopardize the functioning of the entire wastewater treatment plant. With the recently launched fast-track process, Sulzer can ship its highly efficient HST turbocompressors to a plant within 36 hours and help boost energy efficiency by up to 50%.

Back in operation and more efficient than before

Old blowers and compressors consume a large part of the total energy of a wastewater treatment plant. One option is to repair or replace them one for one with the same make and model. The other, more economic option is to replace them with the Sulzer HST turbocompressor. This compressor type reduces the energy costs for aeration by up to 50% and offers a payback as short as two years.

From Finland to Switzerland in less than two days

ERZO, a waste disposal company in Switzerland, required an update of the electronics of an HST turbocompressor that has been in operation for almost 20 years. Lately, the operator had to switch to manual use on a regular basis to ensure sufficient air supply for the biological process of the facility. Initially, the operator planned to update the turbocompressor with a new electronic system. Because of Sulzer's fast-track process, the customer decided to replace the old turbocompressor. Within 36 hours, Sulzer delivered its HST compressor from its factory in Finland to Switzerland and installed it at the customer's plant. Adrian Burkart, Division Manager ARA ERZO, said, "Thanks to the fast replacement, we were able to ensure efficiency and environmental water protection within 36 hours."

 www.sulzer.com/36hours

of a handful of service suppliers who has the equipment and expertise to service such large machines.

How do you repair a gas turbine that weighs 80 tons?

In heavy industrial machines such as gas turbines and electric generators, vibration is a frequent problem, because it can cause catastrophic failure and noise. By repairing and balancing the rotor, vibration can be avoided. But how do you repair a gas turbine rotor that can easily weigh as much as 16 elephants?

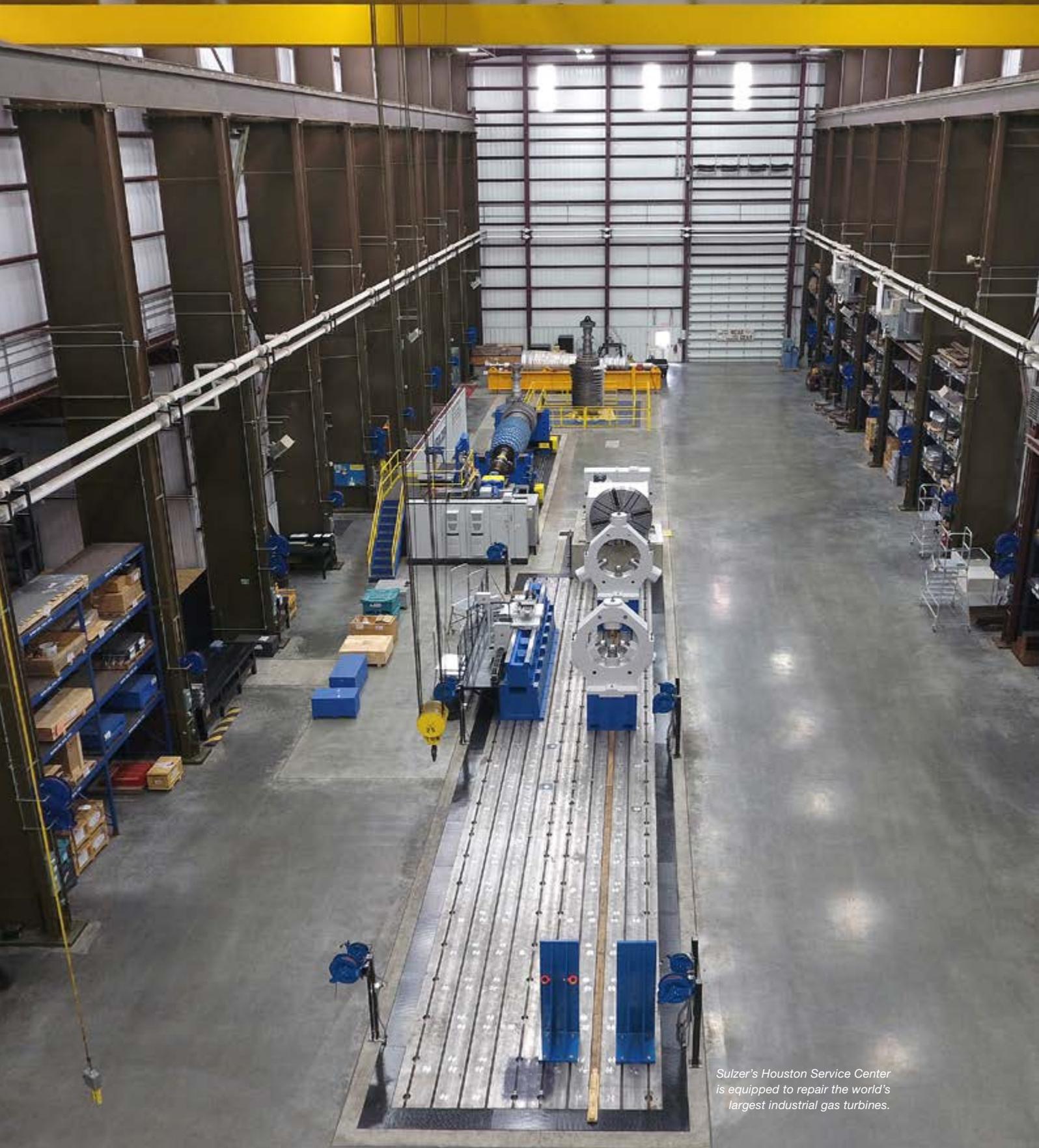
The repair process begins with the inspection of the rotor using the balance machine. This machine can identify any unbalance issues. After the initial balance run, the rotor is then placed into V-blocks (runout stands) and is rotated. This allows the service employee to inspect the rotor critically. Based on these first inspections, engineers decide if the rotor needs to be disassembled.

If this should be the case, it is placed in a stacking pit. For this, a large crane is necessary. Once the rotor is disassembled, the service team inspects the individual components of the respective compressor or turbine parts. Each part is thoroughly examined and inspected in detail for reuse or specialized repairs (such as replacing blades or coating compressor disks). The individual disks go through concentricity checks and are balanced in a horizontal balance stand before being reassembled. After the individual components are qualified, each section is dynamically balanced and prepared for assembly. After reassembly, the compressor section and the turbine section are placed in the lathe to check runouts and correct the rotor if necessary. Each rotor section is then rechecked for balance before it returns to the stacking pit where the major sections are mated. The complete rotor is then ready for final checks and dynamic balancing before being shipped back to the customer.

Minimizing downtime and cost

For the customer, speed of repair and minimizing downtime is crucial. With suitable shop facilities and equipment, it is a relatively straightforward task to deal with a single rotor. Coordinating the repairs to multiple rotors and minimizing the time between each stage is a more complicated issue. Today's repair specialists use systematic planning, have excellent project management skills, and possess a range of versatile equipment to deliver cost-effective, timely, and successful projects.

Over the past year, Sulzer has provided services for around 70 gas turbines in its La Porte facility. Roughly 30 service employees ensure that these large projects are carried out in a timely and cost-effective manner.



Sulzer's Houston Service Center is equipped to repair the world's largest industrial gas turbines.



Jennifer Gaines used to work in Big Bay 3. Today, she is a mechanical design engineer in La Porte, TX, USA.

“The mechanics in Big Bay 3 are true jacks-of-all-trades”

Jennifer Gaines from Houston, TX, USA, used to work as a production engineer in Big Bay 3 (BB3). She has spent the last couple of years dedicating her career to the repair and maintenance of massive equipment in the gigantic shop. Recently, she was promoted to mechanical design engineer in Sulzer’s core engineering group. As one of Sulzer’s female engineers, she looks back at her experience in BB3 with pleasure:

“Repairing these large industrial gas turbines is hard work and requires extreme care. You have to ensure an efficient workflow to get the job done as quickly but, at the same time, as diligently as possible. With this type of heavy-duty equipment, every hour these machines are not in service equates to enormous amounts of dollars and production hours lost.”

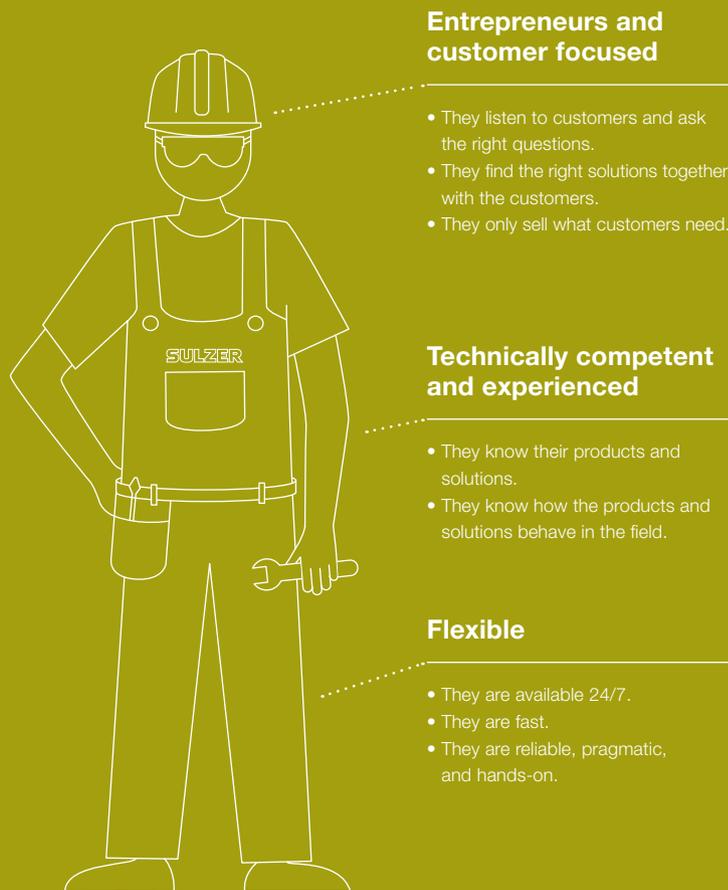
She particularly appreciated the high level of technical experience in the BB3 team. “The mechanics and machinists in BB3 can perform all of the requirements and are truly jacks-of-all-trades. I thoroughly enjoyed working with the team. I look forward to utilizing the valuable skills gained from BB3 in my new job at Sulzer.”

Jennifer Gaines’ career with Sulzer began with a rigorous program that encompassed hands-on training on the shop floor. There, she worked directly with equipment and highly experienced maintenance mechanics and machinists. Once her training on the shop floor was complete, she transitioned to providing cutting-edge engineering services. As part of this, she designed specialized shop tools and solutions to help the mechanics better disassemble, inspect, repair, and assemble equipment.

THE KEY TO SUCCESS

SERVICE IS A PEOPLE BUSINESS

A professional service team is essential for Sulzer. The company's service employees are:



Entrepreneurs and customer focused

- They listen to customers and ask the right questions.
- They find the right solutions together with the customers.
- They only sell what customers need.

Technically competent and experienced

- They know their products and solutions.
- They know how the products and solutions behave in the field.

Flexible

- They are available 24/7.
- They are fast.
- They are reliable, pragmatic, and hands-on.

COST-EFFICIENCY

Customers are optimizing their maintenance and operation costs on a regular basis. Sulzer can support them with equipment that runs reliably and efficiently. Services such as predictive maintenance or monitoring also help avoid unforeseen and expensive outages. It is not always necessary to replace old or worn-out equipment. An upgrade or retrofit can give the pumps a second life. Sulzer offers standardized retrofit solutions that can be installed within one to three months at a competitive price.

PROXIMITY AND SPEED

Sulzer is close to its customers. Present in more than 40 countries around the world, the company operates one of the largest service networks in its field. The service teams provide rapid turnarounds that minimize disruption and keep customers' projects on schedule. At the customers' request, service representatives can stay on their sites permanently. If necessary, they are able to react immediately and leverage Sulzer's global network.

ONE-STOP OFFERING

Sulzer is becoming a one-stop service supplier. Already today, the company is able to repair a range of different products under one roof. In the future, Sulzer plans to establish even more of these service centers. Customers benefit from having one access point for the service of all their rotating equipment. Likewise, Sulzer can provide complete tower field solutions—from modernizing the separation columns to protecting them from corrosion.

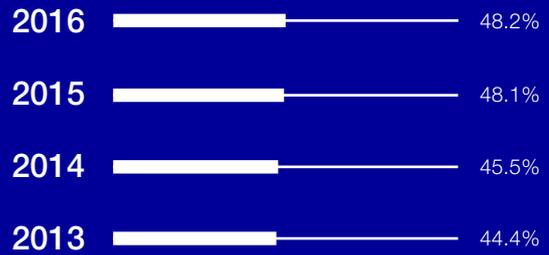
INNOVATION

The company's global research and development (R&D) teams turn ideas into business opportunities. Further, many of the company's innovative solutions have been developed in cooperation with clients during ongoing projects. The company also fosters open innovation: Sulzer has a strong link to universities and external R&D institutes.

NEW TREND: SERVICE BUSINESS

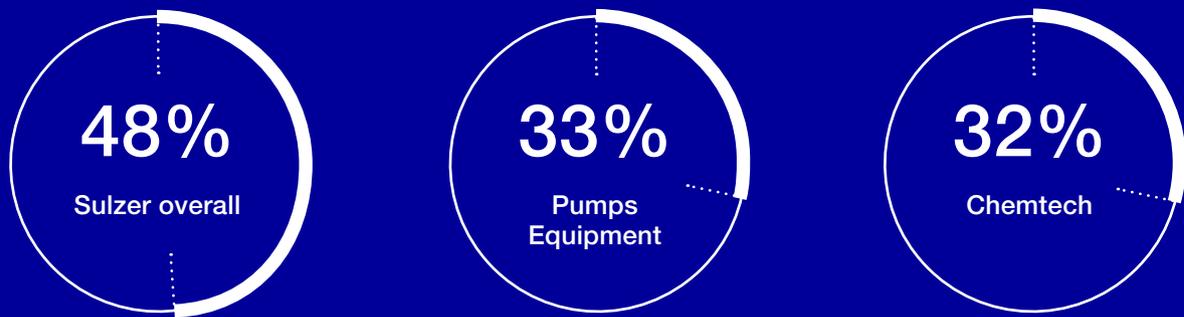
During the past years, more and more manufacturing companies have changed their business models. They have switched from only producing goods to offering a combination of products and services. Companies see the opportunity to generate additional revenues and strengthen customer loyalty. Over the next three years, it is expected that 65% of the global manufacturing industry will be headed in this direction.

Because the service business is becoming more and more competitive, it is vital for an established service provider such as Sulzer to expand its offering and presence. In 2016, the company took further steps to achieve these goals.



The share of sales of aftermarket services at Sulzer has increased steadily during the last few years.

Sales from services in 2016



Overall, the company generates 48% of its sales in the service business. Split by divisions, Rotating Equipment Services generates 100% of its sales with services. In Pumps Equipment, services make up 33% of sales. Chemtech’s sales consist of 32% in the service business.

2016

Sulzer acquired industrial dispenser manufacturer PC Cox, applicator producer Geka, pump manufacturer Ensival Moret, gas turbine maintenance provider Rotec GT, and Wärtsilä’s vessel internal electrostatic coalescer (VIEC) business.

The company introduced new pump types and agitators for the water market and developed a mixing tip with bendable cannula for the dental industry.

Sulzer and FMC Technologies received an order to supply the pumping equipment for one of the subsea pumping modules in Shell’s oil field off the coast of Brazil.

Sohar SWRO Company LLC commissioned Sulzer to supply pumps for the new desalination plant in Sohar, Oman.