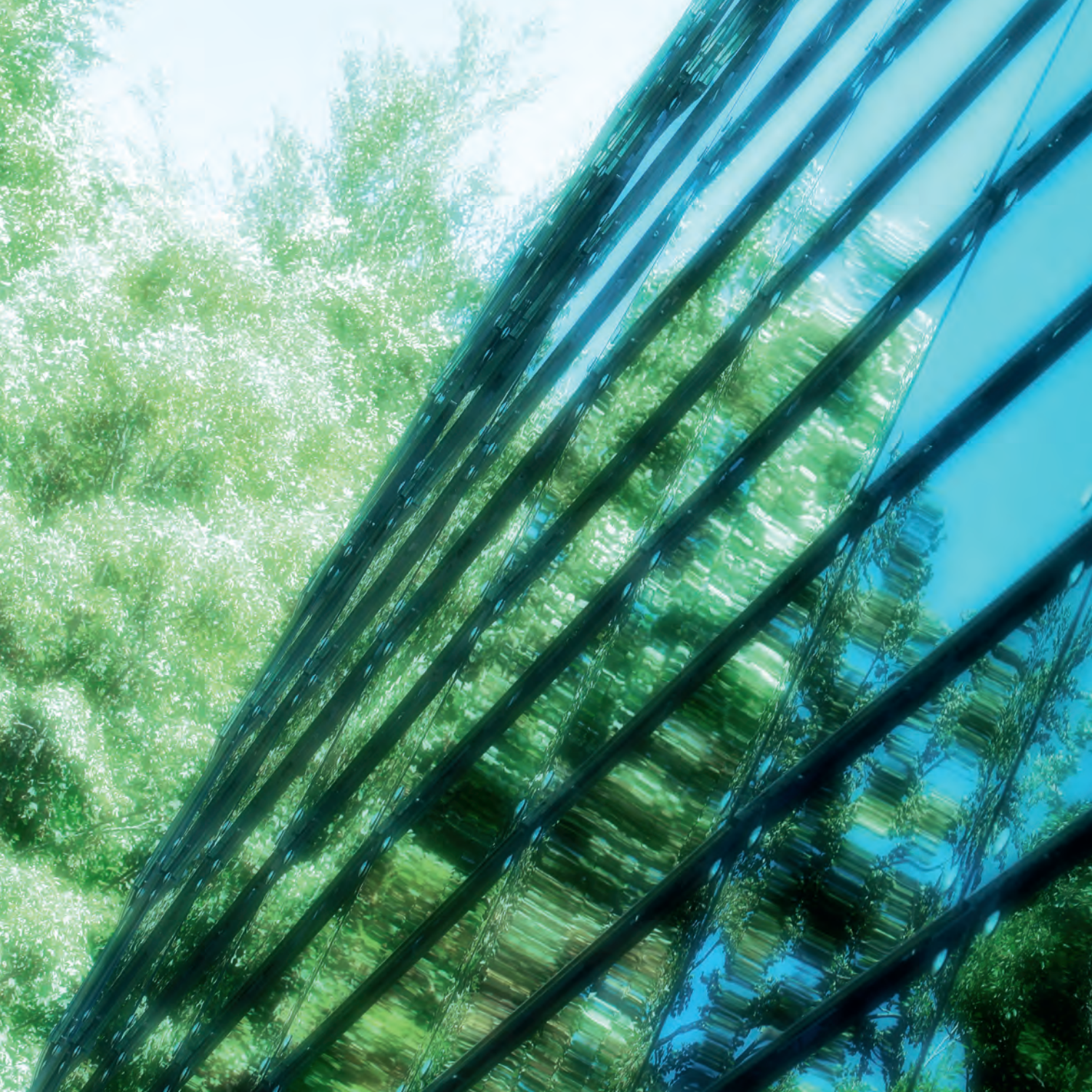




**BOYSEN**  
INNOVATIONEN ABGASTECHNOLOGIE



# We are Boysen

Boysen is a specialist for exhaust technology. We develop and manufacture exhaust manifolds, catalytic converters, diesel particulate filters, silencers and complete exhaust systems. As a complete system partner for the world's leading car makers and commercial vehicle manufacturers, the industry has placed its trust in us for decades. We return this trust to our customers every day. With continuous innovations and the ideal solution to every problem. Such commitment pays off – Boysen is continuing to grow.

Growth needs objectives and vision. We certainly have plenty of both, but we also have something special besides: character. What does that mean? To put it quite simply: we are Boysen. **We do things better.**

# That's me

I only have one thing on my mind: the perfect combination of sound, pressure and resonance.

Combining power and refinement while helping to define the engine note.

I'm happiest when I'm working on efficient solutions for the future.

That's the world I live in, because I'm a **specialist for exhaust technology**.

(A Boysen employee)





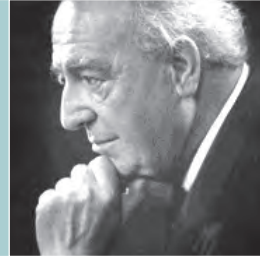
Since 1921, Boysen has constantly been linked with innovations in exhaust technology and with the development and production of silencing systems. As a full system partner, we also provide the automotive industry with integrated logistical concepts for synchronous supply systems. After all, being innovative also means from time to time showing imagination that goes beyond technical expertise. Only in this way can we develop tailor-made solutions that look to the future.

## Friedrich A. Boysen

Friedrich A. Boysen was the pioneer of modern silencer technology. In his studies in the fields of acoustics and flow dynamics, he was the first to take into consideration the effect of exhaust design on the charge cycle, engine performance and the torque curve. Boysen's test rig for exhaust silencers underlines his pioneering achievements – it was the world's first.

- Since 1921** Exhaust silencers for cars, motorcycles and aircraft  
Intake silencers and fresh air heating systems for cars
- 1925** Boysen's work in the field of exhaust silencing formed the technical basis for the first legislation on noise abatement
- 1932** Silencers produced on the basis of his patents were standard equipment in numerous motorcycles, cars, aircraft and locomotives in the 1930s
- 1945** Boysen receives "Authorisation to build an industrial facility for the manufacture of exhaust systems of all kinds" in Stuttgart
- 1949** Boysen relocates its production facility to Altensteig  
In the 1950s and 1960s, the exhaust specialist works for a number of renowned customers from the car and motorcycle industry: Auto Union, BMW, Daimler-Benz, DKW, Ford, NSU, Porsche, Heinkel, Zündapp and Kreidler
- 1975** On 27 October, one-and-a-half months after his 80th birthday, Friedrich A. Boysen dies in Stuttgart
- 2006** On 15 August, Elisabeth Boysen dies. The Friedrich and Elisabeth Boysen Foundation is the sole managing partner of the company

Today, Boysen is a company focused entirely on exhaust technology. Every Boysen employee has the ambition to put their expertise and ability into practice in development, testing, production and logistics. Supported by flexible ideas, pragmatic action and efficient decision-making processes. For fast, targeted results that set new standards.



Friedrich A. Boysen  
(1895–1975)

“I personally decided to use catalytic converters, because up till now they’ve produced the best results, and because it’s relatively straightforward to integrate a catalytic converter into a standard exhaust system.”

(Friedrich A. Boysen in a television interview on 8 January 1965, in answer to a question about the type of exhaust gas treatment that, in his opinion, would be most successful.)

Just under ten years later, catalytic converters were used for the first time in the USA.



# I go my own way

Acoustics, dynamics, performance – parameters that count in a finely tuned exhaust system in a limited space. To put innovations into practice and achieve cost-effective production, you need imagination and foresight for what is essential. In the end, what counts is **the result.**  
(An engineer from Boysen's development department)







9

Our methods and techniques for guiding exhaust flow combined with process-oriented production systems are groundbreaking in exhaust technology. Combining a Helmholtz resonator with an exhaust valve is just one example of the creative potential of Boysen's development engineers. They create innovations in the tightest of spaces and know how to put them into practice in a way that makes sense. That is true engineering skill.

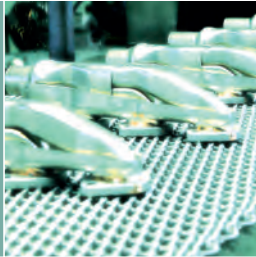
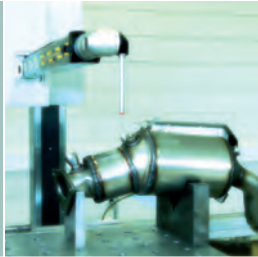
# Products



- 1975** Thermal reactor for rotary engines
- 1978** Reflection silencers
- 1987** Catalytic converters with a metallic substrate
- 1991** Catalytic converters with embedded wire cushion
- 1992** Series-production air-gap insulated exhaust manifolds
- 1993** Cartridge catalytic converters utilising stuffing technology
- 1994** Single-line tubular manifolds  
Helmholtz resonators
- 1997** Close-coupled metallic substrate catalytic converters  
Air-gap insulated diesel manifolds
- 1999** Close-coupled catalytic converters with stuffing technology

Major brands place high demands on the exhaust system. The perfect harmonisation of performance and acoustics in a limited installation space represents a huge challenge for exhaust engineers. For a specialist like Boysen, this is part of our everyday business. That's why the world's leading car makers trust us as a full system partner and original equipment manufacturer.

As an exhaust system specialist, Boysen produces manifolds, catalytic converters, diesel particulate filters and silencers. Complete exhaust systems for premium cars and commercial vehicles represent the upper end of our technological expertise. Our passion is quite simple: exhaust technology.



- 2000** Turbo manifold  
Silencer with an integrated catalytic converter
- 2001** Controlled Helmholtz resonator silencer
- 2002** Cartridge catalytic converter with 1200 cpsi substrates  
Tailored Pipes
- 2003** Exhaust manifold utilising brazing technology
- 2006** Diesel particulate filter  
Manifold-turbocharger unit with close-coupled ceramic catalytic converter
- 2007** Tailpipe trim production
- 2008** SCR technology  
Denox storage catalytic converter
- 2011** SCR systems for commercial vehicles



# I need years

Thinking five years ahead is normal for me. Simulating using the latest methods, building prototypes, evaluating tests – these are just means to an end. It's my attitude that counts.

I have to be where my customers and my partners are. **In the future.**

(An engineer from Boysen's development department)



Model changes in increasingly shorter cycles require a fast, flexible and systematic approach. Even as a new model is being presented, our engineers are already thinking about its successor. Boysen is a partner who is 100% committed to developing the exhaust systems of the future.

# Research | Development



- 1982** Computer-aided evaluation of performance measurements
- 1985** First application of HP Draft CAD system
- 1987** HP ME 30 CAD system
- 1990** Changeover to Unigraphics CAD system
- 1992** System development for car manufacturers  
Changeover to Catia CAD system
- 1997** Resonator with exhaust valve
- 1998** Compact manifold
- 2001** "Glass Factory": completion of the new prototype production facility
- 2002** New construction of the Product Design Centre  
Diesel catalytic converter · Lightweight design/systems  
New materials · Boysen exhaust valve

We are constantly looking for the ideal relationship between lightweight design and durability, between exhaust data and acoustics. State-of-the-art technology is a must. But for us, it can't be everything. Just as important is knowledge gained in practical experience, such as the interaction between production and development know-how. That's how we design and develop more efficiently.

When we need to bring the future of exhaust technology into the present as quickly as possible, our speed is our advantage. We are constantly streamlining our entire processes in every area. We demonstrate our foresight by advancing numerous research projects. To ensure that we are a true partner for our customers and securing them a decisive competitive lead in exhaust technology. Also in the long term.



- 2003** Hot gas valve, active and semi-active flange concepts
- 2004** Pro Engineer CAD system
- 2005** Catia V5 CAD system
- 2006** Determination of sectional strain from operational vibration analysis
- 2009** Bypass double exhaust valve for denox
- 2011** Heat exchanger  
Steam generator
- 2012** BASM – Boysen Active Sound Modelling (increase or reduction in the sound level)





# I look for limits

It's all a question of time. Compressing ten years into a few weeks. Testing all situations that a vehicle goes through. Only then can I be certain that our product will deliver what it promises. To ensure that my customers and I achieve our aim: **long-term success.**

(An engineer from Boysen's testing department)



Before we speak of series-production readiness, we test everything. In our laboratories and on the test rigs, our components are subjected to conditions that occur in reality. Even the fine differences made by a four-wheel drive system, for example, are taken into consideration. After all, we are specialists for exhaust technology.

# Testing



- 1920** First test rig for silencers
- 1988** First endurance and acoustics test rig
- 1992** New construction of Testing Centre 1  
Capability of testing all component-relevant parameters  
Acoustics testing of the engine and vehicle  
Endurance strength test stands  
Operational vibration analysis
- 1994** Modal analysis
- 1996** Introduction of computer-aided simulation technology
- 1998** Psycho-acoustics (sound laboratory)
- 2000** Test results database as an expert system
- 2001** Thermography, mobile temperature measurement

Those who enjoy a good reputation must leave nothing to chance. With all its capacity for innovation, the Boysen brand stands for high-quality components and systems. And we produce them in large quantities. Before it leaves our factory, every individual part is subjected to extensive simulations and tests. For all eventualities that a vehicle might be exposed to. Not only on test rigs but also on the road. After all, the greatest challenge still lives in practical application.

In our endurance tests, we compress ten years into just a few weeks. We deliberately look for limits. Vibration, acoustics, response times – Boysen engineers think of everything. How can the gas be made to flow evenly into the catalytic converter? How does the exhaust gas flow after combustion, independent of the engine speed? Our prototypes have stories to tell. And we understand them.



- 2003** New construction of Testing Centre 2 with innovative test rig technology  
Acoustic roller dynamometer test bench for all-wheel drive vehicles
- 2004** Hot gas generator for engine-Independent temperature testing of components
- 2005** Loading unit for exhaust gas turbochargers in hot gas simulation
- 2006** Extension of engine test rigs to include dynamic driving cycles  
Hot gas technology
- 2007** Exhaust analysis for SCR technology
- 2009** New construction of Testing Centre 3  
Dynamic pre-development test stand
- 2010** Dynamic hot gas test stand for close-coupled exhaust components  
Heat-transfer test stand
- 2011** Test rig for dynamic residual heat utilisation  
Test rig for emission components with controllable temperature increase

# I want perfection

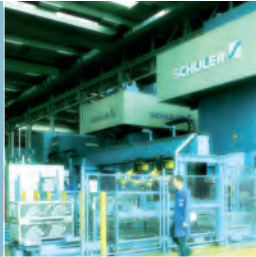
There are no excuses for when something goes wrong.  
I have to do everything I can to make sure processes run smoothly and  
at the same time to ensure continuous improvement.  
What my customers expect is a matter of course for me: **precision.**  
(A Boysen production manager)





Our customers are very demanding when it comes to the quality of the products we supply. For that reason, Boysen uses state-of-the-art methods and processes to guarantee process reliability from the raw material right through to the finished product.

# Production



- 1981** Robotised welding
- 1984** Complex pipe form manufacturing using hydroforming
- 1994** Hydroforming technology  
Transfer stage presses
- 1998** Short pipe production with laser technology
- 2000** Laser welding of manifolds and silencers
- 2002** Tailored Pipes utilising laser technology  
Offline programming of welding robots
- 2003** Brazing

Car makers are demanding smaller and smaller batch sizes with an increasingly high variety of variants. The consequences for us as suppliers are more flexible production, automation and rationalisation. We meet these requirements. We repeatedly find ways to implement the latest production processes in the best possible way. Our solutions have an impact on the entire exhaust technology sector.

Only those who use the very latest technology can satisfy their customers sustainably. Boysen has its own solution for every manufacturing challenge. Hydroforming for complex geometries. Laser welding to avoid welding distortion and spatter. Stuffing technology to produce thin-wall ceramic catalytic converters. Or an interlinked CNC sheet steel machining centre. These are all means to an end, to ensure that Boysen remains well in the lead in exhaust technology.



**2004** Fully automated stuffing technology for catalytic converters

**2005** Metal-spinning technology for catalytic converters  
Fully automatic optical measurement of components

**2006** CNC tailpipe trim production  
Exhaust valve with laser welding technology

**2007** Roller burnishing technology  
Plasma welding technology for silencers and  
automatic weld seam monitoring

**2010** Fully automatic production line for spun silencers

**2011** CNC machining centre

**2012** Fully automatic commercial vehicle SCR production line







# I want rhythm

Keeping in time. Delivering in the right sequence, at any time and to anywhere in the world. Understanding the customer, no matter what language they speak, in order to complete the circuit. I am someone who achieves more and develops more than just technical solutions.

For me, the main focus is on **process-oriented logistics concepts**.

(An employee in Boysen's project department)

# 25

The importance of the flow of goods is a constantly relevant issue also for Boysen. In 1993, we replaced the previous logistics concept in the exhaust sector with our just-in-sequence system. Today, our integrated worldwide logistics network is a modern interpretation of these requirements. What does that mean? To put it simply: the system partner Boysen is faster to respond worldwide – and faster to deliver.

# Logistics



- 1989** Material handling technology  
Driverless transport systems
- 1990** Control centre fine control
- 1991** Online operational data acquisition
- 1993** Just-in-sequence exhaust systems
- 2001** Fractal factory  
Material flow integrated into warehouse technology
- 2002** Material supply chain management  
Material flow simulation

Those who want to benefit their customers in the long-term need a strong organisation. For that reason, we have designed our integrated production system as a finely branched logistical network. At Boysen, the different areas are linked so efficiently that we can reliably supply all customers in Germany and abroad.

Our logistical concepts have always been ground-breaking. Various materials handling technologies at the Turmfeld plant or the first on-site assembly plant in Salching, Bavaria, where exhaust systems are produced just-in-sequence are just some examples. A further milestone is the BAK factory in Simmersfeld, with its high-bay warehouse as an integral part of the materials handling technology. Proof that Boysen is a partner with a system.



**2003** Fully automatic slit strip and tool warehouse  
Material handling via electric overhead conveyors

**2004** Customer-oriented sales process

**2006** Warehouse on Wheels for BMW's Leipzig plant  
Logistics systems BAK plant/press shop

**2009** Just-in-sequence for Mercedes-Benz Sindelfingen plant

**2010** New just-in-sequence production structure

**2011/2012** Three new just-in-sequence production plants worldwide



# We take positions

Where we are is Boysen. In close proximity and at home everywhere.  
One hundred percent committed. Designed for maximum flexibility, and always with  
our finger on the pulse of the industry. As a partner who gets things done.  
No matter where we need to go. No matter how unusual the concepts and processes may be.  
All that matters is our shared success. **Throughout the whole world.**  
(The Boysen employees)



For Boysen, globalisation is a long-term strategy. It calls for continuous growth. Also in research, development, production and logistics. We always focus on our objective of being even closer to our customers. That's how we grew to become an internationally active, medium-sized company. As a result, we are right there wherever our customers need to rely on us. Anywhere in the world.

# Locations



- |             |  |             |   |
|-------------|--|-------------|---|
| <b>1921</b> | Formation of the company in Leipzig                            | <b>1997</b> | New construction of the administration centre                                   |
| <b>1945</b> | Re-establishment of the company in Stuttgart                   | <b>1998</b> | Boysen France   |
| <b>1949</b> | Relocation to Altensteig                                       | <b>1999</b> | Boysen India  |
| <b>1972</b> | New construction of Turmfeld I factory                         | <b>2000</b> | New prototype production plant  |
| <b>1979</b> | AWM component factory  | <b>2001</b> | BAK factory   |
| <b>1988</b> | New construction of Turmfeld II production plant               | <b>2002</b> | New Product Design plant<br>Expansion of Boysen France                          |
| <b>1992</b> | New construction of Testing Centre 1                           | <b>2003</b> | Expansion of the MVO Salching factory<br>New Testing Centre 2<br>New press shop |
| <b>1993</b> | New construction of the MVO on-site assembly plant in Salching | <b>2004</b> | New equipment manufacturing facility in Turmfeld<br>Boysen USA                  |
| <b>1996</b> | Extension of the MVO on-site assembly plant in Salching        | <b>2005</b> | Expansion of the BAK II factory   |

Our company's success is based on responsible employees, efficient decision-making processes and the further expansion of our international presence.

Boysen aims at healthy growth and acts with foresight. In spite of our expansion into international markets, we intend to remain an independent company and to continue to promote the humanisation of our workplaces. As a full system partner for the world's leading vehicle manufacturers, we face international competition every day without losing sight of our values.



- 2006** New administration building at the BAK factory  
New toolmaking plant at the BAK factory
- 2007** Boysen China
- 2008** New factory in Plauen
- 2009** New Testing Centre 3
- 2010** Expansion of USA plant  
Expansion of China plant  
Modernisation of the Boysen MVO factory, Salching
- 2011** New production plant in Turmfeld  
New factory in Egypt
- 2012** New factory in South Africa  
Second factory in USA  
Factory in northern Germany




# I want it to be fair

I am a model. And I have a responsibility: to protect the environment.  
Day in, day out. So that my children's children will still be able to climb trees.

That's why we produce exhaust systems – without producing exhaust.  
Or in other words: exhaust technologies **of the next generation.**

(A member of Boysen's executive committee)



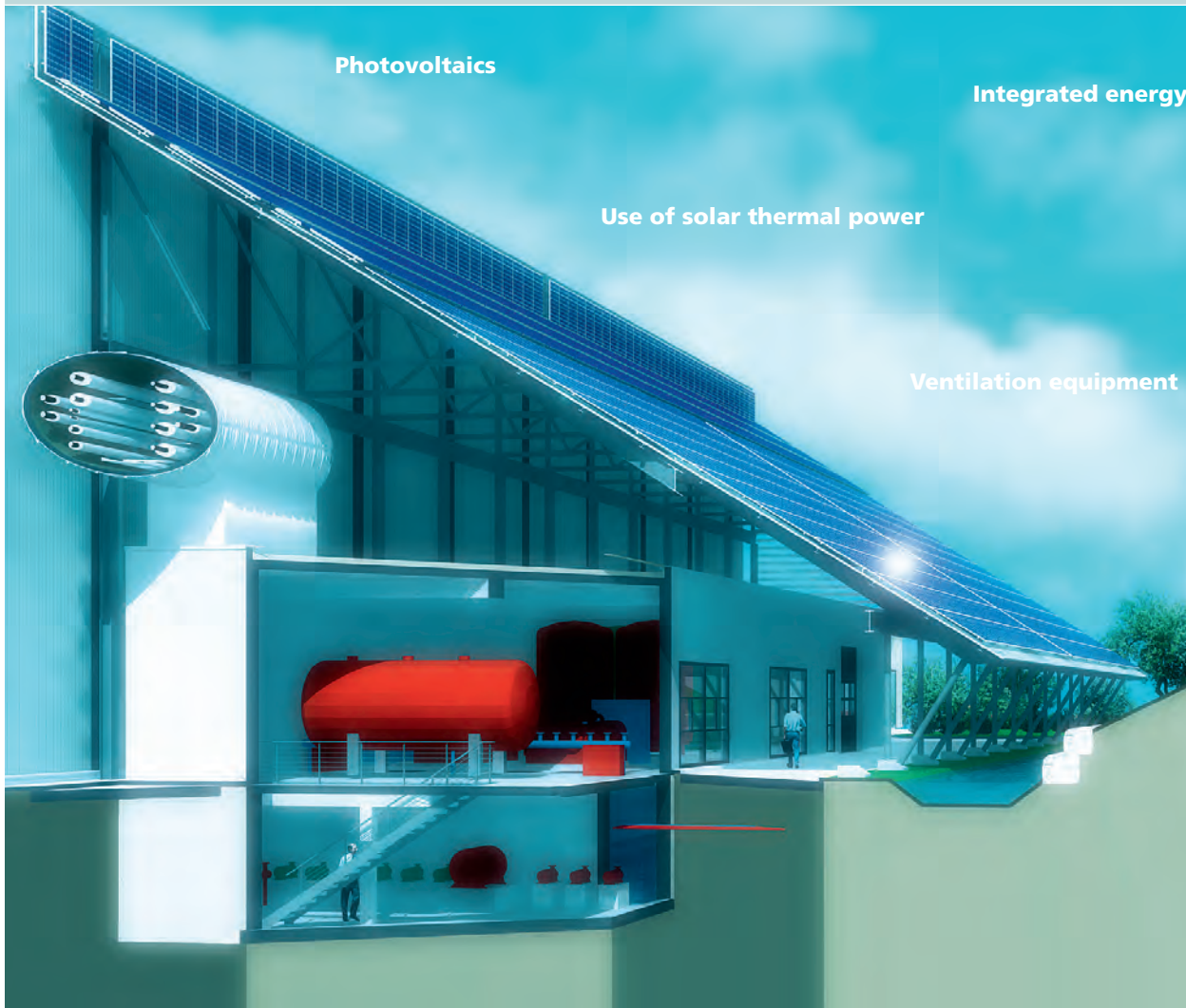




Ever since the company was formed, Boysen has been committed to protecting the environment. It began in 1921 with efforts to combat noise pollution. Today, we have one of the world's most environmentally friendly, carbon-neutral production plants for exhaust systems. And in the future, we will continue to do everything within our power to make our production sustainable and energy-efficient. Our factory in Turmfeld was only the beginning.

# Sustainability

Our carbon-neutral factory in Turmfeld is already a model for an environmentally friendly production facility of the future. Virtually energy self-sufficient, it consistently represents Boysen's policy of sustainability.



Details include, for example, the effective use of photovoltaic and solar thermal power generation over an area of approximately 5,000 m<sup>2</sup>. Or the intelligent use of geothermal energy from more than 100 boreholes. Not least, the factory also has a cleverly designed ventilation system for welding gas: smoke produced during welding is immediately extracted, filtered and efficiently used to generate heat.

These and many other environmentally friendly innovations make Boysen once again something very special. In this case, a pioneer in the carbon-neutral production of exhaust systems.

system

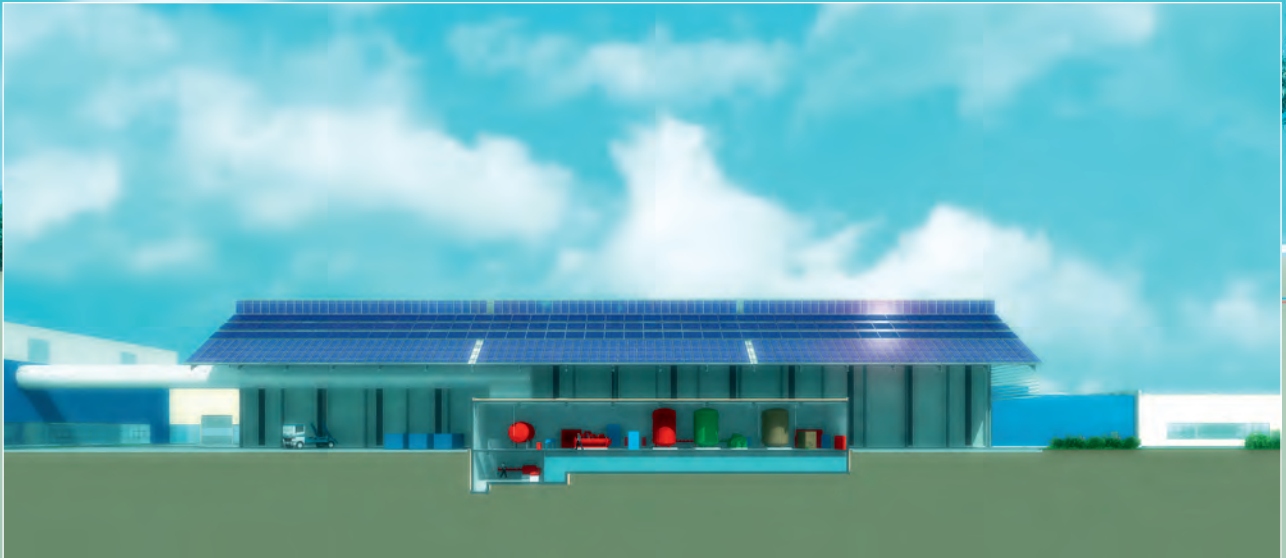
Absorption refrigeration

Power generation by large heat pump

Natural Cooling

Geothermie

Concrete core activation



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**Specialist for Exhaust System Technology.**  
**Partner for Design, Development, Production and Logistics.**

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