ABB Turbocharging
We multiply power

Power and productivity
for a better world™

Contents

Committed to market leadership

ABB Turbocharging – powering your performance through first-class products and services, dedication to excellence and total dependability.

In a manner of speaking, ABB Turbo Systems of Baden travels the world's oceans, mines diamonds and ore, and provides electricity to improve life in developing countries. How? Since the 1920s the company has specialized in the development and manufacture of exhaust gas turbochargers for the medium-size to large diesel engines used in precisely those areas. Time and again, this specialization has produced innovative improvements that have advanced the performance of turbocharged diesel and gas engines. The technological leadership this has brought has also made ABB Turbo Systems the market leader – a position we are committed to strengthening.

With market leadership comes responsibility. It obliges us to perform at our peak in all areas at all times – with our products, with our service, and with due regard to the environment. Our determination to maintain ABB Turbo Systems' position as the technological and market leader is also evident in our commitment to production in Switzerland. With processes designed to be as effective and efficient as possible. And with new technologies that benefit customers and the organization alike. To remain the leader, we invest in our employees, to enable them to make their vital contribution to our success. This dedication to excellence across the organization is something of which ABB Turbo Systems is proud and upon which its future depends.

With this brochure, we invite you to get to know our company better. The next time you drink a cup of coffee or tea, remember that there is a very good chance that its ingredients were shipped on one of "our" vessels.

History and milestones
An idea that prevailed.

Innovative ideas prevail when their time comes, the right partners are involved and conditions are right.

The man we have to thank for the exhaust gas turbocharger is Swiss engineer and inventor Alfred Buechi, who filed his application to patent a “highly supercharged compound engine” in 1905. His ingenious idea was to use the exhaust gases of a diesel engine to drive a compressor via a turbine and force compressed air into the cylinders, thereby increasing the power output of the engine. Previously useless waste energy was thus to be transformed into additional power.

Later came his patent for a multi-stage turbine for circulating liquids and gases, and in 1915 his important “scavenging” patent. Brown Boveri (BBC), one of the founding companies of ABB, recognized the tremendous potential of exhaust gas turbocharging and entered into a partnership for its development and application. BBC brought financial resources to the enterprise as well as expertise and experience in turbine and compressor construction.

The first turbocharger for a large diesel engine was delivered in 1924. This marked the beginning of a phase of intensive research and development at BBC. The engineers in Baden, Switzerland, began to devise new and improved turbochargers of strikingly greater efficiency. It was the beginning of a success story that continues to this day.

1 American Locomotive Company (ALCO) 900 horsepower diesel engine with BBC VTx 350 turbocharger (around 1935) | 2 Ten-cylinder natural gas engine in the USA, turbocharged with two VTR 400 units (around 1949) | 3 The first BBC VT 402 turbocharger for a large diesel engine was built in 1924 for SLM of Winterthur


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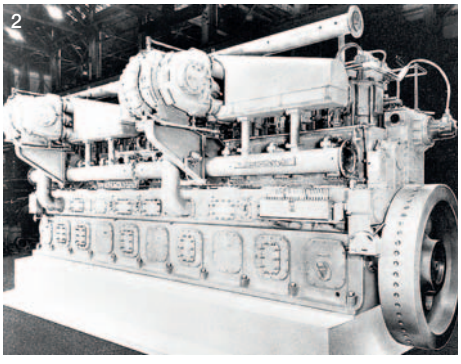
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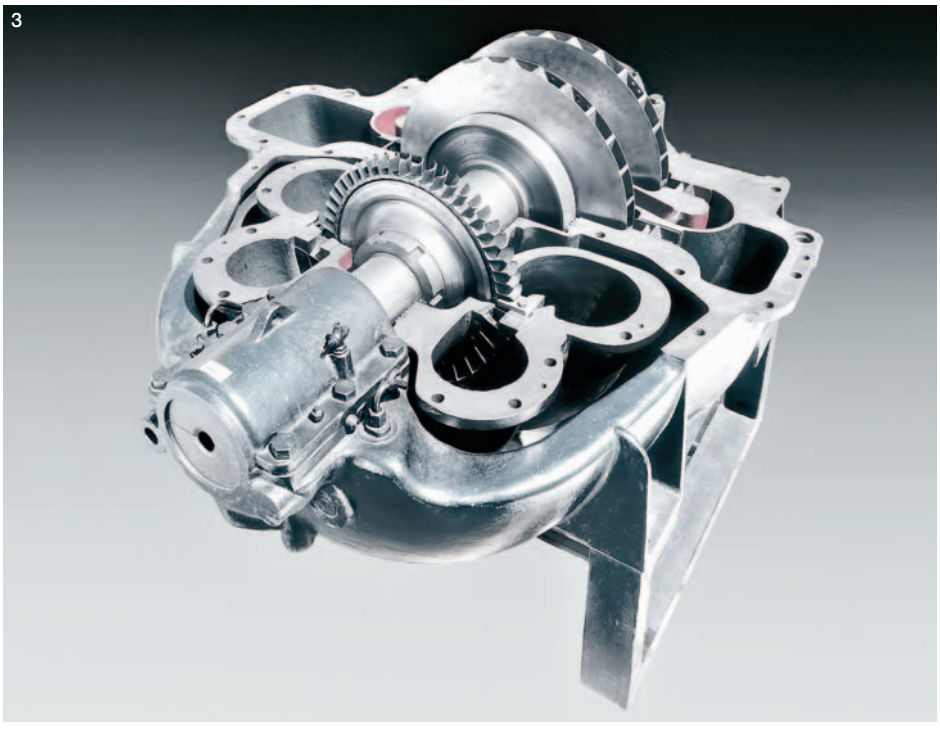
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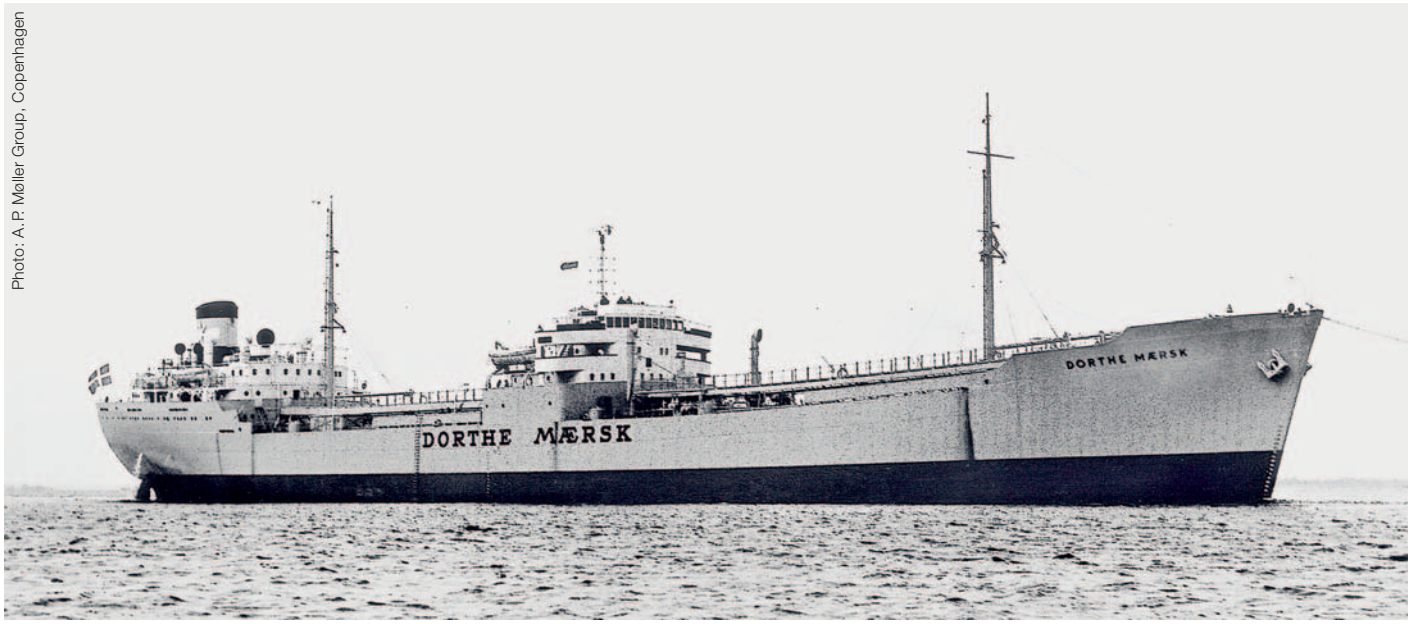
Photo: A.P. Møller Group, Copenhagen



The first ship to have a turbocharged, 2-stroke diesel engine: the 18,000-ton tanker MS Dorthe Maersk from Danish shipyard A.P. Møller (1952)

1905

Alfred Buechi patents his idea.

1924

The first BBC exhaust gas turbocharger is delivered.

1930s and 40s

Development of the VTR series.

1950s

MS Dorthe Maersk is launched as the first ship with a 2-stroke, turbocharged diesel engine.

BBC sets up a turbocharger division with its own factory.

A license agreement is reached with Ishikawajima-Harima Heavy Industries (IHI) of Japan.

1960s

The RR turbocharger series is introduced.

1970s and 80s

Development of new VTR generations raises efficiency to over 70 %.

BBC becomes ABB Asea Brown Boveri. ABB Turbo Systems Ltd is founded as an ABB subsidiary.

Hyundai Heavy Industries (HHI) of Korea receives a license to build ABB turbochargers.

1990s

The VTR series is enlarged. Parallel to this, ABB Turbo Systems develops the new-generation TPS and TPL series.

ABB Turbo Systems and IHI set up a joint venture company, Turbo Systems United (TSU), in Japan.

The first ABB turbocharger with variable turbine geometry (VTG) is launched.

Since 2000

TPS and TPL become runaway successes.

The new Turbocharger Service Center in Baden is opened.

ABB develops and builds the world's largest and most powerful turbocharger.

ABB Turbo Systems and Jiangjin Turbocharger Plant (JTP) set up ABB Jiangjin Turbo Systems Co., Ltd. as a joint venture company in China.

More than 1000 units leave Baden factory in one month.

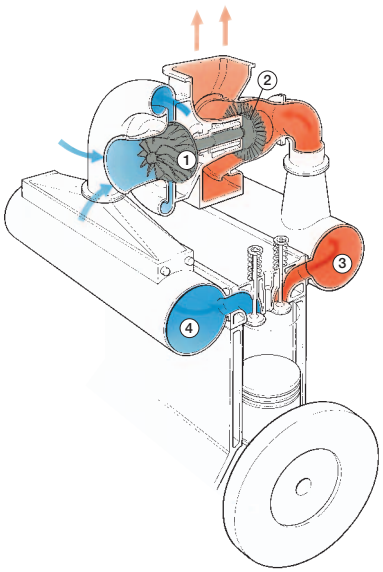
The A100 generation is launched as a new benchmark in single stage turbocharging.

The global service network opens its 100th Service Station.

Production begins at new turbocharger factory in Klingnau.

Introduction of Power2 two stage turbocharging

How turbocharging works



The exhaust gas of a diesel or gas engine is a useful resource, capable of producing an up to fourfold gain in engine power, lowering costs and reducing fuel consumption.

A turbocharger consists of a compressor ① and a turbine ② mounted on a common shaft. It is installed on a diesel or gas engine for the purpose of increasing the power density of that engine. The engine's exhaust gas energy ③ drives the turbine, causing the compressor wheel to compress the air ④ fed (via a cooler) to the engine.

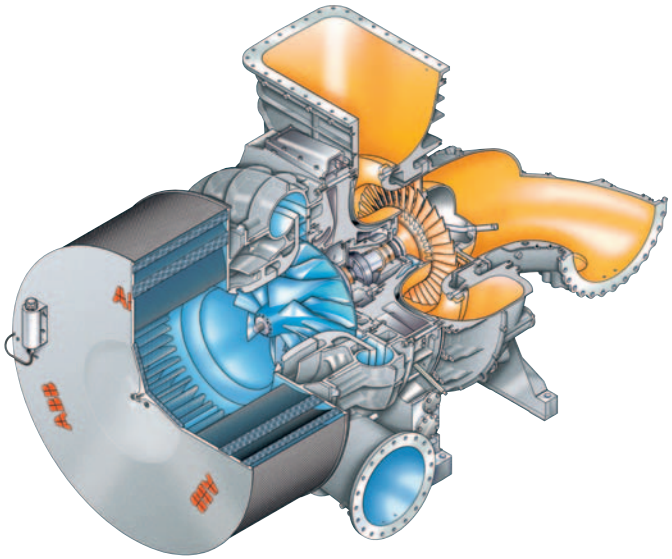
Thanks to this relatively simple principle, engine output is increased fourfold. In other words, nearly 75 percent of the total output of an engine is the result of turbocharging.

Less fuel, more power

The benefits of exhaust gas turbocharging are clear: Engine power output is increased and overall costs are lowered, with specific fuel consumption also reduced thanks to the higher engine efficiency. Turbocharging therefore helps conserve energy resources. Turbochargers which are properly serviced also significantly reduce diesel engine emissions.

Simplify, strengthen, and improve

The trend in turbocharging is towards simpler construction with fewer parts, and even greater efficiency at higher pressures. Modern turbochargers feature a simple, robust and compact design, and are modular for maximum flexibility in application. The number of parts, overall size and weight are being continually reduced, all the while with performance improvements, longer lifetimes and increased times between overhauls (TBO).



Cutaway model of the most powerful ABB turbocharger, the TPL 91-B for 2-stroke diesel engines

Products and applications
Providing power, wherever it is required.

Ships, power generating facilities, locomotives and mining equipment: Wherever diesel engines are used, ABB turbochargers are not far away.

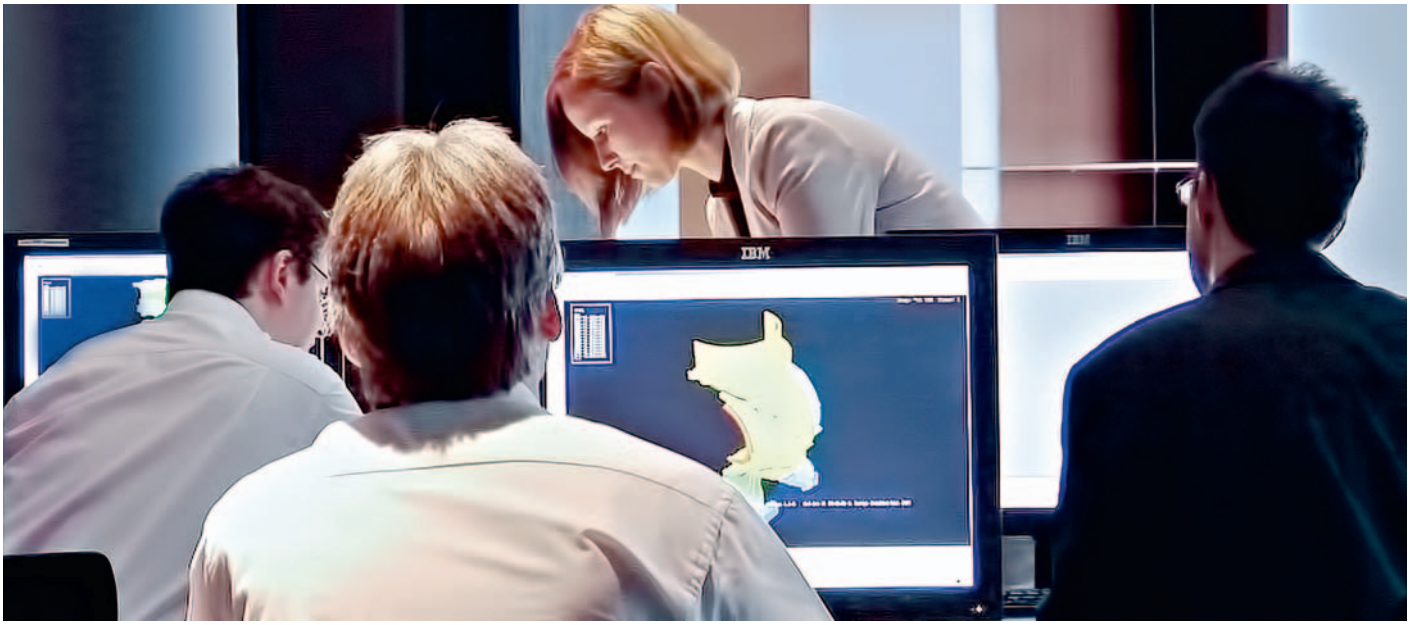
The ABB range of turbochargers has a model for every 2- or 4-stroke diesel engine designed to operate within the 500 to 25,000 kW power range. Worldwide, more than 200,000 ABB turbochargers are in operation – on container ships and cruise ships, tankers and ice-breakers, high-speed ferries and river ships, in mining vehicles and diesel locomotives, in stationary installations with diesel or gas driven engines, and on mobile power generators or emergency gensets.

The most important market segments are the marine sector and the stationary plant sector, followed by locomotives and off-highway vehicles. ABB Turbo Systems' unbeatable experience makes it a reliable partner for customers in each of these areas.

150 MW power barge Sultana del Este in the Dominican Republic

1 Qishuyan-built DF8CJ locomotive with two ABB TPR61 turbochargers | 2 Mining vehicle with load capacity of around 250 tons | 3 Monte Rio power plant, Dominican Republic | 4 Container ships are an important market segment for the largest ABB turbochargers

Research and development
Progress must be earned.



Computer aided engineering

Nothing is so good that it cannot be improved. Research and development tests the limits of the feasible.

Turbocharger research and development has clearly formulated objectives: greater efficiency, higher turbocharging pressure, operating safety, long service life, compact construction and low production costs. These objectives are part of a long-term product strategy, with projects that look to the future. Typical project goals are new turbocharger generations, technologically innovative compressors and turbines, and higher compression ratios.

An investment that pays off

Measured against sales, ABB Turbo Systems invests a substantial amount in research and development in areas such as thermodynamics, aerodynamics, computational fluid dynamics (CFD), particle flow, acoustics, structural mechanics, blade mechanics and dynamics, bearing technology and rotor dynamics, materials science, surface treatment, coatings, computer aided design (CAD), production and metrology. These investments pay off. ABB Turbo Systems guarantees top products through a forward-looking policy that includes the use of advanced design techniques, more efficient manufacturing processes, longer-lasting materials, and sophisticated measurement technology. Larger projects are always handled by interdisciplinary teams to ensure optimal coordination.

Non-intrusive flow measurement by means of laser optic particle image velocimetry

Increase and apply basic knowledge

The Test Center plays an important role in our research and development efforts. In this center of excellence for turbomachinery technology and application we advance our basic knowledge through practical experiments and theoretical work, focusing on the mechanics of fluids and vibrations, combustion technology and acoustics, and turbomachinery and combustion chamber metrology. Highly modern test rigs, advanced computer software and in-house workshops ensure that projects are completed quickly and efficiently.

Manufacturing
With bits, bytes, and wrenches.

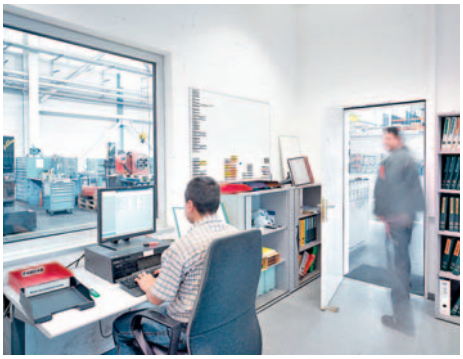
Each year ABB Turbo Systems in Baden produces thousands of turbochargers. They are manufactured in our state of the art production plant, with a flexibility that permits fast response to technological progress as well as to changes in the marketplace.

Production processes are also reviewed

ABB Turbo Systems subjects its production processes to regular review, underlining our ongoing commitment to “efficiency plus quality”. The latest technologies are used at all stages of production.

Production and all upstream activities are part of a market-oriented, IT-supported process. This makes greater demands on our employees and calls for more planning and monitoring, which also makes the work more interesting.

Production flexibility allows fast response to new situations.



Components factory in Deitingen

The tightly integrated production processes make use of the very latest in assembly technology. Pre-assembled casings and rotors are combined during final assembly into products ready for scheduled delivery. Each fitter is responsible for the assembly of "his" turbocharger, right down to the very last bolt.

New development and applications

Traditional industrial manufacture would not be possible in Switzerland, with its high labor costs, without the uncompromising application of technology and the integration of suppliers – including our own components factory in Deitingen, near Solothurn. The same approach is evident at our new factory for small turbochargers in Klingnau, near Baden. The level of investment in production is an expression of ABB Turbo Systems' commitment to Switzerland as a manufacturing base.

Investment in manufacturing is not restricted to Switzerland, either. For local customers, ABB Turbo Systems also has factories in China and India.

We are convinced that top quality products, a highly trained workforce, and optimized manufacturing processes are the key to our future. That this conviction is its own reward can be seen year after year.

Sales and service
Be convincing, contactable, and ready.

Good relationships are at the root of any business that both parties find rewarding. That is why ABB Turbo Systems makes customer service a top priority. The application engineers and “their” personal customers among the engine manufacturers are the best example of this. These close contacts have been responsible for and have speeded the development of innovations in turbochargers. In turn, ABB Turbo Systems’ extensive experience provides important input for engine development. In the maritime sector, ABB Turbo Systems has close relationships with shipping companies.

How cooperative effort shapes processes

Customer care and closeness to the customer are more than just interpersonal activities. They shape the development of business processes. Since shipbuilding and the construction of diesel power plants are often global projects, time and cost play an ever more important role. ABB Turbo Systems, as a key partner in these projects, supports customers in meeting their targets. For example, a single organizational unit is responsible for the entire project, from order entry to delivery. This reduces unnecessary interfaces, involves fewer levels of decision making and provides freedom to integrate the ongoing wishes of the customer – adding up to flexibility, effectiveness and efficiency.

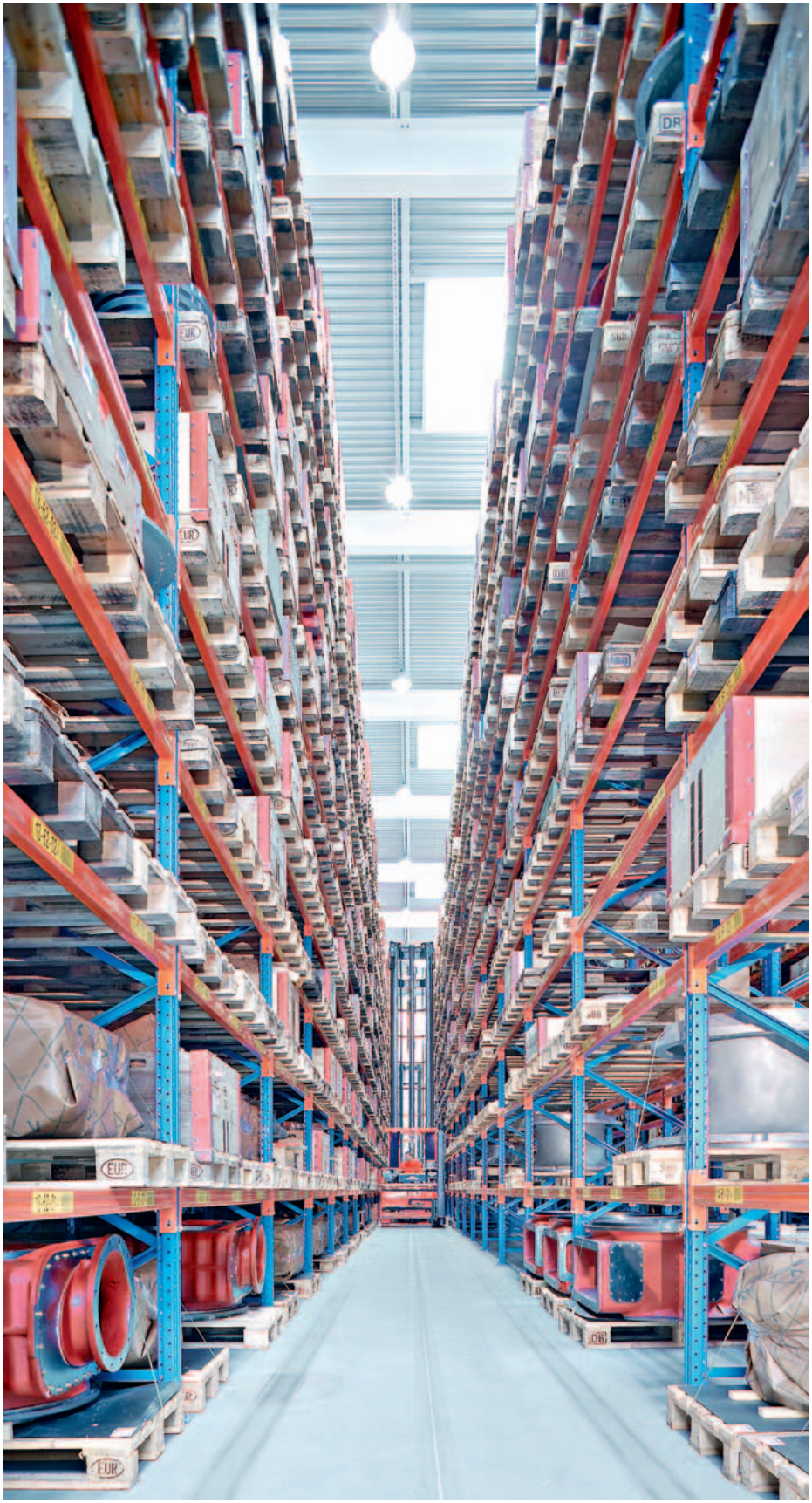
Customer care, availability, service: ultimately, a contract is between people.

Prevention and assistance

After a turbocharger has been installed and is running on an engine, customers rely on fast and efficient support being available around the clock. Should a turbocharger fail, the engine concerned will lose up to 75 % of its power. Downtime for a ship is extremely costly. Shipping companies therefore want to be able to count on thorough, reliable maintenance and service, no matter where the ship is located.

Prevention of failure is always better than repair. ABB Turbo Systems therefore operates what is essentially a preventive maintenance program. This means that servicing and maintenance work are planned proactively, on request through a customized ABB Original Service agreement. Whenever possible, service is carried out during a ship's turnaround time. Knowing and understanding the lifecycle of a turbocharger, as well as having application know-how, provides the best assurance that the machines remain safe and reliable. Serious problems can then normally be avoided.

With a global presence that now comprises more than 100 ABB Service Stations, well-organized Original Parts service, modern communications technology and highly trained personnel, ABB Turbo Systems is equipped to meet these challenges. The heart of this ABB Service network is a central database that monitors the service intervals. It contains, for every single installation, the turbocharger and plant specifications, the complete service history, all customer data, and the operating history. In addition, information is given about which parts are available in which warehouses. This is of great benefit to our customers. All of this information can be accessed 24 hours a day online by our Service centers around the world.



People and finance
Having the right resources is key.

Agree on the objectives, set the course, and enable everyone to contribute. Investment in human capital is imperative.

ABB Turbo Systems Ltd employs around 1,000 people in Switzerland. Almost half are graduates of a university, college or technical school. Technicians, production workers, sales staff and managers work closely together. The latest information technologies allow easy transfer of knowledge. Management reviews company strategy annually and targets are set accordingly. These provide the basis for the everyday operations of all employees. The finance and controlling department supports management at all levels with figures and analyses that allow an ongoing evaluation of the business situation. This permits comparison of the targets set and values achieved, and implementation of the measures needed to reach the objectives. Setting goals and reporting achievements are a regular part of employee communications. Various internal publications and regular meetings keep employees well informed about where the company stands.

Training and further education – a matter of policy

Manufacturing turbochargers makes high demands on company and personal performance. This need can be met if processes are fine tuned and conditions are right. One of the most important reasons for the constant evolution of ABB Turbo Systems is the desire of its employees to continue learning. Work-related training and further education are provided to this end. The improvement of technical and personal skills is supported through a program of courses and workshops. Assuming responsibility, showing initiative and having team skills, are particularly important core competencies that we encourage among employees.

ABB Turbo Systems was the first company within the ABB Group in Switzerland to introduce flexible annual working time. Besides enabling the company to plan capacity utilization better, it also facilitates employee planning in meeting professional and personal needs.

ABB Turbo Systems is an independent unit within the ABB Group. More than 2,500 specialist personnel work in the turbocharger business worldwide.

People – a key asset of ABB Turbo Systems

The environment, quality and safety
Taking responsibility, acting responsibly.

Long-lasting, safe and environmentally sound; reliable, easy to service and cost-effective; warranted and regularly checked by internal and external auditors.

Ship classification societies, European standards, ISO certification, ABB Group directives – a company that professes quality, environmental compatibility and safety is challenged to satisfy requirements that come from different quarters.

The role of the ship classification companies

These independent companies provide expert opinions on any risks that might arise and issue the relevant design certification. ABB Turbo Systems is required to make available to them the necessary documentation, drawings and materials specifications. In addition, each turbocharger destined for shipping is manufactured, installed and documented according to the quality management system certified by the ship classification companies. Only after a turbocharger has passed the final inspection is it deemed “seaworthy”.

Safety guidelines of the European Union

The CE marking on a product tells the buyer that both the product and the accompanying documentation correspond to the safety guidelines of the European Union and meet the legal requirements pursuant to European law. If this turns out not to be the case or flaws are present, there can be serious consequences: import restrictions, confiscation, sales bans or, in the worst instances, product liability claims.

ISO

Quality management and environmental management at ABB Turbo Systems are certified according to ISO. In this way, the company in Baden demonstrates the seriousness of its commitment to producing high-quality products and systems that are environmentally friendly. The internal impact of the ISO ratings is that the concern for quality, safety and the environment never ends.


Certificate

ABB Turbo Systems Ltd.

SN EN ISO 9001 : 2000
SN EN ISO 14001 : 2004
BS OHSAS 18001 : 2007

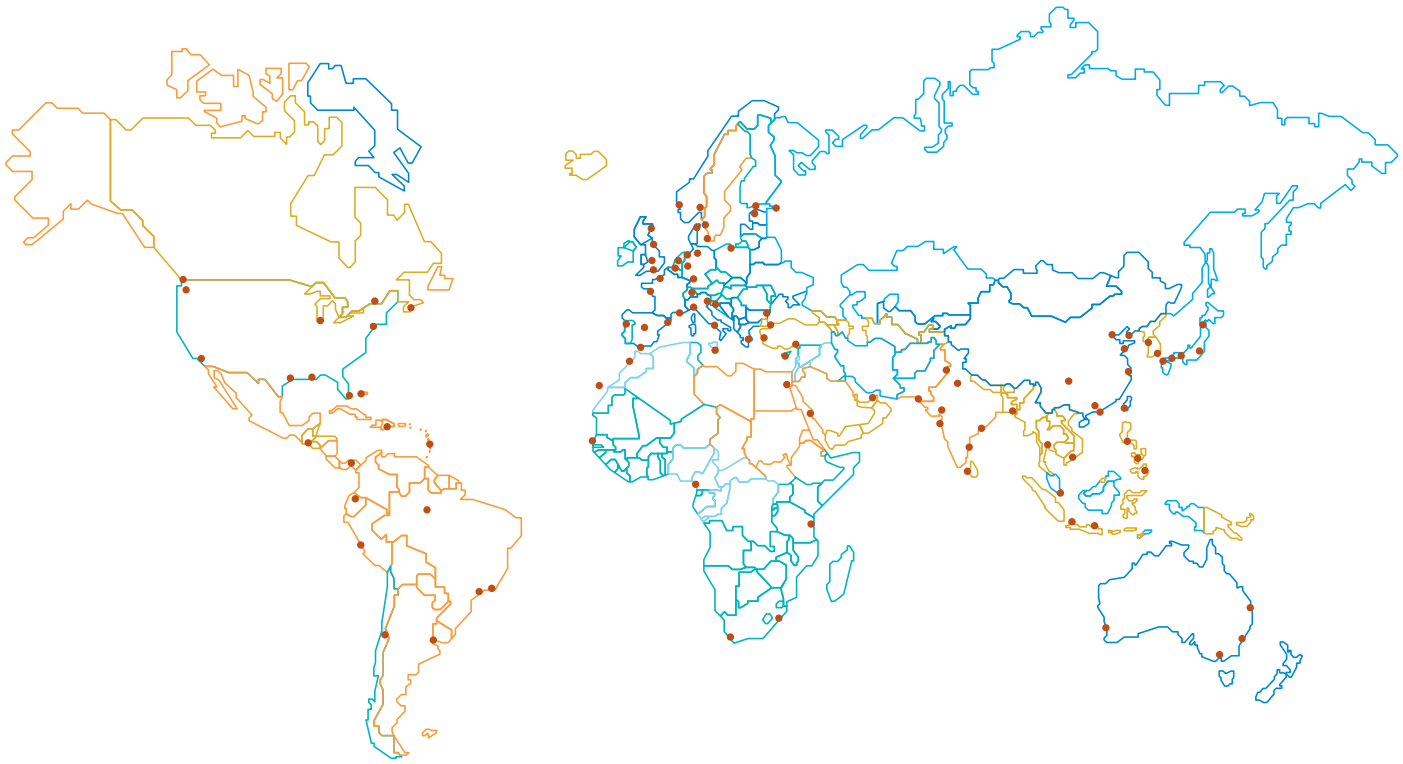
ABB Group directives

The ABB Group is committed to making its environmental audit transparent and easily understandable.To this end, the companies of the Group document the environmental compatibility of their individual products and indicate where improvements could be made and how they could be implemented. This process analyzes and grades the entire lifecycle of a product.

What are the benefits?

Quality, environmental and safety management offers a company some key opportunities. In the short term, it is useful to determine weak points in products and processes, and to improve them. In the medium to long term, these improvements will have a positive impact on profitability. And, finally, ABB Turbo Systems is aware of the fact that our company is part of a greater whole. We want our contribution to be beneficial to all.

ABB Turbocharging Service network



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