

175 YEARS **BORSIG**



BORSIG 1837–2012

175 Years of Technology
for a Changing World



Vase commemorating the 25th
anniversary of Borsig, 1862.

BORSIG 1837–2012

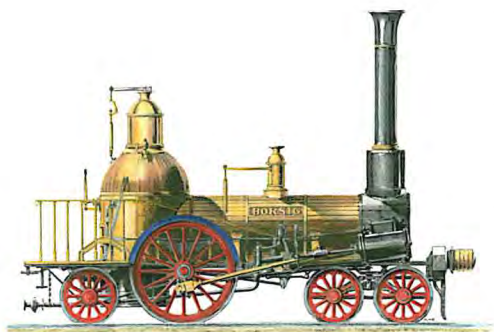
175 Years of Technology
for a Changing World



From the first cast to the 1,000th locomotive

August Borsig starts trading

On the eve of the German industrial revolution, the 32-year-old August Borsig had been a foreman at the iron foundry of Franz Anton Egells for over ten years, but had had plans to go into business under his own name for a long time. In 1836, Borsig invested his savings of 8,000 Prussian thalers and the money of two financiers in two plots of land in what was then the center of machine-building Berlin, the Chausseestraße. The first order soon followed as Borsig was contracted to produce 117,000 screws – despite the fact that he had almost no equipment to produce them. Borsig staked everything on completing the order, with production going on in wooden sheds and horses used to drive machinery; to work the bellows, Borsig even hired a troop of soldiers from a nearby barracks. This was only a temporary solution, however, and by 1837, Borsig was already using his first steam engine. On 22 July 1837, the first iron was cast on the site, and Borsig had a commemorative plaque made out of it. That date went down in history as the founding of this company that would soon become synonymous across the world with steam locomotives.



The first Borsig locomotive, 1841.

Prussia's first steam locomotive is built

It all began in early 1840, when August Borsig had the chance to examine the blueprints for two locomotives already running on the Berlin-Potsdam Railway, designed and built by an American, William Norris. Borsig was impressed, but saw plenty of room for improvement. By lengthening the boiler, Borsig increased his locomotive's performance, compensating for the higher weight by adding a dead axle to the rear of the driving axle, which he moved further towards the front of the body. The greater mass of the boiler allowed the locomotive more grip on the rails without the power wheels slipping, while the overall distribution of steam in the locomotive followed British designs. It was this combination of existing methods with original ideas that made the locomotive a success. In 1841, the first Borsig locomotive left the factory, named simply *Borsig 1*. On 24 July of that year, it competed against a British locomotive on the newly-opened Berlin-Jüterbog line – and won. Berlin's future "Locomotive King" had his crown and caught the attention of Prussia's actual monarch, Frederick William IV, who also took great interest in Borsig's steam engine, albeit not one mounted on wheels, but stationary.

An 80 Horsepower Fountain

Between 1745 and 1747, King Frederick II of Prussia had the rococo-style Sanssouci Palace built to his specifications in Potsdam. It had everything he had desired, with one exception: fountains shooting water high into the air. At that time, his designs simply could not be implemented for an affordable sum, and even 100 years later, many thought them utterly impracticable. Not August Borsig. For Borsig's young and growing company, the order was both its first large-scale commission and a matter of royal priority: the customer was none other than His Majesty Frederick William IV, who required a steam engine and a pump station – complete with foundations and stairs. Borsig's

real challenge was the steam engine, which was the most powerful yet to be built anywhere in Prussia. On 23 October 1842, August Borsig and his staff looked on nervously while the king awaited a demonstration of the finished fountains, and were relieved beyond measure as their engine unfurled 80 horsepower and sent a torrent of water 6.5 centimeters thick 36 meters up into the air. There could be no better recommendation for Borsig's suitability for prestige projects in and around Berlin, and soon the firm would be working with renowned architects such as Persius, Stüler, and Strack. Borsig was becoming a force to be reckoned with, and not just in Berlin; the company's name would soon be known across Germany and the world.

Albert Borsig takes over as the company expands

On 6 July 1854, August Borsig – by then a privy councillor to the Prussian throne – died, leaving his only son Albert an empire which had delivered 500 locomotives to date, with two supplementary production sites in Berlin's Moabit district, a sizeable private dwelling, and land with mining rights in coal-rich Upper Silesia. The young Albert had big shoes to fill. The 25-year-old had grown up in and around his father's firm, experiencing the astonishing rise of Borsig for himself. Now the question was how he, the Prince to the "King of Prussian Industry," could make his mark on the company. Albert Borsig's strategic goal was to bring the entire production process under his control, from raw materials to finished locomotives. His first move was to have modern winding towers erected over the coal bunkers his father had acquired in Biskupitz, Upper Silesia, with the first mining shaft being opened in 1856. To

lower production costs, he transferred iron and steel production and the Moabit rolling mill to Upper Silesia; the Moabit site was then used to manufacture boilers. The original Chausseestraße plant now became the central assembly site for Borsig locomotives, which were selling in increasing numbers abroad.



"The Borsig Establishment at Moabit"; colored engraving by J. M. Kolb, 1862.

Up until 1854, Borsig had never sold more than 3 percent of its production abroad, but by 1869, the company was exporting 58 percent. And while Albert Borsig had taken the international markets by storm, there was cause for celebration back in Berlin.

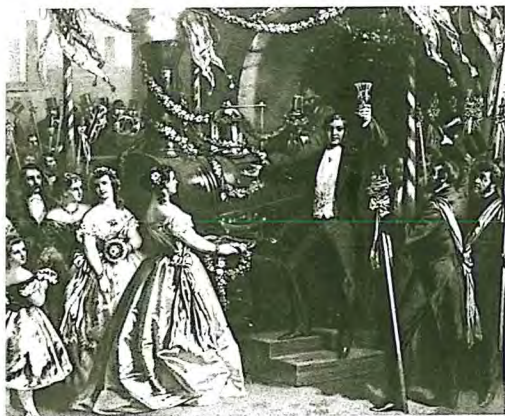
Berlin celebrates its 1,000th locomotive

It was a city-wide show that not even prominent academics such as Alexander von Humboldt could resist. Along with 30,000 Berliners, Humboldt watched as Borsig “christened” its 1,000th steam locomotive. Since 1841 and the *Borsig 1*, the Borsig plant had been producing an average of one locomotive per week – an impressive figure considering the high percentage of the

work that was still carried out by hand. Thus, on 21 August 1858, the *Borussia* stood covered with flowers under the factory gatehouse. The Borsig workers held their tools up high in celebration of each of the parts they had produced, and Albert Borsig gave a celebratory speech. A procession accompanied the *Borussia* from the plant at Chausseestraße through Moabit to the train station Potsdamer Bahnhof, where it was ceremonially handed over to its new owners, the Cöln-Minden Railway. The lasting applause for the 1,000th locomotive in the media was music to Albert Borsig’s ears, with Prussia’s most widely-read magazine of the

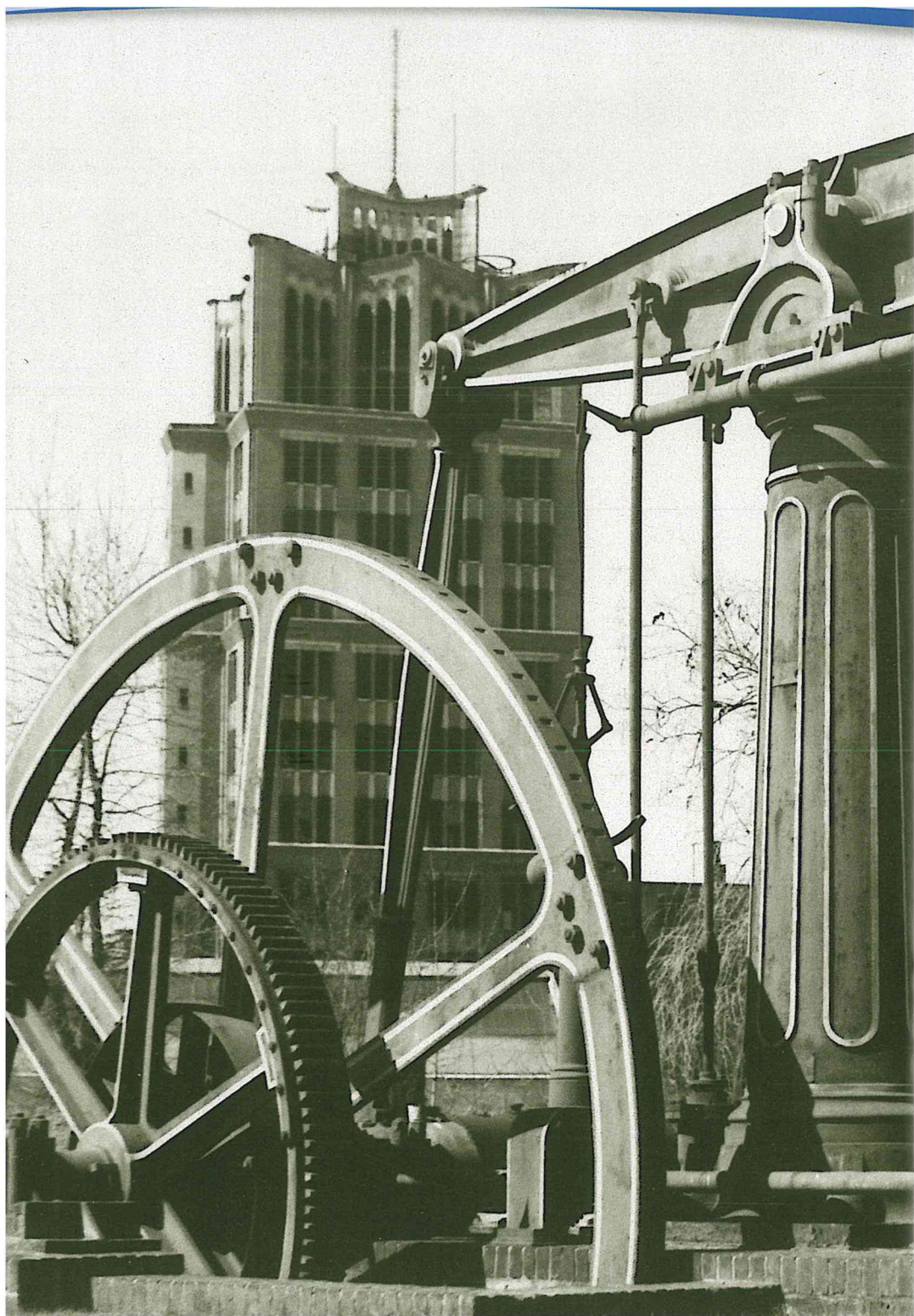
Albert Borsig “christens” his 1,000th locomotive on 21 August 1858.

time, the *Gartenlaube*, writing that “this 21st August 1858 shall take up a more important place in the history of mankind than many a celebrated day in the worldwide annals.”



1837–1858





From a family business to a subsidiary of Reichswerke Hermann Göring

The Third Generation

At their father Albert's death in 1878, Arnold, Ernst and Conrad Borsig were all still minors, meaning that a consortium of legal representatives had to take over the running of the family firm. Their hesitant decision-making and frequent disagreements almost ruined the company. The Borsig sons had spent years preparing for the moment when, in 1894, Conrad reached the age of 21, allowing them to dissolve the consortium and take control of the company. Ernst purchased a new site in Tegel, still outside of Berlin at the time, measuring 216,000 square meters – the equivalent of around 40 American football fields. The idea was to bring together the various factories across the city, and to add new facilities to produce piping, airlift pumps, and appliances for the chemical industry. Once the new factories were ready in 1899, Borsig could also start building locomotives again, an activity which the consortium had almost completely abandoned in 1886 as it was considered unprofitable. The brothers decided to try and prove them wrong. One of them, however, Arnold, died in an accident in the company's Upper Silesian coal mines and did not live to see the success his brothers made of Borsig, increasing turnover and profits, and expanding into new product areas.

The move into consumer goods

Back then, they were luxury products: in 1922, the Saugling, Borsig's first household vacuum cleaner, cost 140 marks. At only 3.8 kilograms including the motor, the turbine, and the dust bag, this vacuum cleaner was sensationally lightweight. Until then, machine

dust removers had been much heavier, some even being installed directly into walls, such as the Borsig vacuum cleaner in the Reichstag. Around the same time, another new consumer product, the refrigerator, was finding its way into the first houses and apartments. Borsig was able to use its experience in industrial cooling in this area, but even the smallest of its products was 2.5 meters high and 3.5 meters wide, with a capacity of 360 liters – a size which today would only be found in professional kitchens. The

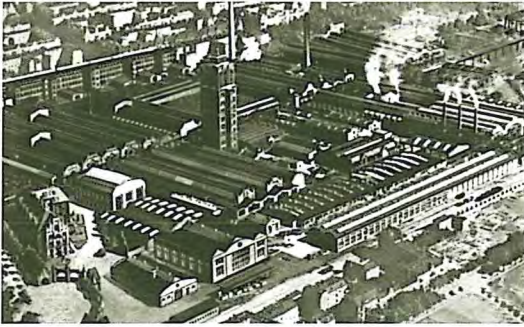


Household electrical dust vacuuming device, approx. 1930.

electricity consumption was astronomical, making this and the first vacuum cleaner niche products for the well-to-do: in 1925, only 25 percent of Berlin's households even had electricity. Nevertheless, with its Saugling and the first fridges, Borsig had shown how easy-to-use, safe, high-performance electronics could be integrated into the modern home. Meanwhile, Borsig was not just modernizing Berlin homes, but making its mark on the city's skyline, too.

The Borsig Tower

The Borsig firm already had a history of setting its goals high, and in 1924, this ethos was to receive an architectural expression. With a good economic climate, production at Borsig went up in the early 1920s, and the company's offices were bursting at the seams. On the existing site, space was at a premium, but placing new offices too far away would have slowed down the company processes. The perfect solution was to build upwards, and so Conrad and Ernst von Borsig engaged Berlin architecture professor Eugen Schmohl to design the capital's first high-rise office building. Contemporaries regarded the idea with scepticism, as skyscrapers were at the time an entirely Ameri-



The Tegel works and the Borsig Tower, approx. 1927.

can phenomenon; Berlin building regulations also prevented industrial structures from going over five floors. Despite this, Borsig received permission to build its high-rise offices, and the Borsig Tower's foundation stone was laid in 1922. Through the intervening inflation crisis in 1923, which made building

material scarce, the brothers stuck to their plan for a twelve-story tower, and it was completed in early 1924. At 65 meters, the Borsig Tower was only two meters lower than the Berlin city palace. Yet this was not necessarily a source of pride for many Borsig workers, who criticized the structure as an unnecessary extravagance during a time of economic crisis, questioning whether the company could afford this kind of building at all.

Insolvency and the takeover by Rheinmetall

For some years following the First World War, Borsig had made good money building locomotives, but the increased demand both at home and abroad due to war damage and reparations was soon satisfied. With the hyperinflation of 1923, Borsig's revenue declined sharply. In addition to the general economic climate, competition in the locomotive sector from companies such as AEG, Krupp, and Rheinmetall were adding to Borsig's woes. When the German state railways put all orders on hold for two years in 1928, the company was facing the wall. Arnold Borsig, the great-grandson of August Borsig, was subject to the harshest criticism, accused of having wasted money on pres-

*Rheinmetall headquarters in Düsseldorf:
Borsig became part of it in 1935.*



tige projects and supporting dubious friends. The company management and the family were able to avoid bankruptcy for several years, often by pumping their own money into the firm, but the sale of the entire locomotive production arm to AEG in 1929 showed just how desperate the situation had become. Borsig was left to limp on producing pumps, coolers, vacuum cleaners, and household goods, markets that would not help it survive the gathering world economic crisis. In December 1931, Borsig declared itself insolvent, and by March 1933, the only remaining course of action was to sell the company to the state-owned Rheinmetall AG – two months after Hitler had taken power in Germany.

Borsig becomes part of Reichswerke Hermann Göring



Celebrations for 1 May 1933 at the Borsig site in Tegel.

With the National Socialists' seizure of power as of January 1933, Germany's democratic structures were progressively dismantled, and many German companies were forced to fire opponents of the system, or look on as Jewish and communist members of staff were violently persecuted. Yet very few companies were as subject to the whims of the National Socialists as Borsig. In December 1935, Borsig became part of the Rheinmetall-Borsig AG, which was then bought up by a state-run company named after Her-

mann Göring in 1938. While the former Borsig sites in Berlin and Upper Silesia profited greatly from Hitler's rearmament policy, there were some signs of resistance: Fritz Lüben at the Tegel site organised an anti-Nazi group known as Mannhart, which counted around 25 Borsig employees. Meanwhile, Ernst von Borsig (junior) was part of the anti-fascist Kreisauer Kreis. During the Second World War, Borsig sites were increasingly run on forced labor. Prisoners from the East, especially Poland and what was then the Soviet Union, were often subject to horrific conditions at the barracks and camps in which they were held. While Hitler retreated to his bunker near the Reichstag, the war came to the city of Berlin with a vengeance, and Allied air attacks hit the Tegel site hard.

1878-1945



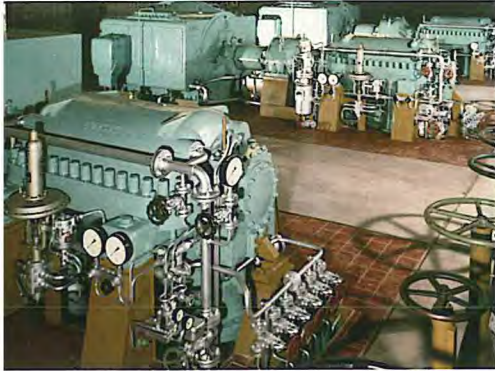


From post-war rebuilding to the Babcock era

The effects of the defeat

By early 1945, the greater part of the Borsig site at Tegel was in ruins, and even before the final German surrender, Soviet armies had already dismantled 2,000 machines at a total value of 25 million reichsmarks. Yet the Borsig workers kept going, and in 1946, there were 3,613 people employed at Tegel – until the shock of 1947. All work at the site ceased on the orders of the French occupying force, in whose sector the Tegel works were situated; most of the staff had to leave. The reason for the stoppage was the French claim for 2.5 million reichsmarks in reparations against Rheinmetall-Borsig, which would develop into a three-year-long legal struggle. In the meantime, some of the former Borsig workers started a new cooperative just five kilometers away from the Tegel site, which offered repairs and services for products and machines manufactured by Borsig. In November 1949, Germany's first peacetime chancellor Konrad Adenauer met with the three foreign ministers of the Western Allies at Petersberg near Bonn, receiving assurances that no more industrial equipment would be dismantled in Berlin; just a few months later, 700 of Borsig's old staff went back to work at the old site. The way was cleared for a return to large-scale projects – and for an entry into new markets.

Borsig goes into turbo compressors and ship engines



A turbo-compressor built by Borsig, 1960s.

In its 115-year history up until that point, Borsig had already produced and delivered hundreds of piston steam engines and gigantic coolers for maritime use, but the order to build a complete ship diesel engine for freighters nevertheless represented a major challenge. In order to be able to start production quickly, Borsig bought a licence from the Fiat factory in Turin and, eleven months later, Borsig's first ship diesel engine was ready for service. Built for the Lenz shipping company of Schleswig-Holstein, the 3,600 horsepower motor passed its first run with distinction on 27 November 1952. In 1960, Borsig extended its portfolio to include turbo compressors, which are used wherever large amounts of gas need to be reduced to a smaller volume – e.g. for gas pipelines or at refineries. Borsig's product range included compressors for a wide range of applications, and they were in high demand both on the German and the international markets. Just twenty years later in 1980, Borsig had sold its 775th turbo compressor to a customer in China. While Borsig did not renew its production licence with Fiat after it ran out in 1973, it has remained present on the compressor market: BORSIG ZM Compression, which has been a part of the BORSIG Group since 2004, still produces them at its site in Meerane, Saxony. In 1970, however, Borsig's sights were set further west – on the Rhineland.

The Babcock Era

Despite the fact that the name Borsig had been synonymous with German engineering for more than a century, post-war Borsig simply could not make it out of the red. It was not until 1970, when Borsig was sold to Deutsche Babcock AG of Oberhausen, North-Rhine Westphalia, that this trend was reversed. With the new owner laying off about 200 workers, Borsig staff were at first upset about the sale to Babcock. Yet just six years later, even the harshest critics had to admit that things were going well: since the take-

over, Borsig's revenues had more than doubled. The secret to this success was a strong focus on exports, with major orders coming from the Soviet Union and South America, and Borsig suddenly had cash reserves it could only have dreamed of before. The press raved about the "wonder of Tegel," and as the shooting star of German industry, Borsig increasingly overshadowed the growing difficulties of the overall Babcock corporation. Its board had been buying up ever more machine builders, including competitors of yesteryear, and management at Oberhausen was preparing to risk another round of buy-ins and acquisitions. By the early 1980s, Borsig was transferring more money to the corporation's accounts than it was receiving, meaning that its profits were being used to support other, less profitable investments. Much of its profit came through the worldwide development of oil and gas supply networks.

Ball valves for pipelines



In 1981, Borsig celebrated the sale of its 25,000th ball valve.

All pipelines need ball valves to regulate the flow of gas or oil. In essence, they have the same role as taps on water piping. As the name "ball valve" suggests, the design is spherical. Bored through to match the diameter of the pipe that it will be used to regulate, the ball valve is simply turned 90 degrees to shut off the gas or oil supply. When open, however, the open section simply forms

another part of the pipeline, allowing the fuel to flow through unhindered. Ball valves can also be fitted with automatic warning systems that turn them to shut off the pipeline if pressure drops due to a defect somewhere in the pipeline. Between 1960 and 1992, Borsig produced three different types of spherical valve, for example under the name Superbloc, quickly rising to become the worldwide market leader in this segment. As early as 1981, just twenty

years later, Borsig had sold its 25,000th valve to the Moscow Machinoimport company. Machinoimport bought 2,015 ball valves from Borsig in 1980-1981 alone, most of which were installed in gas pipelines from the Siberian isthmus of Jamal to Western Europe. What nobody could have imagined at that point was that, just ten years later, the overall political and economic playing field in Germany – and especially Berlin – would have changed almost beyond recognition.

The Berlin wall falls



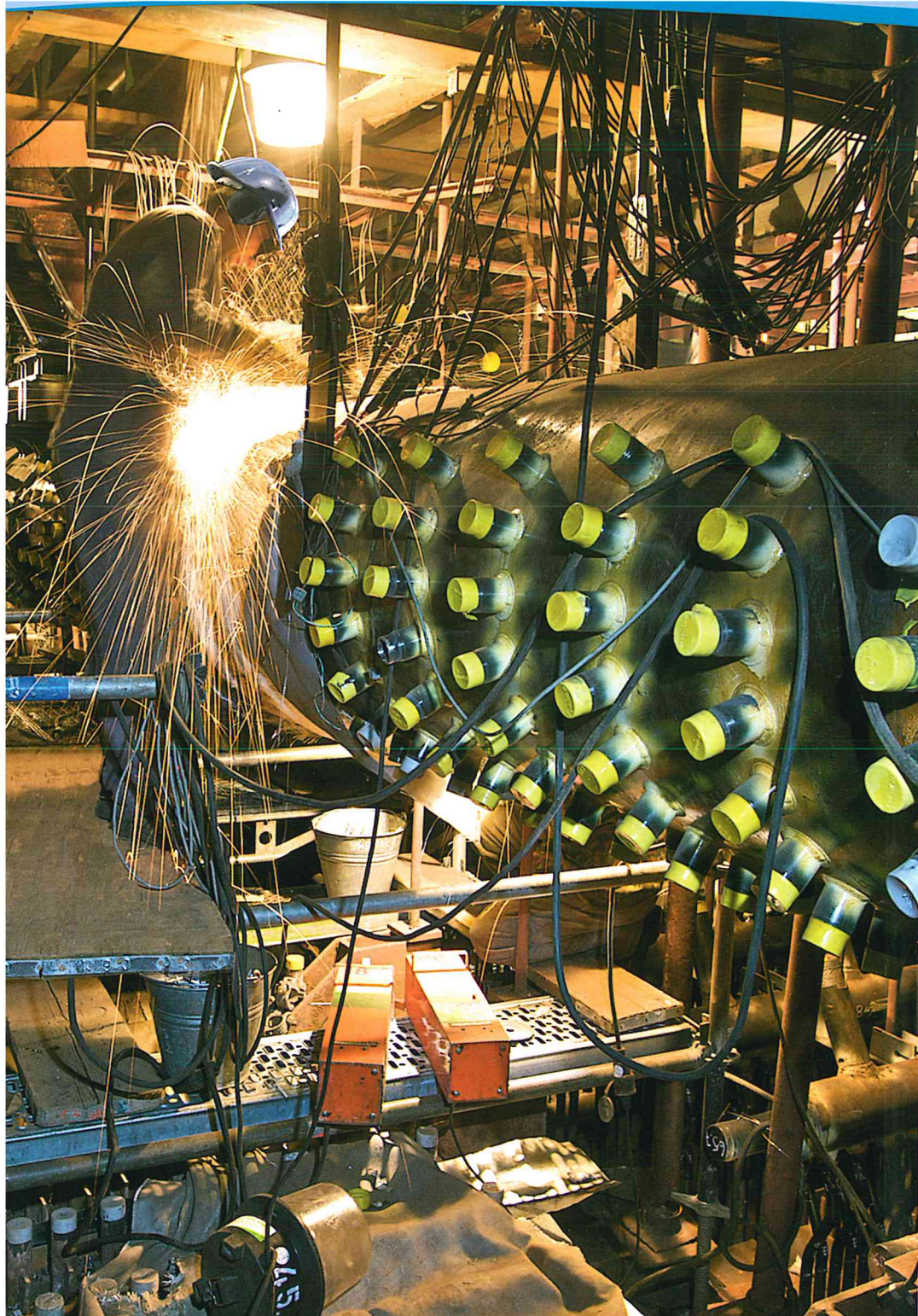
Three piston compressors, 1990.

Boundless joy as people from the East and West meet in the thousands on the Wall that had been so strictly patrolled for so many years, fireworks above the Brandenburg Gate to celebrate German reunification: the images went around the world, but nowhere was the end of the Cold War felt as keenly as in Berlin. There were celebrations at Borsig, too, located in Reinickendorf in what was now already the “former West Berlin.” Nevertheless, the dawn of this new era meant that the company had to adapt quickly. Subsidies from the federal government, which

had been paid to businesses in order to encourage economic activity in a city cut off from the rest of the free market, fell away, leaving Borsig 20 million deutschmarks a year worse off than before. Meanwhile, competition across the globe was increasing, and the Babcock corporation still required liquidity. Borsig was forced to cut back, with 400 redundancies in 1993. The construction of boilers, ball valves and absorption refrigeration systems ceased; the compressor arm of the company was sold to MAN. Working hours were made more flexible to allow Borsig to react faster to fluctuations in demand. To create synergetic effects across the company, five other Babcock subsidiaries joined Borsig at the Tegel plant, and much of the old site was sold off. Without a doubt, Borsig became a more efficient operation than ever before.

1946–2002





A fresh start as the BORSIG Group

BORSIG reinvents itself in 2002

When the Babcock-Borsig group, which had been created only a few years earlier in 1998, went bankrupt in one of the biggest insolvencies in German post-war history, the manager of Borsig's pressure vessels and heat exchangers division, Konrad Nassauer, was not surprised – and had an emergency rescue plan waiting in his desk drawer. Together with several senior members of Borsig staff, Nassauer had worked on a plan for a future after the concern-wide insolvency. Remaining staffing overcapacity from the Babcock days was to be reduced and manufacturing was to focus on its core competency – welding. The driving idea behind the plan was to move the business into a new private company – BORSIG GmbH – which would then be sold to an investor in conjunction with a management buy-out. After the insolvency practitioner and the creditors had agreed to it, the plan was implemented from September 2002 onwards. Circumstances played into BORSIG's hands: the Tegel works had full order books, and many long-standing customers were willing to help BORSIG, anxious to avoid it being split up into different companies due to its unique competencies. Several customers actively supported the transition process and paid for their orders in advance, which allowed the staff to keep working as usual; the success of the daring plan to save this traditional Berlin company was in no small part down to the mutual interests of BORSIG's management and its customers. As of 2003, 75 percent of the company belonged to the Berlin financial investor capiton AG, while 25 percent belonged to the BORSIG management. The crisis was officially over. BORSIG was ready to grow again.

The BORSIG Group is born



BORSIG ZM piston compressor for a gas storage facility.

As early as 1854, Borsig had expanded beyond the city limits of Berlin by acquiring the Biskupitz coal pit in Upper Silesia, and in 1949, the company purchased a site in Gladbeck. Yet it was not until 2006 that a group of companies was formed. With the Zwickauer Maschinenfabrik (ZM), founded in 1842, BORSIG acquired a real piece of German industrial tradition in 2004. Two years later, another new production site was added, this time in Hamburg in the form of the boiler construction company DIM KWE. 2006 also saw a new organizational structure put

into place, under which the BORSIG Group was created with five business areas: BORSIG Process Heat Exchanger GmbH in Berlin; BORSIG Membrane Technology GmbH in Gladbeck, Berlin, and Rheinfelden; BORSIG ZM Compression GmbH in Meerane (with a service office in Gladbeck); BORSIG Boiler Systems GmbH in Hamburg; and BORSIG Service GmbH with sites in Berlin, Gladbeck, and Hamburg. Within the group, the five areas operate independently, each with its own sales and production arms; the central BORSIG GmbH brings together internal auditing, accounting, legal and HR divisions, PR, and IT services. The five management teams meet on average at least once a month and discuss the overall positioning of the BORSIG Group. With this setup, BORSIG was ready to respond dynamically to market conditions, but there was still a logistics issue to be tackled.

Reactivating the Borsig Harbor

Over the years, the maximum load for Berlin's bridges was reduced ever further, until BORSIG was limited to transporting machine parts at 100 tons or under. For a company producing heavyweight machines that can easily weigh three times as much, this was a serious handicap. When this situation almost led to BORSIG losing a large-scale order, it became clear that the company would either have to re-open the harbor it closed in the 1970s or leave



The Borsig Harbor, 2007.

Berlin altogether. Relocation would have cost hundreds of jobs and deprived Berlin of a living piece of its industrial history, and so BORSIG management and several other industry representatives met with the Berlin city council and the Reinickendorf municipal authority to launch the idea of reactivating the Borsig Harbor at the Tegeler See (Tegel Lake). It would cost 4.2 million euros and require a roll-on/roll-off ramp for heavy-goods vehicles, as well as a dedicated 2,100 square-meter platform for mobile cranes. Today, the harbor allows BORSIG's Berlin site to ship 500-ton loads to anywhere in the world; and in 2008, the company took another step towards becoming truly international.

BORSIG as part of the KNM Group

The partnership between BORSIG and the Berlin financial investor capiton was never meant to be a permanent solution, and so once the company had expanded its business successfully after the fresh start in 2003, it set out on the search for a long-term partner with similar markets. In the search for a new partner, BORSIG could afford to be selective. In just six years, the management buy-out had more than just broken even, with a stable turnover in 2008 of 255 million euros and a staff of 500 – almost twice the number employed just six years before. Nevertheless, BORSIG did need a strong partnership to succeed on a global scale, and so it chose the KNM Group of Malaysia. Founded in 1990, KNM's principal activity is delivering industrial process technology for refineries, power plants, and bio-technology sites among others. This was a good fit to BORSIG's core areas, and allowed the German company better access to Asian markets. KNM also saw opportunity in the



A boiler on the move, 2007.

deal with BORSIG, bringing 350 million euros to the table. "BORSIG could become the jewel in our crown," said Chairman of the KNM Group Board, Lee Swee Eng, at the time. Yet Malaysia is not the only Asian country in which BORSIG is a well-known brand name.

BORSIG pressure vessels and heat exchangers for Fujian

At the beginning of the 21st century, China is the emerging global economic power, and this makes itself felt in its growing hunger for energy and raw materials. China is thus more interested than ever in efficient process technology, and BORSIG can share its knowledge to the benefit of both parties. A prominent example of BORSIG's activities in China is the petrochemical plant at Quanzhou in the south-eastern province of Fujian. Begun in 2007, the



Fujian petrochemicals site, 2009.

\$3.5-billion investment alone shows just to what extent the Chinese-American-Saudi consortium behind the site wanted to set new technological and quantitative production standards. BORSIG supplied 45 quench coolers at 27 tons per piece; they are used to fast-cool synthetic gases down from up to 900 degrees Celsius. In addition to this, BORSIG delivered three reactor-cooler systems for producing synthetic gas with a total weight of 470 tons. These are all core elements of a petrochemicals site, and any defects in them would cause problems across the entire system. For this reason, reliability is es-

sential, and the fact that BORSIG was chosen to produce these components shows the level of trust that the company's customers place in it 175 years after it was founded.

BORSIG Process Heat Exchanger GmbH

Finding leading technologies for innovative solutions – that has been BORSIG's company philosophy for 175 years. The product portfolio includes pressure



A waste heat recovery system being shipped.

vessels, heat exchangers, compressors, membrane systems, industrial boilers as well as boiler and power-plant technology, all of which function reliably around the world thanks to 650 eminently qualified professionals at six different locations. BORSIG Process Heat Exchanger GmbH in Berlin is home to the experts for waste heat recovery systems, which are employed in numerous chemical and petrochemical facilities. The overarching purpose of the BORSIG-made devices is to take synthesis gas originating from the splitting of petroleum or natural gas with a catalyst in a reformer furnace, and to cool it from anywhere between 900 and 1,500 degrees Celsius down to roughly 350 degrees Celsius for further processing; water serves as the coolant. The cooling process results in high-pressure steam, which is channeled into a steam drum and used for energy generation – to power turbines, for instance. The distinguishing feature of the waste heat recovery boilers developed by BORSIG is their thin tube sheet, which measures only about 20-30 millimeters.

Transfer line and scraped surface exchangers

Ethylene gas is indispensable to the production of bulk plastics. Although ethylene is a natural resource, these days it is industrially produced in huge facilities around the world. This process involves thermally splitting long-chain hydrocarbons extracted from petroleum into cracked gas (short-chain hydrocarbons) in a cracking furnace (also known as a “cracker”) at approximately 1,000 degrees Celsius. The cracked gas contains ethylene among other gases. In order to achieve the highest ethylene yield, the cracked gas has to be very rapidly cooled to approx. 400 degrees Celsius. This process is made possible by the BORSIG transfer line exchanger. The Berlin-based company is the global market leader in this field. BORSIG transfer line exchangers are available as tunnellflow and linear coolers. The client's plant design is crucial



Transfer-line exchanger in an ethylene cracker.

in determining the appropriate construction. An entirely different type of cooler is the scraped surface exchanger, which is used for example in the dewaxing of lube oil. It is necessary to remove almost all traces of wax contained in lube oil in order to prevent it from causing severe engine damage during use. The paraffinic lube oil flows through an internal tube in the cooler. The surrounding external tube contains a freezing agent that cools the lube oil-paraffin mixture to approx. -30 degrees Celsius. This causes the paraffin to crystallize along the surface of

the internal tube, where it is continually abraded by a rotating scraper blade. The separation of the paraffin occurs in downstream drum filters.

BORSIG ZM Compression GmbH

In 2004, some ten years after the sale of the in-house centrifugal compressor division to MAN, compressors once again became part of the BORSIG portfolio. This business segment is now based in Meerane, Gladbeck and Flensburg, and draws on the long-standing tradition of the Zwickauer Maschinenfabrik, which was founded as early as 1842. Today, BORSIG ZM Compression GmbH acts as a full-range supplier of reciprocating and centrifugal compressors. Reciprocating compressors work much like a reversed internal combustion engine in accordance with the principle of positive displacement. The gas flowing through a cylinder is compressed in a piston and discharged through valves upon reaching the desired pressure. The resulting increase in pressure causes the temperature of the compressed gas to rise, so that it has to be cooled prior to further compression. Reciprocating compressors enable very high final pressures. If very large volumes of gas are to be moved, centrifugal compressors are possibly the better choice. Much like a turbine, this type contains one or more rotors with vanes. The gas flows axially into the rotor, the rotation of which increases gas pressure. The gas subsequently discharges from the compressor through a radial opening in relation to the rotor.

BORSIG Membrane Technology GmbH

The term “membrane” describes a layer that is only permeable by certain substances. In the human body, membranes support vital functions such as digestion or the absorption of oxygen into the bloodstream. However, membranes are also produced artificially for industrial use. This is the expertise of BORSIG Membrane Technology GmbH based in Gladbeck, Rheinfelden and Berlin. Industrial membranes may consist of plastic, metal or ceramics. To name an example: BORSIG Membrane Technology GmbH employs these thin membranes to purify exhaust air, for instance in so-called BORSIG vent recovery systems that are used at petrol stations around the world. One highly desirable side effect is that the re-liquefied gasoline separated from the air can be reused later on. Such facilities take on considerably larger dimensions when they are deployed at fuel depots, and BORSIG Membrane Technology GmbH produces these constructions, as well. However, the industrial applications of membrane technology go well beyond the cleansing of exhaust gases: membranes are also an indispensable component in the preparation of biogas or the manufacture of synthetic materials.



Recovery of propylene monomers during plastics production.

BORSIG Boiler Systems GmbH

As early as 1841, a steam boiler was the central component in the first BORSIG-made locomotive. To this day, various industrial processes cannot function properly without a boiler. At BORSIG today, Hamburg-based BORSIG Boiler Systems GmbH is responsible for the field of boiler construction. The underlying functional principle has barely changed over the past 175 years. A steam boiler consists of a combustion chamber and subsequent heat exchangers. Fuel is incinerated in the combustion chamber. The resulting hot flue gas flows into a water tube boiler, which generates steam from the water.

The steam-water mixture is then fed into a steam drum, where it is separated into water and saturated steam. To produce hot steam, the saturated steam is once again channeled through the boiler for overheating. Residual heat from the fumes is used to preheat the water. Naturally, it is also possible to produce only hot water – to be used in an urban heating station, for example. Because the circuit is normally pressurized (typically at 10 bar), it is possible to heat water to over 100 degrees Celsius without evaporating it.

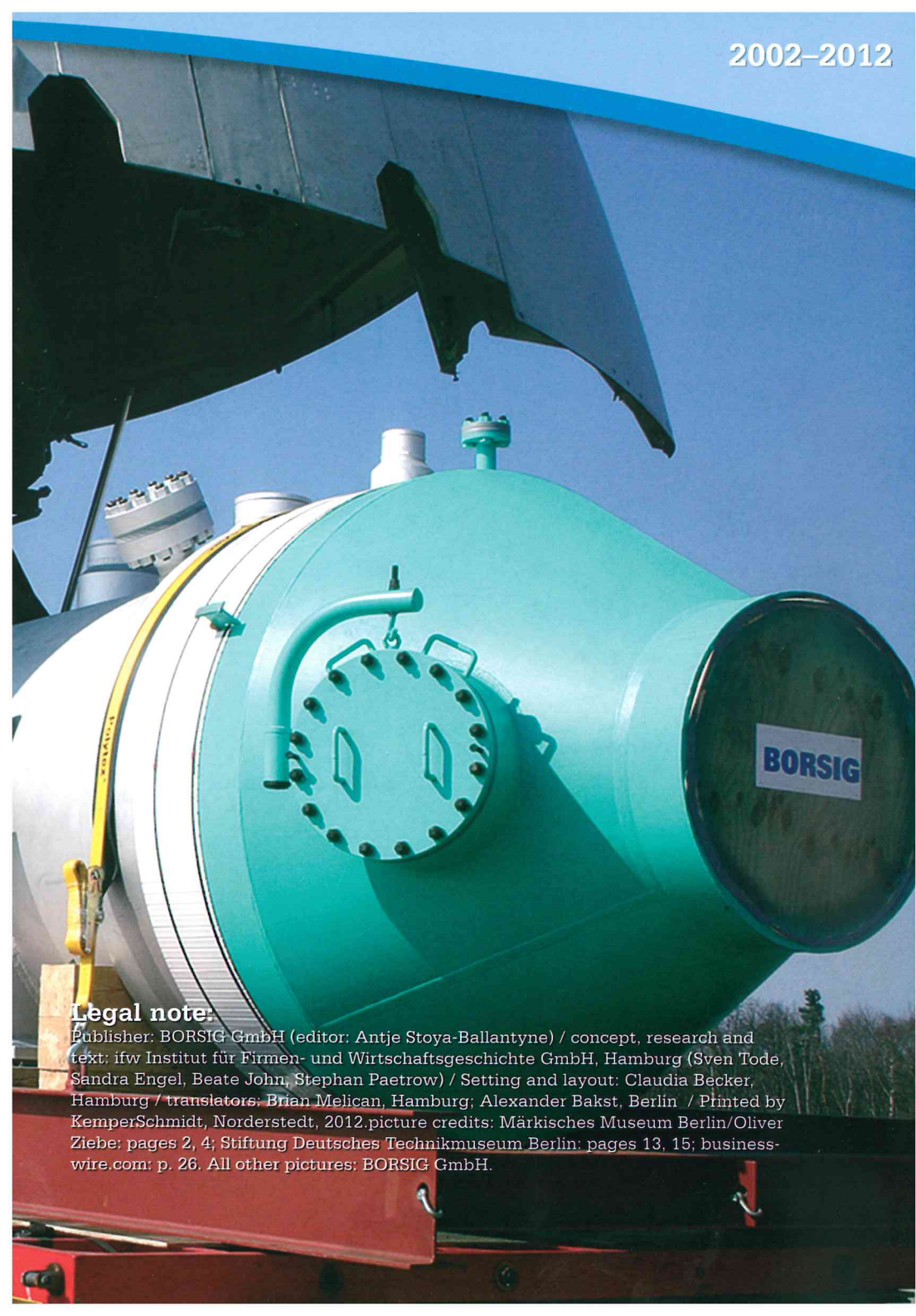
BORSIG Service GmbH



Repairing a ball valve.

The breakdown of even the smallest components in power plants and industrial facilities can have dramatic consequences within a short amount of time – including the standstill or even failure of the entire facility. That is why service and installation engineers bear great responsibility. BORSIG Service GmbH based in Berlin, Gladbeck and Hamburg disposes of wide-ranging experience in the planning, implementation and completion of various installation and maintenance services for new and existing facilities. In this context, the scheduling of necessary repairs is already of great significance. The goal is to avoid costly downtime to the greatest possible extent. If a facility outage does occur, rapid response times are key. When service work cannot be

performed on-site for technical reasons, the maintenance of containers, instruments, pumps and other components takes place at the service workshop in Gladbeck. BORSIG Service GmbH specializes in complex assembly jobs for components in new industrial facilities using structural elements with a weight of up to 50 tons and a height of up to 100 meters. This would be unthinkable without special tools and expertise. If nothing else, the BORSIG staff can draw on 175 years of company history since 1837.

**Legal note:**

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