

Smoke-free Escape and Rescue Routes

Smoke Pressure Systems (SPS) save Lives



Contents



04

Overpressure
keeps areas
reliably smoke free

05

Fresh air for
escape and rescue
routes

06

Getting out safely
in the event of fire

08

Modular SPS solutions –
everything from a single
source

10

Planning and
execution for reliable
liability exemption

11-17

Case studies

18

Delighted
project partners

19

STG-Beikirch –
leading experts for
more than 30 years

Overpressure keeps areas reliably smoke free

Structural fire protection requirements become more stringent, the taller a building is. Everyone must have the reassurance that the building they enter or use will not become a hazard or lethal trap in the event of fire. Unfortunately, fires can never be completely ruled out in practice – they can be caused by technical malfunctions or human error.



© gpa Städtebau, Grand Tower, Frankfurt am Main

Securing escape and rescue routes

A fire creates a toxic mixture of fumes that can generally reach life-threatening concentrations in just two to four minutes. A smoke pressure system (SPS), also known as an overpressure ventilation system, designed to the specific requirements of a building ensures safe escape and rescue routes for users and firefighters and minimises the risk of owners and operators being held liable. This holds especially true in high-rise office and residential complexes where thousands of people live and work.

Over the past 20 years, some truly spectacular skyscrapers have been built.

Nowadays, the ten tallest buildings in the world have an average height of around 580 metres. As this skyscraper boom progressed, safety technology – such as SPS – was improved and optimised.

Fresh air for escape and rescue routes

In the event of fire, an SPS is responsible for creating controlled overpressure to ensure that the escape and rescue routes that are mandatory and must be protected under building law are free of smoke or that smoke levels are kept down. Depending on the building type and utilisation, such routes might include staircases, fire service lift shafts and escape tunnels – including the areas leading to them.



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The overpressure in escape and rescue areas is constantly compared to atmospheric pressure and adjusted if necessary. In the process, care must be taken to ensure that emergency exit doors to staircases can still be opened and closed by hand without using excessive force. If the emergency exit doors are open, the air must flow sufficiently fast from the staircase to the utilisation unit on the floor where the fire has broken out to reliably keep fumes out of the staircase. When the doors are opened and closed, the overpressure must be reinstated within just a few seconds. Generally, only SP systems that are actively controlled can meet these requirements.

Actively controlled SPS systems made by STG-Beikirch

The SPS concepts designed by STG-Beikirch are generally based on the principle active control – even smaller systems in low buildings. Environmental impacts must be considered when engineering an SPS for buildings that are taller than 60 metres or that are lower, but with a complex geometry.

The use of actively controlled SP systems is generally essential in such cases.

SPS applications

- Buildings that are subject to mandatory smoke-free evacuation routes under building law, that do not have a second escape route or that must provide protected areas in the

event of fire. For example: internal staircases with or without lobby, safety staircases including airlocks, corridors and hallways, evacuation tunnels, fire service lifts or disabled lifts with mandatory functional integrity.

- Special buildings designed to accommodate a lot of people. For example: exhibition and trade fair halls, event venues, administration buildings, railway stations and airports, hotels and leisure centres, shopping and adventure centres, schools and nurseries, large multi-functional buildings or residential high-rises.

Protective aims in the event of fire

- Make sure you and others are safe
- Support of the fire brigade for rapid rescue and extinguishing attacks
- Prevent the uncontrolled spreading of smoke to adjacent rooms
- Reduce the thermal stress in rooms

Getting out safely in the event of fire

In the event of fire, SPS systems flood the escape and rescue areas with fresh air, thus keeping smoke and toxic fumes out. The air in the room is completely replaced. If the doors are closed, the SPS generates continuous overpressure to ensure that the areas are flooded with air as soon as the door is opened.

01

Phase 1

Fire breaks out in a utilisation unit. The door is opened. The occupants of the smoke-filled rooms escape to the staircase.

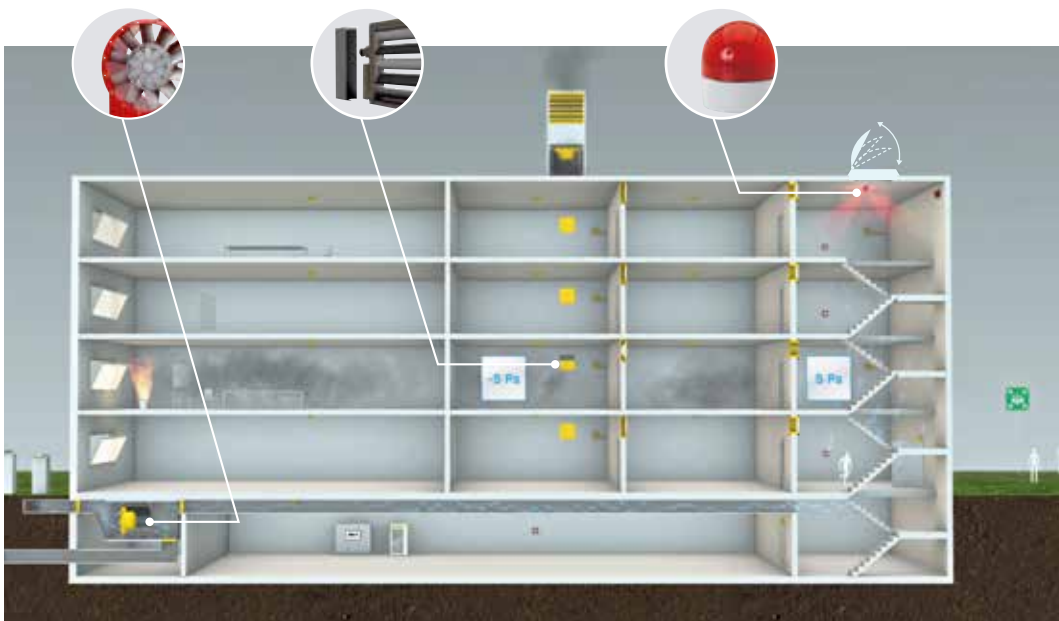


02

Phase 2

The SPS is activated, either automatically by fire alarms/ smoke detectors or manually from a call point. The control unit in the command centre responds.





03

Phase 3

Flushing phase (within max. 60 seconds from activating the SPS): A supply air fan feeds air from the outside into the emergency staircase, roof vents open, the escape and rescue routes are flushed with fresh air. Acoustic and visual alarms are triggered, doors close, ventilation buttons are deactivated.



04

Phase 4

After flushing, pressure control is activated and builds up overpressure in the staircase.



05

Phase 5

As soon as the risk of fire is eliminated, the system can return to monitoring status.

Modular SPS solutions – everything from a single source

STG-Beikirch offers engineers, architects, property developers and operators a full portfolio of SPS products and services from a single source and building code-compliant to guarantee maximum planning certainty and liability exemption. Together, we can design and implement the best possible SPS solution for a building – from modular systems for buildings with up to 14 floors right through to complex large-scale plants for skyscrapers.

Our team of experts helps you to plan and consider building code and standards requirements, develops proposals for dimensioning fresh air and pressure control volume flows, air distribution, evaluates potential leakage areas and through-flow pres-

sure losses in high-rise staircases, and much more.

Full service and support

Once installed, we commission both the functional and air technology aspects of our systems and adjust

them to the right settings.

Our service team is present for the final acceptance, compiles measurement logs, trains the operating team, and services and controls all components and system functions.

STG-Beikirch system components



Electronic alarm



RBH/3A/RDA manual SPS call point



SPS control unit with BUS technology



LM EasyDrive/2 chain drive



M2 VdS linear drive



Multi-sensor



Smoke extraction flap



Smoke detector in duct



Overflow flap with fire shut off flap and cold smoke damper



Differential pressure transmitter



Fire damper



Axial medium pressure fan



Photo optical smoke detector



WRM2 24V wind/rain sensor



Electronic temperature sensor



Temperature sensor



Flashlight



Precision control flap

Decentralised BUS technology

Many buildings require advanced solutions to implement complex SPS control functions. As this cannot be achieved with standard products, we offer advanced options based on STG-Beikirch BUS technology that can be used to interconnect SPS components distributed vertically throughout a building. Because of

the decentralised structure of the BUS system, there are no restrictions on the length of cable connections.

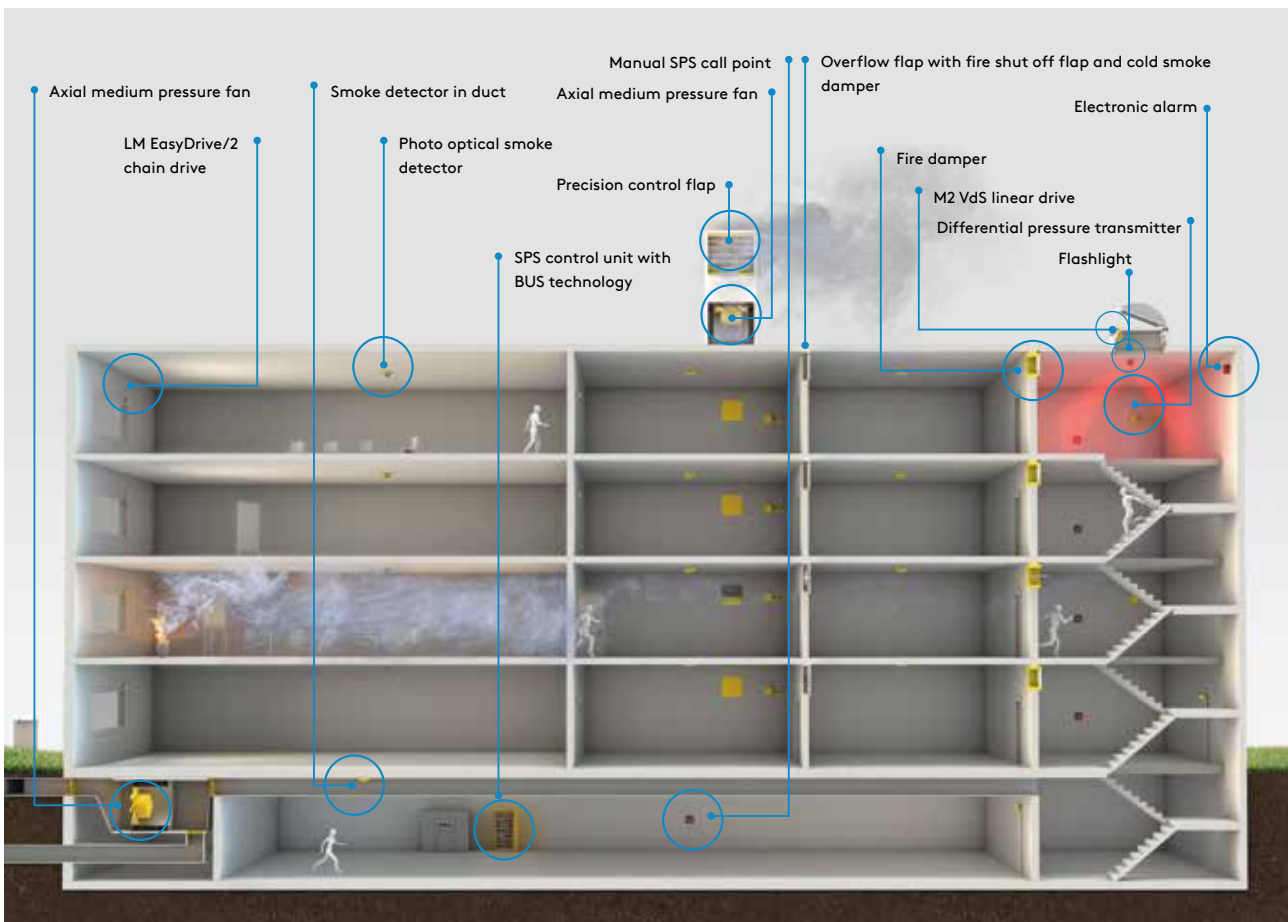
The pressure control opportunities offered by the specific and rapid control of ventilators, fresh air, waste air and bypass flaps are virtually limitless. And our BUS technology sets standards when it comes to

speed, safety and dependability.

Large-scale SPS can be implemented safely and affordably thanks to decentralised STG-Beikirch BUS technology.

Benefits of STG-Beikirch BUS technology

- Rapid response of the SPS systems
- Smaller cable cross-sections, less material expenditure required for decentralised configuration
- Lower installation costs for the power supply
- Parameterization via PC user interface
- Early and fast diagnosis possibilities for the facility management team
- Central, standardised interfaces for linking in other systems, such as fire alarm systems, building security panels and building management systems



Planning and execution for reliable liability exemption

The SPS user guide issued by the SPS working group contains basic planning information for buildings, together with rules governing SPS installation and requirements with regard to the components, operation and maintenance.

To ensure compliance with all flow engineering requirements, the fire protection concept/fire protection survey needs to clearly define the protective aims of the future system. A ventilation survey ensures that the required airflows can be channelled through the building. Early simulation can save considerable costs and space with regard to the SPS components.



SPS user guide:
download free of charge from
www.rda-arbeitskreis.de

There are three options for certifying preventive structural fire and smoke protection:

- Based on the material requirements of the relevant state building code and coupled with applicable technical regulations
- Based on generally accepted best engineering practice, where applicable as technical building regulations in the relevant federal state
- Based on the current state of science and technology, for example the use of engineering methods such as validated and verified fire simulations, zone and field models



Tower 185

Frankfurt am Main

Property

Tower 185 is a 51-storey, 200 m tall skyscraper close by the Frankfurt exhibition centre. It comprises a horse-shoe-shaped plinth with a natural stone façade topped by two high-rise sections with aluminium-glass façade that encase a glass centre section.

Starting point

Thermal currents in buildings as tall as this cause pressure states and flow effects in the shafts that can only be contained using dynamically/actively controlled SP systems. Passively controlled systems with barometric flaps do not function reliably in such conditions.

In December 2012, STG-Beikirch was commissioned to replace all of the existing SPS technology in the fire service lift and to build three new extraction systems distributed over the height of the building by the end of March 2013.



STG-Beikirch solution

All of the smoke pressure systems operate independently and are designed with STG-Beikirch BUS technology. As a result, it was possible to locate the control cabinets on different floors. Pressure measuring points on all floors continuously track the differential pressure to the external atmosphere. The control system also considers the thermal influences exerted by the height of the floor where the fire is located and the outdoor temperature. By incorporating its rapid servo powered pressure control flaps, STG-Beikirch was able to design the SPS in compliance with the specifications of EN 12101-6.

The entire systems (pressure sensors, control flaps, ventilators and control panels) are redundant: if the primary system malfunctions, a secondary system offering exactly the same functions takes over.

Sky Office

Düsseldorf



Property

The 89 m standalone building with 23 floors is an eye-catching landmark in Düsseldorf. The transparent envelope and wing-shaped roof ensure that Sky Office attracts attention on Kennedydamm. The central access and utility cores provide the same natural daylight and ventilation performance for all office areas.

Starting point

The SPS and BUS technology made by STG-Beikirch already represented an innovative break from tradition in Sky Office back in 2009. This pioneering concept marked a new milestone for best possible implementation of the complex requirements for SPS systems in high-rise buildings. At the time, the interaction between various components based on decentralised BUS technology with functional reliability certified to class SIL1 was one of a kind.

STG-Beikirch solution

Loops connecting to pressure measuring points in the façade were installed on the 3rd, 9th, 13th and 18th floors to continuously track the differential pressure to the outside air. The SPS compiles the measurements into a pressure measurement curve that is used to control the entire system. Pilot control based on the floor that is on fire and the outdoor temperature is possible, as is pressure regulation based on differential pressure. As the system actively responds to outdoor climate conditions, there was no need to design a closed façade. Occupants can open the windows whenever they feel like it.

The smoke pressure systems in both staircases are always activated simultaneously. With a response time far below the standard maximum three seconds specified in EN 12101-6, the SPS made by STG-Beikirch is one of the fastest actively controlled systems in the marketplace.

Deutsche Börse

Frankfurt am Main

Property

The 87 metre block that is the new home of Deutsche Börse in Eschborn near Frankfurt is clearly visible from afar. The newly built, sophisticated office high-rise houses more than 2,000 employees on an area in excess of 50,000 m².

Starting point

Within the floors, the pressure distribution, barometric changes in pressure and wind pressure to which the building is exposed adversely affect the control of the SPS system. Eliminating these effects and ensuring that the escape and rescue routes are kept free of smoke even in challenging climate conditions necessitated appropriate adjustments to both the structural conditions and the engineering design in the planning phase.



STG-Beikirch solution

The SPS concept was designed in close collaboration with the planning engineers and encompassed the location and dimensions of the fresh air and waste air ducts, fans and extraction openings, as well as the engineering design including specification of the control technology and permissible pressure conditions. The reference pressure in the building is generated by a piping system consisting of a loop on the roof from which standpipes fitted with differential pressure sensors led to the staircases and extraction shafts.

Early planning kept costs down to a minimum, e.g. by channeling the extraction shafts over the public lifts in two of the total four emergency staircases.



Alpha Rotex

Frankfurt am Main

Property

Since mid-2013, the 16-storey Alpha Rotex office complex has been the highest building at Frankfurt airport. The building with its unmistakable design is 68 metres tall and is a landmark that is visible from afar. The basic shape is a triangle with rounded corners. The wings of the building rotate around the core, leaving space for five conservatories that are 30 metres tall.



Starting point

Given the complex geometry of the Alpha Rotex building, extraction through the façade was not an option. As a result, a total of six internal extraction shafts had to be installed to pressure ventilate three safety staircases and one fire service lift.

STG-Beikirch solution

All of the pressure ventilation systems are controlled separately using STG-Beikirch BUS network technology, and are split into four separate systems. The SPS BUS system enabled an extremely compact and space-saving design of the control panels. Actively controlled SPS systems have meanwhile become indispensable in buildings that are taller than 60 metres or that are lower, but with a complex geometry.

One special challenge of this project was the architects' requirement for a sophisticated roof appearance. With planes flying over, especially, all of the ventilator technology and pressure control flaps had to be hidden from sight.

Andreas Quartier

Düsseldorf

Property

Autumn 2017 marked the completion of a new urban district measuring 18,000 m² in Altstadt, the historic and social centre in the old part of Düsseldorf. Andreas Quartier – also known as “Düsseldorf’s living room” – is home to exclusive apartments, a conference centre, hotel and catering facilities. It exudes an extravagant charm in the heart of the city. It combines the perfect city centre location with sophisticated architecture and quality construction.

Starting point

The SPS systems already installed in the luxury residential complex (8 – 9 floors) comprising four buildings with cellars surrounding a communal courtyard did not comply with the statutory protective aims. STG-Beikirch was asked to redesign and implement new systems. Alongside the time factor, certain structural conditions posed additional challenges with regard to fire protection and functional reliability: only one staircase in each building, which therefore had to be design as a safety staircase and rescue route in the event of fire. Each building has a pressure ventilated fire service lift. The specified air flow at the doors leading to the floors was raised to 2.5 m/s instead of the usual 2 m/s, even when the main door out of the building on the ground floor was open. This required a fresh airflow of 5,000 – 70,000 m³/h instead of the usual 5,000 – 30,000 m³/h.



STG-Beikirch solution

The system solution built by STG-Beikirch is based on an actively controlled modular SPS. Components already in place in the building, such as ventilation ducts, fans and extraction flaps were integrated into the concept to keep the conversion work and costs down. Replacing key operating and control components was, however, unavoidable.

In addition to the required redundancies, a cleverly designed malfunction, detection and alert concept was integrated to assure very high availability of the system. It ensures that someone is on site very quickly in the event of a malfunction. The SPS extraction shafts also extract the smoke from the underground garage in the event of fire.

Bau1

Basel

Property

Since 2015, the Bau 1 office high-rise – also known as the Roche tower – represents a key cornerstone in Basel's urban development. It is located on the site of Roche pharmaceuticals company. Its straightforward yet unmistakable double helix architecture blends superbly into Basel's urban landscape. The building is home to attractive office landscapes with

communication zones, catering facilities, a viewing terrace and a large auditorium with a seating capacity of up to 500. Some 2,000 employees work on the 41 floors. With its height of 178 metres, Bau 1 is much taller than Prime Tower in Zurich, which measures 126 metres and was, until then, the highest building in Switzerland.

Starting point

Bau 1 has 41 floors and a total of five staircases and two fire service lifts from which SPS systems must extract smoke in the event of fire. STG-Beikirch was commissioned to install the entire technology, together with two extraction shafts for the smoke pressure systems.



STG-Beikirch solution

STG-Beikirch's SPS concept builds on actively controlled systems. The flaps used to control pressure, for example, are servo powered for adjustment in just seconds, enabling them to respond very quickly to changes in pressure. This concept is even capable of ensuring perfect technical control of airflows up to 75,000 m³/h. A conscious decision was taken not to provide redundancy for all components in this project. Instead, the required functional reliability is achieved through continuous and extensive automatic self tests of all system functions. They ensure the necessary high level of system availability. A proprietary GLT computer monitors the SPS and controls and logs the automatic function tests. Another special feature of this system is the use of fibre optic rather than copper cables for BUS transmission in a critical part of the building in order to avoid transmission faults.

Henninger Turm

Frankfurt am Main

Property

Since spring 2017, newly built Henninger Turm is one of Germany's tallest and most modern residential towers. The building is 140 metres tall and has a circular section offset at the top and a 5-storey plinth. The striking architecture drew on the appearance of the old tower, which used to house a grain silo. The sophisticated appearance earned

the building the International Iconic Award 2015. The 130 metre residential tower is home to a total of 207 luxury apartments. Building highlights include the "barrel" at the top, which accommodates four apartments, while the panorama restaurant on the 39th floor offers a spectacular 360° view.



Starting point

STG-Beikirch was commissioned to fit the two staircases and fire service lift in the 40-storey residential tower with SPS systems. Staircase 1 posed a special challenge: as it does not lead up to the roof, it was not possible to create a pressure relief opening at the top.

STG-Beikirch solution

The redundant smoke pressure systems installed by STG-Beikirch feature two extraction shafts and a total of four systems that separately control extraction in the staircases and fire service lift.

A pressure relief duct in staircase 1 ensures regular throughflow and pressure relief. To overcome structural challenges in staircase 2, a support fan was installed on the 39th floor to provide additional extraction performance. Further special features: The special geometry of the building necessitated installation of around 100 pressure sensors. In addition, a temperature measuring function was integrated into the SPS control system to precisely adjust thermal regulation in summer and winter.



Our best reference: delighted project partners ...

**Operator:**

"Thanks to the components' compact design, the SPS system only takes up very little space, leaving us more space for areas we can rent out. Apart from which, the SPS technology from STG-Beikirch is so flexible that subsequent changes in the utilisation of the rental units is child's play."

**Investor:**

"Compared with other systems, SPS made by STG-Beikirch cost less to buy and operate. The systems using BUS technology can monitor themselves, and numerous components are capable of self adjustment. The maintenance workload for these systems is lower compared to other makes. Both commissioning and maintenance can be performed quickly and easily."

**Fire protection expert:**

"STG-Beikirch provides me with competent and dependable support right from the planning phase, and I can rest assured that it will be possible to implement my fire protection concept without restrictions. Apart from which, the SPS components made by STG-Beikirch comply with all the requisite European and international standards. And the functional reliability of the SP systems can be certified to Safety Integrity Level (SIL) requirements any time."

**Occupant:**

"With an SPS from STG-Beikirch I have total reassurance that all escape and evacuation routes will be kept free of smoke in the event of fire. I don't need to worry that I might not make it out of the building and to the safe meeting point in time."

**Architect in charge of overseeing construction:**

"Our sophisticated design concepts for building façades and interior rooms are not restricted in any way if we use SPS technology made by STG-Beikirch as the company's project design department is always able to adapt the SPS to meet our design requirements. With smoke pressure systems made by STG-Beikirch, we can climb as high as want to!"

**Facility manager:**

"I found the training to use the SPS technology very easy. The STG-Beikirch technicians explained everything in a way I could understand easily, and even if I have a question now that the systems are up and running, I can always reach someone at the company who can help me. Apart from which, the self diagnostics option means that checking the SP systems is a piece of cake."

Leading experts for more than 30 years

For more than 30 years, STG-Beikirch GmbH & Co. KG has been developing standardised and project-specific façade automation solutions and ranks among Europe's leading manufacturers of smoke pressure (SPS), smoke and heat extraction (SHE) and controlled natural ventilation systems.

The technology behind our electro-motive window drives, contactless window protection system, SPS and SHE systems enhances convenience and safety in industrial, commercial and administrative buildings around the world. We also play a valuable role in optimising capital expenditure and operating costs.

Take advantage of our expertise and the competence we have developed from projects of all sizes, from working closely with specialist testing agencies and engineering firms, and from our active involvement in various associations and working groups focusing on customised modular fire protection and ventilation solutions from a single source.

STG-Beikirch provides a broad range of products, technologies and services from our production facility in Lemgo. Our portfolio encompasses the design, planning, execution and servicing of ventilation equipment and smoke and heat extraction systems, together with their system components.

Since October 2016, STG-Beikirch has been part of the new "Light & Air" division of Kingspan.

Kingspan Group

Founded in the late 1960s, Kingspan is meanwhile listed on the stock exchange and ranks among the global leaders in the field of sustainable high-performance building insulation products, building envelope systems and solar-integrated building envelopes. The product portfolio includes daylight systems, insulated roof and wall elements, as well as panels for sectional doors, complete with accessories. The company is acknowledged throughout the entire building industry for its outstanding innovation, design, quality and engineering expertise.

As part of its business strategy to develop products and system solutions to continuously improve energy efficiency and fire protection, Kingspan formed a new global division – "Kingspan Light & Air". This business unit brings together all the core competencies surrounding sustainable lighting, natural ventilation and smoke management solutions for flat roofs and commercial building façades. As one of the leading manufacturers and providers of ventilation and safety solutions in the European façade market, STG-Beikirch is one of the key members of the Kingspan Light & Air division.



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