Going offshore

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2013 was a tough year for many of our customers and for us. Nevertheless, we were able to provide our customers with some 10,000 turbocharging solutions. As the market situation is going to stay challenging in 2014, our strategy is first and foremost to provide those solutions that respond directly to our customers’ needs. Topics we shall focus on will include fuel efficiency, reliability and 24/7 support, wherever our customers need it.

This issue of charge! looks at, among other topics, service upgrades with a fast payback for end users by significantly reducing fuel consumption and allowing immediate and long-term lower maintenance costs. And you can read about another key technology contributing to lower fuel consumption in the report on our two-stage turbocharging solution, Power2 800-M. This is the second generation of Power2, which was successfully introduced in 2010 and solves the dilemma posed by demand for a reduction in both NOx emissions and fuel consumption. Power2 800-M offers a portfolio with four sizes covering the entire power range of large medium speed engines.

ABB Turbocharging is also a reliable partner of the oil and gas industry, where safety and security play a huge role. Joachim Bremer – head of ABB Turbocharging in Scandinavia – talks about his experience and the company’s commitment to the high standards of this demanding sector in the interview starting on page 18.

For more information about ABB Turbocharging products and the industries we serve, please visit our website www.abb.com/turbocharging which, I have the pleasure to announce, offers an updated content in a new, lighter and fresher layout starting this spring.

It would also give us great pleasure to meet you personally at the Posidonia Exhibition taking place in Athens on June 2 – 6. We look forward to seeing you there at Stand 2.211. In the meantime, please enjoy this issue of charge!
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Power2 leading the way in two-stage turbocharging

Second-generation Power2® can be used for the entire power range of large medium-speed engines.

Text Dr. Thomas Behr, Photography Michael Reinhard, ABB Turbo Systems Ltd
In 2013 ABB Turbocharging began presenting to customers Power2 800-M, the second generation of its two-stage turbocharging system Power2. Offering considerable improvements in engine efficiency and reductions in emissions that go far beyond any single-stage system, even exceeding the high expectations, Power2 in its second generation represents the next step in two-stage turbocharging for large medium-speed engines. A portfolio with four different frame sizes is planned for second-generation Power2, two more than for the first-generation Power2 that has been on the market since 2010.

Two-stage turbocharging is a key technology that facilitates a reduction in both fuel consumption and emissions while helping to increase engine power density. With pressures of up to 12 bar and turbocharging efficiencies over 75%, second-generation Power2 leverages the full potential of extreme Miller cycles to minimize NOx reduction and fuel consumption.

Optimum performance

Power2’s high efficiency comes as a result of its sophisticated design, which was always planned as a dedicated two-stage turbocharging solution. Its compressor and turbine stages make a special contribution in this regard.

Two-stage turbocharging implies specific requirements having to be met by the thermodynamic components that differ from those of single-stage systems. Pressure ratios of compressors and turbines in low- and high-pressure turbochargers of two-stage systems are generally different to those of components in single-stage turbochargers. Fig. 1 shows this difference by comparing the compressor maps of a single-stage design and the Power2 low-pressure stage design for the same impeller wheel diameter. With respect to flow areas, differences in fluid density resulting from specific temperatures and pressures in the high- and low-pressure stages need to be considered. In addition, performance maps of compressors and turbines need to be matched perfectly in order to allow unrestricted engine operation over the entire load range.

The high-pressure turbocharger features two compressor stage variants, which are specified according to the desired overall pressure ratio. The compressor stage known from the first generation yields optimum performance for applications with pressure ratios up to \( \pi_c = 10 \). For pressure ratios up to \( \pi_c = 12 \), an entirely new high-pressure compressor stage design has been developed. Both stages have been optimized, focusing on the compressor map width and efficiency at their specific operating range. Performance maps of both stages are presented in Fig. 2. Both stages operate at an efficiency level of up to 84% at design pressure ratio.

Axial turbines will be used for both the low- and the high-pressure stage. The turbine stage designs take into account the diverging needs of the high- and low-pressure sides. These result from different temperature levels and flow area requirements.

**Fig. 1:** Compressor performance maps of a single-stage turbocharger (A100-M) and Power2 800-M low-pressure turbocharger at equal impeller wheel diameter.

**Fig. 2:** Compressor performance maps of the Power2 800-M high-pressure turbocharger.
For the second generation turbochargers the proven cartridge concept has been enhanced in order to further reduce service time.

The axial turbine design for the high-pressure turbocharger combines the advantages of high specific volume flow (Fig. 3), excellent efficiency even at part load and good acceleration behavior due to low mass moment of inertia.

The requirements for the low-pressure turbine stage also differ significantly from those for single-stage turbines. The required range of specific volume flows in the case of the low-pressure turbine is shifted toward a lower level than for single-stage turbines (Fig. 4). Consequently, this lower requirement has been exploited in the design of the new low-pressure turbine stage to gain higher stage efficiency.

In addition to the compressor and turbine design, the design framework around these components needs to be considered to achieve optimum system performance. Therefore, the design of the flow channels and subsystems has been optimized specifically during development of the new turbochargers.

Fig. 3: Turbine efficiency vs. specific effective flow area of a single-stage turbocharger and Power2 800-M high-pressure turbocharger.

Fig. 4: Turbine efficiency vs. specific effective flow area of a single-stage turbocharger and Power2 800-M low-pressure turbocharger.
Focus on minimal service downtime

Engine availability is a key factor for achieving optimal economic performance. Consequently, the time required for service work needs to be reduced to a minimum. In the case of two-stage turbocharging, this aspect becomes even more important as there are double the number of turbochargers to be serviced. During development of the new turbocharger generation, service friendliness has been considered from the very beginning. The designated goal was to reduce service time of the complete two-stage system to below the reference value of current single-stage turbochargers.

For the second generation turbochargers the proven cartridge concept has been enhanced in order to further reduce service time. The idea behind the extractable cartridge is a turbocharger which has an outer shell, consisting of compressor casing and gas casings, and a cartridge group which contains the entire interior of the turbocharger. In order to exchange the cartridge during service, only the air inlet casing together with the insert wall of the compressor needs to be removed. All other interfaces to the engine, such as oil connections, air outlet flange connection, gas inlet and gas outlet flange connections, remain untouched. Furthermore, there is no need to remove the insulation of the turbocharger anymore, since only the flange connection of the air inlet needs to be accessed during service (Fig. 5).

Conclusion

Demand for highly efficient engines with high power density and low operating costs that comply with today’s emission requirements is driving the development of new turbocharging solutions. Second-generation Power2 represents an optimized technology enabling engine designs that fulfill all these requirements at once. The entire system has been designed and optimized for the specific needs of two-stage turbocharging. With pressure ratios of up to 12 and turbocharging efficiencies beyond 75%, Power2 enables full exploitation of the advantages of two-stage turbocharging. Ease of service has been especially considered in the design. With the new extractable cartridge, service downtime has been minimized, which increases engine availability. The Power2 800-M series provides a two-stage turbocharging solution for the entire range of large medium-speed engines.
ABBA offers engine builders a turbocharging solution that enables gas and diesel engines to go from idling to full load in half the time it usually takes, thereby significantly reducing fuel consumption and greenhouse gas emissions.

Fuel accounts for more than two-thirds of the operating costs of gas and diesel engines. This and the increasingly stringent emissions regulations for the maritime, power generation and other industries make engine efficiency the number one priority for engine builders and end users alike.

One of the tools that engine builders are using to reduce fuel consumption and greenhouse gas emissions is Valve Control Management (VCM®), ABB’s variable valve train system.

VCM can typically increase gas engine efficiency by more than one percentage point, and that means fuel savings of more than two percent. For a 10,000 kilowatt gas engine, this translates into about $200,000 in fuel savings annually. For a power plant with ten such engines or more, the savings are significant.

Optimized at all times

VCM is an intelligent valve train system that works adaptively to provide an engine with the optimal amount of air for different speeds, loads and operating conditions. This enables, among other things, the turbocharger to take the engine from idling to full load in no more than half the time it usually takes.

As a result, a turbocharged engine equipped with VCM operates with optimal air supply and maximum efficiency at all times. It reduces engine fuel consumption, greenhouse gas emissions and the engine’s thermal load. VCM in combination with ABB’s two-stage turbocharging solution, Power2, enables customers to further reduce emissions and save even more on fuel.

VCM is particularly effective for high-performance engines in which large operating ranges or rapid load responses are required such as tugboats, icebreakers, pump drives, compressor drives and power generators.

Integrating a VCM in the cylinder head has the following benefits:

- The cylinder head remains virtually untouched except for limited machining operations.
- The original mounting and assembly process is retained.
- Existing parts, including the mechanical bridge, rocker arm and rocker shaft, are reused.

Aside from the new VCM unit, the only components that are modified are the shortened push rod, the cam profile and the rocker cover with its gaskets.

The VCM unit can be designed so that a minimum of modifications and new parts are needed even when space is limited. Thanks to this design, it would also be possible to use the VCM unit with a diesel version of this engine.
Maximizing safety for ABB turbochargers

Containment ensures that even in the unlikely event of a turbocharger rotor bursting, the ejection of rotor parts can be reliably avoided.

A190-L turbine with a maximum operational speed of 11,280 rpm. At that speed a centrifugal load of 109 tons acts on a single blade. The kinetic energy of the bladed shaft is equivalent to a 20 tons truck traveling at 100 km/h.

Of course, a turbocharger can never be compared with a nuclear reactor in terms of its potential to endanger life or property. Nevertheless, as with any fast rotating machine, the risk of a turbocharger rotor bursting does exist and has to be taken seriously. Turbochargers are operated at very high rotating speeds, with centrifugal forces that produce very high loads. As a result, high kinetic energy is stored in the rotor components and a burst can lead to considerable damage being caused to the rest of the turbocharger, nearby equipment and – in the worst case – persons close by.

Text Markus Kahi, Photography Michael Reinhard, ABB Turbo Systems Ltd
ABB Turbocharging’s recognition of the importance of turbocharger containment safety goes back more than thirty years and the company is committed to ensuring that, in the unlikely event of a rotor bursting, the ejection of components is avoided as reliably as possible.

History of containment safety and qualification methods
First containment tests with ABB turbochargers were carried out with the VTC..4 and RR..1 in the 1980s, long before the classification societies or other regulatory authorities required any verification of containment safety. A whole program of containment tests followed in the 1990s with the VTR..4 turbochargers. Through these tests, ABB Turbocharging gained an insight into the basic causes and types of rotor bursts and learnt how to apply this experience to future design and manufacturing for containment safety. The engineers were getting to grips with the complexity of the different mechanisms taking place during a burst incident on both the turbine and the compressor side.

Building on the know-how obtained from these tests, upgrades, for example changing the casing materials from gray cast iron to nodular cast iron and introducing special protection measures on the turbine side, were implemented in the 1990s for the VTR..4 turbochargers. In fact, since that time, ABB Turbocharging has used nodular cast iron exclusively for all relevant turbocharger casings.

At the same time, a systematic qualification test program that included containment safety as one of the important qualification criteria was established for every new turbocharger series. Containment safety became an integral part of the product development process. All ABB turbochargers introduced since then, such as the TPS, TPL, TPR and A100® series, have been developed, tested and verified for containment safety.

ABB Turbocharging has not stopped there. The development of new and improved design and qualification methods relating to containment continues. An example is the introduction of a dedicated and highly reliable method to initialize the bursting of the compressor wheel at a desired rotating speed. The picture below shows the compressor end of an A100-L turbocharger which has successfully passed the containment test.

The experience and know-how obtained from structured testing and evaluation are complemented at ABB Turbocharging by software tools that simulate burst incidents. These computer simulation tools provide indispensable support during the design process as they enable containment safety to be considered at a very early development stage. Often, with their help, the final experimental qualification test can be passed successfully today with just one single verification run. An example of such a containment simulation during the design phase of a new turbocharger type is shown in the picture on page 11.

Today, it can be stated that, together, the containment related design process and qualification tests ensure an optimal level of safety for ABB turbochargers.

SIKO – Minimizing the risk of a burst in the first place
While the possibility of a rotor bursting can never be ruled out altogether, measures are of course taken to reduce this risk to a minimal level. To this end, ABB Turbocharging has developed a sophisticated safety design concept known as SIKO. Development of this concept also started in the early 1980s and the field experience since acquired has provided the basis for its continuous improvement.

Since the 1990s ABB Turbocharging uses nodular cast iron exclusively for all the relevant turbocharger casings.
ABB Turbocharging’s SIKO concept specifies speed limits, temperature limits and replacement intervals of rotor components for different application conditions.

### How operators can contribute to safety

As already mentioned, innovations and action taken since the 1980s have continued to increase the safety of ABB turbochargers, and this has been confirmed by the positive field experience gained from the large ABB turbocharger population.

However, for our turbochargers to stay fit for purpose they must be operated within the defined design limits and with parts fulfilling ABB Turbocharging’s design standards. Therefore, owners and operators can also contribute to operational safety over these products’ life cycle by following the instructions and precautions found in the operating manuals and by using only ABB Original Parts and Original Service for all repairs and overhauls.

Further information on the importance of containment in the oil and gas offshore industry can be found by turning to page 18.

Example of a containment simulation study on the compressor side. Left hand images show the analysis of deformations and stresses.
A batch order has been received from China to equip the first production series of the “Smart Loong” locomotive with TPR turbochargers. Roll-out of the locomotives is scheduled for the second half of 2014. The TPR turbocharger, featuring enhanced flexibility with VTG technology, will also be tested in Russia on a new medium-speed traction engine. Test material is being prepared and engine performance testing is scheduled toward mid 2014. First requests to test VTG technology have also been received from India.

With the order from China, the roll-out of ABB Turbocharging’s Variable Turbine Geometry (VTG) on the TPR turbocharger platform into the railway market has definitely taken off. Engine testing in China has successfully proven the benefits of the VTG technology, i.e. fuel savings and lower thermal engine load as well as improvements in load acceptance and smoke emissions during the acceleration phase. Moreover, operational advantages were shown during 2013’s locomotive testing, e.g. how the VTG technology compensated for extreme ambient temperature conditions and also enabled the engine to develop full power up to an altitude of 2,500 meters.

VTG technology provides this market with the potential to utilize the full capability of single-stage high-pressure turbocharging during future engine development steps. ABB Turbocharging is ready to support this development of new railway power packs in order to maximize benefits for engine builders and operators alike.
New Service Station in Namibia

 Fully equipped: The new Namibian Service Station in Walvis Bay.

Walvis Bay. ABB Turbocharging opened a new Service Station in Walvis Bay, Namibia, in fall 2013. The market for ship repair is growing on the West African Coast as a result of new oil and gas business in Angola, and the new facility will accommodate this increasing need. The Service Station’s full range of equipment, including a balancing machine, meets all customer needs. The new premises have been placed near the Elgin, Brown & Hamer’s dry dock, one of the busiest in the region, where competent repair of supply and support vessels is in great demand.

Worldwide Service Network adaptations

Network. ABB Turbocharging adapted its network. Two full-size ABB Turbocharging Service Stations were opened in Barranquilla, Columbia and Dhaka, Bangladesh. Seven Service Support Points were opened: in Walvis Bay, Namibia; Mombasa, Kenya; and Mauritius and Batam, Indonesia.

Service Support Points were opened inside the Dubai Drydocks (see charge! 2|13) and in two Chinese shipyards.

LBU numbers adjusted

Scandinavia, Iberia and North America. The LBUs Norway, Denmark and Sweden were brought together to form LBU Scandinavia on 1 January 2014. Spain and Portugal have been combined to form LBU Iberia. Head of LBU Iberia is Marta Sanchez. LBU North America comprises the United States and Canada. Chuck Noddin continues to head up LBU North America, formed in 2013.

SQEP gold certification for ABB Turbocharging

Baden. Following its Bronze Level Award in 2013, ABB Turbocharging was named a Gold Level SQEP supplier for Caterpillar Motoren Kiel GmbH & Co. KG. SQEP, or Supplier Quality Excellence Process, is Caterpillar’s system for ensuring the high quality of its suppliers and confers upon a company preferred supplier status.

Caterpillar’s SQEP certification recognizes their supplier’s dedication to providing superior quality and is only awarded to those who demonstrate such world-class performance on an ongoing basis. Each year, suppliers are evaluated with increasingly strict criteria for distinguishing outstanding supplier quality performance, exceptional service, capacity planning, and delivery performance.

Achieving SQEP status for equipment as complicated and varied as a turbocharger constitutes a major achievement, because it must meet strict requirements in several categories, including product quality, process management, manufacturing, logistics, delivery and customer service, to name just a few.

Original Services

OPAC

Customize. With ABB’s Operation Performance Package (OPAC), you get a fully customizable, fully delegable OEM service package, paid by the actual number of turbocharger running hours. Designed with and for the customers, the OPAC is a more flexible, cost-effective approach to turbocharger servicing, made to meet your exact needs everywhere, every time, with Original Parts and Original Service.

You can go with OPAC BASE, which offers the fundamentals of good service and lets you upgrade at any time. Or you can build on that solid foundation with OPAC PREMIUM and prepare for unforeseeable incidents well in advance.

MMA

Optimize. A Maintenance Management Agreement (MMA) is a service agreement for maintaining your ABB turbocharging solutions in your fleet. It optimizes your maintenance management and reduces your workload. You get an annual budget plan, advance service recommendations, discounts on new Original Parts, and a single point of contact who will work with you in your language and on your time.

If you’re looking for a full-service support system that gives you a proactive role and full transparency, then an MMA is right for you. 150 of our customers are already convinced. They have chosen to cover some 7,000 turbochargers under an ABB MMA, and that’s not just because you can save 20% on Original Parts.

Precision technology from top to bottom

When an offshore oil well in the North Sea needs repairing or stimulating, the ABB turbocharged Island Wellserver from Norwegian company Island Offshore can help. “Depth no obstacle”, down to 1,500 meters.

Text Tiziana Ossola Auf der Maur, Photography Island Offshore, ABB Turbo Systems Ltd

First a few figures: worldwide there are 5,000 offshore wells in production and this number is firmly set to go up. According to ABB calculations, in 2010 oil and gas offshore met 18% of global total energy demand. It will rise to 21% by 2020. In the past few years, oil and gas production shifted more and more toward deep water – 300 to 500 meters – and ultra-deep-water – 1,500 to 3,650 meters. This is challenging in the extreme. At such depths – unattainable for humans – water pressure is several hundred times higher than air pressure on the earth’s surface. It is dark and cold.
The need to develop and then to maintain offshore wells has grown in recent years. It requires materials that can withstand the extreme ambient conditions at these depths. And then there is the actual process of boring holes into the well that has to be mastered technologically. Just as in microsurgery on a human body, this prescribes maximum precision and maximum safety. All these methods used had to be developed from scratch and have been rigorously tried and tested over the past 20 to 30 years. This evolution was rapid.
One specialist company in the oil and gas offshore sector is Island Offshore based in Norway. It was founded in 2004 and having grown constantly since then now boasts a fleet of 27 high technology service vessels, with a further six projects either at the planning or building stage (status May 2014). A subsidiary of Island Offshore is Island Offshore Subsea, whose activities cover, among others, light well intervention (LWI). The aim of LWI is to increase oil recovery from a well. Island Offshore Subsea develops solutions to achieve this goal. One of the LWI ships is the MOU Island Wellserver. Based on good, long term experience, Island Offshore relies on Rolls-Royce engines for its power plants, and in turn, Rolls-Royce chooses turbochargers from ABB for the vessel’s four main engines.

Since it slid down the slipway in 2008, Island Wellserver has never been out of work. The reason: during the life of an oil or gas well, a number of planned or unplanned interventions may be required, including processes such as diagnostics, stimulation, surveillance, manipulation of equipment and repair of mechanical failures. Also, the age of the subsea wells is increasing, resulting in the need for light well interventions to maintain the wells’ condition and optimize oil recovery.

Traditionally, many well operations have been carried out from drilling rigs. LWI operations performed from dynamically positioned vessels like the Island Wellserver have become more attractive in recent years, because they can achieve results faster and with less preparation.
The Island Wellserver can sail relatively quickly to the well and for certain operations needs no additional anchor handling and supply vessels. A ship like the Island Wellserver can execute trenching, plugging and abandoning (P&A) of suspended subsea wells, to name but a few examples of undersea processes. In central and northern parts of the North Sea multiple XMT installations—both horizontal and vertical—have been performed. An XMT or, “Xmas tree”, controls the flow of oil or gas out of the well. In some cases a tree injects gas or water from another well into a non-producing well to stimulate oil production.

Inspector on the ocean floor

To replace hands and eyes on the seabed, offshore operations employ so-called Remotely Operated Vehicles (ROVs), which are launched and retrieved from the ship. In fact, the Island Wellserver has available the most advanced version of an ROV: Heavy Work Class Vehicles (WROVs) are dependable inspectors even in ultra deep water applications and are literally capable of using their “hands”. Measuring, fault detection, tool transport or replacement and valve operations are part of the WROV’s repertoire.

This highly specialized underwater technology conforms to quality norms above the surface, too. The Island Wellserver has the class notation “DNV comfort class”, which includes a set of criteria such as noise, vibration and indoor climate. For the 50 to 70 experts per vessels involved in tasks in the North Sea, value was placed on comfort in well-equipped eating and leisure areas, etc. Still more, the ship was not only classified by DNV, but also received the highest comfort class ratings for some of its fixtures and fittings. In terms of noise and vibration levels, the Wellserver fulfills the same requirements as a cruise ship.

Island Offshore’s visit to ABB Turbocharging: Common understanding

Some time ago, Alf Ove Sævik and Karsten Ola Klungsøyr, Island Offshore’s Ship Managers, paid a visit to ABB Turbocharging in Baden, where Sales Manager Scandinavia Truls-Magnus Lindseth and Regional Manager Thomas Knüsel received their Norwegian guests. They were able to experience turbocharger production in Klingnau, which both Sævik und Klungsøyr found very impressive.

Island Offshore is well acquainted with ABB Turbocharging as a service partner in Norway—a cooperation which has run smoothly for years. “For us it’s important to have short response time and to fix problems quickly and reliably,” Sævik notes. “ABB Turbocharging has proven to be a very good supplier.” “With our Service Stations we are close to our customers and close to their needs,” says Sales Manager Truls-Magnus Lindseth, who works in Oslo. In saying this, he makes it clear that customers can also be regarded as colleagues. “Above all, we have the common goal of keeping the turbochargers in top condition; there is a common understanding of the products and we communicate well together,” he confirms.

Island Wellserver in figures

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Interview

Head of ABB Turbocharging’s Center of Excellence Oil & Gas Offshore, Joachim Bremer.
Safety and reliability is the focus

The oil and gas offshore industry will continue to grow. Joachim Bremer, head of ABB Turbocharging’s Center of Excellence Oil & Gas Offshore and head of ABB Turbocharging in Scandinavia, understands what that means for business.

Interview Tiziana Ossola Auf der Maur, Photography ABB Turbocharging in Scandinavia

What is the importance of the oil and gas offshore business to ABB Turbocharging?

Oil and gas offshore is a strongly expanding segment within the marine market, driven by the world’s constant thirst for energy from depleting finite resources. Currently, about 10% of our installed turbocharger population is running on offshore vessels. However, the current ship newbuilding order book shows that about a third of recently ordered vessels will be employed in the oil and gas offshore segment, and demand remains strong. Thus, the segment’s importance will likewise continue to grow in terms of turbocharger new business as well as service.

Tell us about ABB Turbocharging’s offering in oil and gas offshore?

The oil and gas offshore industry is a close partnership of the marine sector with the petroleum industry, with a very high focus on reliability, safety and risk minimization. This is a perfect match with

We do all we can in the very early stages of design to ensure that the turbocharger can be operated safely at all times.
Interview

ABB Turbocharging’s strengths and philosophy. Consider our long established and proven features, like containment (see page 9) and the safety design concept (SIKO). With these we do all we can in the very early stages of design to ensure that the turbocharger can be operated safely at all times and so that – in the worst case – no consequential damage arises. Or look at our unique, dense service network with dedicated turbocharging professionals at literally every appropriate location in the world. All this supports our customers in achieving reliable, safe and efficient daily operation, so that they can focus on their own businesses and serve their clients as well as possible.

In addition, we also offer service tailored to customer’s needs. Being able to perform turbocharger service rapidly at very short notice is vital for oil and gas customers, who place the highest priority on the availability of their ships. Under our “Swing Unit Concept”, customers get an exchange turbocharger and can go back to sea straightaway. While they are away, their turbochargers are serviced.

Where is ABB Turbocharging represented in the worldwide oil and gas industry?

We are continuously optimizing our global Service Station Network and now, for example, we are covering the coast around Africa quite well. Additionally, we are planning to open soon a new Service Station in Tromsø in northern Norway, to be close to our customers in that developing region. Our extensive worldwide network of more than 100 Service Stations is absolutely fit-for-purpose for the global oil and gas offshore industry, be it in Brazil, the Gulf of Mexico, North Sea, Africa, South East Asia or Australia.

How is the oil and gas offshore business developing?

The new wells being discovered and brought on stream these days are all in more and more remote areas, in deeper and deeper waters and ever further from the nearest coastline. In these locations the industry works with floating production platforms instead of fixed installa-

Oil and gas customers place the highest priority on the availability of their ships. Being able to perform turbocharger service rapidly at very short notice is vital.
A good place to be

Joachim Bremer is head of ABB Turbocharging in Scandinavia. He has been living in Oslo, Norway for two years. A mechanical engineer, he was previously General Manager Business Development & Cooperations at Head Office in Baden.

The move to Norway was no problem for Bremer. Norway offers a high quality of life. Bremer appreciates a number of advantages that Norway has over Switzerland: “It’s wonderful to go out fishing in a boat with friends on the Oslo fjord on a summer evening. Cod, sea trout, floundre and mackerel. The fjords are teeming with fish of different kinds.”

Norway is generally a great place to live and work. “The people are very open, friendly and the work climate is similar to Switzerland. What is special here in Norway is the high emphasis on a good work-life balance, family and gender equality.”

Bremer is head of ABB Turbocharging in Scandinavia and is presently establishing the new Center of Excellence Oil & Gas Offshore. It is located at ABB Turbocharging in Norway due to the global leadership the Norwegian oil and gas industry clusters enjoy in terms of both the technology used and their market status. He is involved with existing circumstances and the future development of the industry worldwide.

And in Norway in particular?

In the past few years new oil and gas fields have been discovered in Northern Norway, including the area up toward the Barents Sea. The business is moving further north. Whole towns and regions, like Tromsø, which were previously rather sleepy, are now starting to boom.

Keyword Arctic: How does activity in deep sea areas measure up in terms of safety and environmental protection?

That is an important subject. The whole sector is under an obligation to act responsibly. Indeed, to a great extent this awareness exists. Both with the field operators and the large oil companies, as well as with the shipping companies that provide the infrastructure and sustain day-to-day operations. All are doing their utmost to minimize risks. Quite rightly, standards for safety, quality, risk management and environmental protection here are as high as anywhere in the world. Mishaps are in no-one’s interest.

Under our “Swing Unit Concept”, customers get an exchange turbocharger and can go back to sea straightaway. Meanwhile their turbochargers are serviced.
Offshore in Brazil

The platform support vessel (PSV) CBO Arpoador, seen here off Copacabana, is designed for the flexible transportation of bulk and general cargo to Brazilian installations offshore. It was delivered in 2013.
ABB Turbocharging offers a range of products and services to the growing oil and gas offshore industry. High standards of safety are paramount in this sector.

Text Francisco Lopes and Fabricia Morais, Photography CBO
The Brazilian oil and gas industry is going through a time of great change. The country, which already previously had a robust infrastructure for exploration and production activities offshore, and led global production of hydrocarbons in deep and ultra-deep waters, significantly expanded its growth opportunities in 2007 with important oil discoveries in what is called the “pre-salt layer”.

“Pre-salt”, a geological term, is a cluster structure lying below the salt layer that was formed later. The pre-salt is located off the Brazilian coast, extending for 800 km. In certain coastal areas, the layer can be as much as 2,000 meters thick. The distance between the surface of the sea and the oil reservoirs can be as much as 7,000 meters.

Petrobras, a Brazilian state company responsible for the oil and gas industry in Brazil, has formulated the ambitious goal of reaching the country’s new reserves and increasing its oil production by 2020, especially in deep pre-salt layer waters. This challenging project is having a strong impact on the whole value chain of this particular business, such as exploration, underwater construction, oil recovery, ship construction, platform support, as well as on after-sales services.

Well-trained for Campos bay’s platforms

ABB Turbocharging is present in Brazil with Service Stations in Santos, Rio de Janeiro and Manaus. In 2005, the Rio Service Station was inaugurated to serve Brazil’s oil and gas offshore market, strategically located to operate on Campos Bay’s main platforms, located 300 km from the coast, and to serve Brazil’s largest ship repair and construction yards. ABB Turbocharging’s experts also carry out offshore services all along the coast of Brazil, such as repair or maintenance work on oil platforms and all kinds of supply vessel.

For this, ABB Turbocharging has set up a well-trained team of professionals and qualified maintenance engineers, conversant with Petrobras’ high standard of safety rules for offshore work. Periodically, every engineer has to complete a number of training programs, such as preparation for rescue and evacuation out of helicopters and platforms, as well as health and safety techniques and procedures. Annual health checks are mandatory. Marc Paredes, LBU-Manager ABB Turbocharging in Brazil, explains: “People working in potential hazardous offshore environments require a strong health and a proactive safety culture. These qualities are highly requested, monitored closely and very strictly by oil companies.”

Since ABB integrated CBO’s turbocharger fleet into its maintenance programs, there have been no more breakdowns.
In just the last half year, the CBO vessel fleet equipped with ABB turbochargers increased from 20 to 23.

and gas offshore companies. Every effort is made to prevent accidents that could injure people or damage the environment and equipment. Safety, high quality and reliability are going hand in hand: A healthy, well trained and safely acting professional is also an efficient and well performing professional.” To illustrate safety aspects offshore, Paredes gives a picture: “Offshore vessels operate next to platforms. An engine failure or a turbocharger breakdown can cause problems with the propulsion. Should the vessel no longer be maneuverable, it could hit the platform and cause serious damage. Maximal safety minimizes all kind of risks.”

Fulfilling high expectations

As said, safety, quality and reliability go hand in hand. Quick response times and locally available inventories help to avoid operational problems on site and equipment downtime. Many oil and gas offshore companies carry out audits in order to guarantee the service company's quality standards and compliance with Petrobras' high expectations. Companhia Brasileira de Offshore (CBO) is a maritime company specialized in the petroleum platform support sector and is based in Rio de Janeiro. The CBO quality standards determine the choice of business partnerships. CBO selected ABB Turbocharging as the preferred partner for turbocharging, delegating the maintenance, repair and overhaul of turbocharging equipment to ABB. With success, since ABB integrated CBO's turbocharger fleet into its preventive and predictive maintenance programs, the equipment has not caused any problems whatsoever. There have been no more breakdowns.

For Paulo Conte, Operations and Maintenance Director at CBO, these are the aspects that make all the difference: the guarantee that comes with purchasing high quality products with immediate availability, service quality from system implementation to maintenance of the entire turbocharger fleet and the availability of round-the-clock service with rapid response times. Currently, the company is committed to modernizing its fleet in order to adapt to the more complex operations in the oil and gas offshore business. In just the last half year, the CBO vessel fleet equipped with ABB turbochargers increased from 20 to 23.

As Marc Paredes emphasizes, “ABB Turbocharging has many years of experience working with oil and gas offshore businesses in Brazil. We are committed to delivering quality in both our products and services. But that’s not all. ABB Turbocharging is one hundred percent responsible for safety. That goes for every professional in every operation.”

The overall engagement is recognized and acknowledged. Only a few weeks ago CBO demonstrated its complete satisfaction by certifying ABB’s compliance with central aspects that every business activity in the oil and gas offshore demands: “Security, environment and health.”
First choice for maritime training

The Dalian Maritime University in China is acquiring a freighter as a training ship for master marine engineers, prospective maritime instructors and superintendents. It chooses turbochargers from ABB. “We are fired up about this project,” says Markus Kohling, the ABB Turbocharging manager responsible.

The pleasure was mutual. High ranking representatives of the Dalian Maritime University (DMU) recently welcomed ABB Turbocharging Vice President Axel Kettmann, Senior Global Project Manager Markus Kohling und Sales Manager Andy-Cong Chen to Dalian, to prepare a planned cooperation between the two partners and to confirm their common interests.

This year DMU ordered a 30,000 dwt multi-purpose heavy-lift vessel with 11,000 kW of engine power and all that involves. It is ocean-going and can do everything a conventional merchant vessel can do. It is suitable for the transport of dry bulk cargo like grain, salt, sugar, metals and mineral ores, but also commercial vehicles and yachts.

The owners are going for the highest quality: The components are all state-of-

11,000 kW of engine power with A165 turbochargers from ABB: Visualization of the planned training ship.
The owners go for the highest quality: the components are all state-of-the-art, the suppliers hand-picked.

The owners go for the highest quality: the components are all state-of-the-art, the suppliers hand-picked.

For the best

A 200 meter freighter with the latest marine technology and providing real working conditions instead of simulators and lecture theatres: Which place of further education can offer its students this? With around 20,000 students DMU, on the East China Sea, is one of the largest specialist marine universities in China. It is a maritime institution under the Ministry of Transport of the People’s Republic of China. Its tradition as an academy for education and training in the area of shipbuilding and shipping goes back to the 1920s. And in all that time, the DMU has always enjoyed a high national and international reputation as a center of excellence.

That this university should be endowed with such a considerable investment is indicative of the importance that China attaches to its maritime industries. The country needs well educated personnel and consequently the availability of a high quality educational system. Anyone who has been chosen to complete several weeks of training on the ship belongs to the best. These are the master students who will later become teachers and instructors at the DMU, as well as the future superintendents of the Chinese marine industry. The courses encompass traffic engineering, navigation and mechanical engineering. The vessel will also be equipped for scientific research in these subjects.

Trained by ABB

A further education project of these dimensions is unique on both a national and international scale. “The project captured our imagination from the start,” says ABB Turbocharging Senior Global Project Manager Markus Kohling succinctly. “The fact that the DMU authorities, who are themselves engineering experts, selected our products has a historical background. We are recognized as world leaders in engine turbocharging, with a vast fund of knowledge and experience,” Kohling stresses. From 2015, the elite of the DMU will grow up with turbocharging technology from ABB. “This is an honor and a privilege.” Because what one learns as a student leaves its mark, as every mechanical engineer knows from personal experience.

The academic resources that the DMU can boast, so close to industrial reality with its whole value chain, is something Kohling could only have dreamed of as a student. The graduate of a technical university recalls: “I only saw fully equipped test stands like that used for the students at the DMU after my studies when I started my first job – as a matter of fact at ABB Turbo Systems Ltd.” For his diploma thesis on theoretical aerodynamics, Kohling had to buy himself a 20 MB hard disk computer from his own pocket, and in those days they cost far more, MB for MB, than they do today.

In the course of the delivery of the turbochargers, ABB Turbocharging will instruct the DMU lecturers so that they are capable of giving tuition aboard ship. It was also discussed whether experts from ABB Turbocharging should lecture on turbocharging as guest tutors. “ABB Turbocharging is open to proposals,” says Kohling. “There are certainly many of us who would like to swap an office job for a job in a lecture theatre on a training ship for a day or two.”
Developing to benefit the customer

Upgrades: Tailor made solutions significantly improve a turbocharger’s capabilities. Fuel saving is just one positive effect.

Text: Axel Martin, Photography: Michael Reinhard

Engine operators around the world have seen their operating costs increase significantly over the past decade, and mainly due to the escalating price of fuel. Hence, operators are always looking for ways to meet these new challenges. As a consequence of this market trend and to support its customers, ABB has developed different turbocharger upgrade packages providing added value for our customers by reducing the operating costs.

How does it work?

As a technology leader, ABB Turbocharging is continuously developing new components and technologies to further improve the capabilities of its turbocharging systems.

The implementation of these developments into existing turbocharger platforms running in the field is an attractive option from which customers can benefit. The available solutions are as versatile as our customers’ expectations.

As an example, application engineers at ABB have run computer simulations to evaluate the use of a new, high efficiency compressor stage in existing turbochargers, this having turned out to be the most promising option. The simulation revealed a potential fuel saving of about 1%. After the design and manufacture of the parts to be modified, these were installed during regular maintenance of the turbocharger in order to carry out a field test. The proximate measurements even slightly exceeded the expected reduction in fuel consumption.

Taking into consideration that the annual fuel costs for large diesel engines can easily reach tens of millions of dollars, a saving of 1% reflects a significant amount of money.

As a secondary effect, the exhaust gas temperature level dropped about 40 °C after the installation of the new, high efficiency compressor stage, also in line with the computer simulations. This will have a positive impact on the lifetime of all components affected by the hot exhaust gases and further contribute to a reduction in the operating costs.

The above mentioned upgrade is just one example of a range of solutions ABB can provide. To reach the optimum in a given situation a tailor-made solution is essential, and only a technology leader like ABB Turbocharging can provide it. The following optimizations give an idea how an upgrade could have a positive effect on your operation.

- Reduction in fuel consumption.
- Longer time between overhauls (TBO).
- Increased efficiency stability.
- Reduced thermal loading of components.
- Resolution of operational restrictions.
- Competiveness of installation maintained.
- Spare part availability.
- Emissions (e.g. NOx) reduction.

TPL-A turbocharger with components for a compressor stage upgrade highlighted.
The best upgrade solution needs to be determined case by case. During meetings with the customer, ABB Turbocharging collects the information relevant for selecting the most promising solution for an individual installation.

In all cases, the engine and turbocharger need to fit together well. In many cases, to achieve the maximum operational benefits it is essential to cross the borders of the turbocharger and to involve the engine builder as the specialist for the complete system.

**Upgrade levels**

When talking about upgrades, ABB Turbocharging differentiates between different execution levels:

- Exchange single turbocharger components.
- Exchange the complete turbocharger by a similar or technically optimized version.
- Replace with a completely new turbocharger (identical outline dimensions).
- Replace with a completely new turbocharger (different outline dimensions).

The easiest way is to exchange single components of an existing turbocharger. Usually, these modifications can be done during a normal overhaul of the turbocharger without additional engine downtime.

Alternatively, an existing turbocharger can be replaced by a new unit featuring different properties such as higher efficiency compressor stages or turbine stage, or components with special coatings. If the outer dimensions and connecting positions are similar the adaptation is easy; otherwise new adapter parts are needed to connect the new turbocharger.

Considering the costs, pay-back times of three years or less are realistic, and if such upgrades are conducted at the time of an exchange of the rotating components, the additional upgrade costs are minor.

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**Axel Martin** graduated as a mechanical engineer at the University of Applied Sciences in Konstanz, Germany. 2005 he completed his studies in Konstanz with a master’s degree in mechanical engineering and international sales management. Axel Martin joined the engineering department of ABB Turbocharging in 2003. Today he is Team Manager Technical Service.
Harmony in the shape of a cake

Berries harmonize wonderfully with cream and vanilla. The Norwegians have enshrined this idea in a classic dessert: Bløtkake. This is the international feel-good-recipe No. 8, to be first eaten with the eyes.

Text Tiziana Ossola Auf der Maur, Photography Roger Hardy/Samfoto

The western world knows many classic desserts based on berries, cream and vanilla. They are tastes which ideally complement each other. In Norway, this combination is the perfect basis for the much loved Bløtkake, meaning "soft or wet cake". On Norway Constitution Day Syttende Mai (May 17) as well as on birthdays or at weddings, the airy, creamy cake forms a culinary backdrop in the shape of a gateau. In our suggested recipe, it consists of layers of sponge cake separated by a light vanilla filling, with the cake, in this case, wrapped in whipped cream. The fresh berries are used as a decorative topping and are a real eye-catcher.

Norway is not only rich in mineral resources; it also has a fantastic berry season. Nature’s bounty includes strawberries, raspberries and blueberries. Special mention should be given to Norway’s much loved cloudberries, which we recommend picking yourself from bushes growing wild.

If you prefer to carry your basket to the supermarket instead, no problem: Bløtkake can be made to your personal taste. You simply use the berries you prefer and that are available. Those who live in Europe or North America have the good fortune of being able to obtain native varieties in the coming weeks and months.

Strawberries forever

Berries are always a treat. You would hardly believe it, fine and delicate as they are, but berries truly explode with nutrients. In 100 grams of strawberries there is enough vitamin C, potassium, magnesium and calcium for one person for a whole day. Folic acid and iron also make them healthy eating for expectant mothers. They are even said to be an aphrodisiac.
Norwegian Bløtkake

**Ingredients**
1. vanilla sponge cake, sliced horizontally (one or more times)
2. eggs, at room temperature
3. 225 g sugar
4. 140 g plain flour*
5. 1 tsp. baking powder*
6. 1 tsp. vanilla extract
7. 250 g cream, whipped
8. 500 g raspberries and blueberries (or berries to your personal taste), washed
   (*Or 140 g self-raising flour)

**Preparation**
1. Preheat the oven to 175 °C.
2. Line the bottom of a 23 cm round spring-form pan with baking paper and smear with butter.
3. Beat the eggs in a large bowl with an electric mixer until frothy. Raise the speed on your mixer to high, and add the sugar gradually, beating until thick and lemon-colored.
4. Using a separate bowl, stir together the flour and baking powder. Reduce the speed of the mixer to low and slowly add the flour to the whipped eggs, mixing until just blended. Finally, blend in the vanilla.
5. Pour the mix into the prepared pan, spreading it out to the edges and bake for 25 – 30 minutes, until lightly golden. Check if cooked through with a toothpick – the center of the cake should bounce back when touched. Remove the cake from the pan and cool on a wire rack before slicing it.
6. Decorate the top with the whipped cream using an icing bag.
7. Add the berries as shown in the picture or to your own pattern.
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