

BRANDSCHUTZ transparent

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International Edition



Fire-resistant Glass

Pilkington **Pyrostop**®

Pilkington **Pyrodur**®

Pilkington **Pyroclear**®

First international edition:

Welcome to BRANDSCHUTZ transparent

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We would like to welcome our worldwide readers to the first international edition of **BRANDSCHUTZ transparent**! For the German, Austrian and Swiss markets this magazine has been a popular publication for about two decades, featuring a variety of subjects dealing with the technical application context of Pilkington's comprehensive range of fire-resistant glass.

Pilkington for some time now has been supplying its product lines Pilkington **Pyrostop**®, Pilkington **Pyrodur**® and Pilkington **Pyroclear**® not only to the European but also to the international markets. Therefore it might be reasonable time to cover the subjects specific to other countries and to feature them in an international edition.

Though the general purpose of fire-resistant glass – integrity and protection against heat radiation on exposure to fire loads – is more or less common in the context of modern building safety worldwide, there are substantial differences in testing, approval processes, applications and fire ratings. This is exactly what we touch on in this first international edition, giving you examples of applications from the USA, Switzerland and Germany including their individual conceptual backgrounds.

In addition to these reference projects an interview with Pilkington's Commercial Director Fire Protection Glass, Nils Brinkmann, provides an overview of Pilkington's activities in adapting their products to country-specific testing, approval and building regulations.

In the 1980s, Pilkington was one of the first companies to invent transparent fire-resistant glass for façades, roofs, partitions and doors that not only provide integrity under defined fire loads but also protect against the dangers of heat radiation. Since then, numerous application-specific glass types and functional combinations have been developed, extensively tested and approved. As you can see from our reports on the latest product developments of Pilkington **Pyrostop**® and Pilkington **Pyrodur**® glass types, this is an ongoing process with the aim of constantly making our products even more transparent and color-neutral and increasing glass sizes in combination with slim frame constructions of our worldwide market partners. We do so without ever compromising on the systems' consistent fire safety performance, durability and elegant design.

Enjoy reading the first international edition of **BRANDSCHUTZ transparent**.

Your Editorial Team

NEW: Pilkington Pyrostop® Line:

Monolithic butt-jointed glazing now available for EI 30 and EI 60



Pilkington is launching two new monolithic glass compositions to complement its fire-resistant glass product line Pyrostop®. The two new additions, Pilkington Pyrostop® Line 30-604, 22 mm, and Pilkington Pyrostop® Line 60-603, 27 mm, comprising extra clear Pilkington Optiwhite™ for maximum light transmittance are now available for flush glazing without the need for vertical framing.

Pilkington Pyrostop® Line has been successfully tested, approved and officially certified to comply with the requirements for CE-marking. The tested configurations in frames made from steel and timber to a maximum tested size of 1,400 mm width and 3,000 mm height form an excellent basis for national approvals according to extended application (EXAP) rules.

Type	Fire resistance class	Supply Form*	Nominal Thickness [mm]	Thickness tolerance [mm]	Nominal weight [kg/m²]	T _L [%]	R _w [dB]	U _g [W/m²K]
Pilkington Pyrostop® Line								
30-604	EI 30		≥ 22	± 1,5	≥ 51	≤ 87	≥ 40	≤ 4,8
60-603	EI 60		≥ 27	± 2	≥ 60	≤ 86	≥ 41	≤ 4,7

* Monolithic Glass

Butt-jointed glazing calls for non-standard statical calculations

As opposed to standard glazing where the glass is held on all four sides by a frame, butt-jointed glass units are only supported by frames along the top and the bottom with the longer edges being left free and unsupported. For such applications where the monolithic glass is not able to comply with the mechanical load requirements we recommend to use the 39 mm thick triple insulated glass version, Pilkington Pyrostop® Line Triple, comprising additional toughened glasses either side of the Pilkington Pyrostop®. Pilkington's well experienced and knowledgeable Technical Advisory Team will provide support and is able to assist in the selection process of the appropriate glass types for the customer's individual requirement. ■



Flush glazed butt-jointed partition comprising Pilkington Pyrostop® Line without vertical frames (available for fire-resistance classification EI30 and EI60 in steel, stainless steel or timber frames).

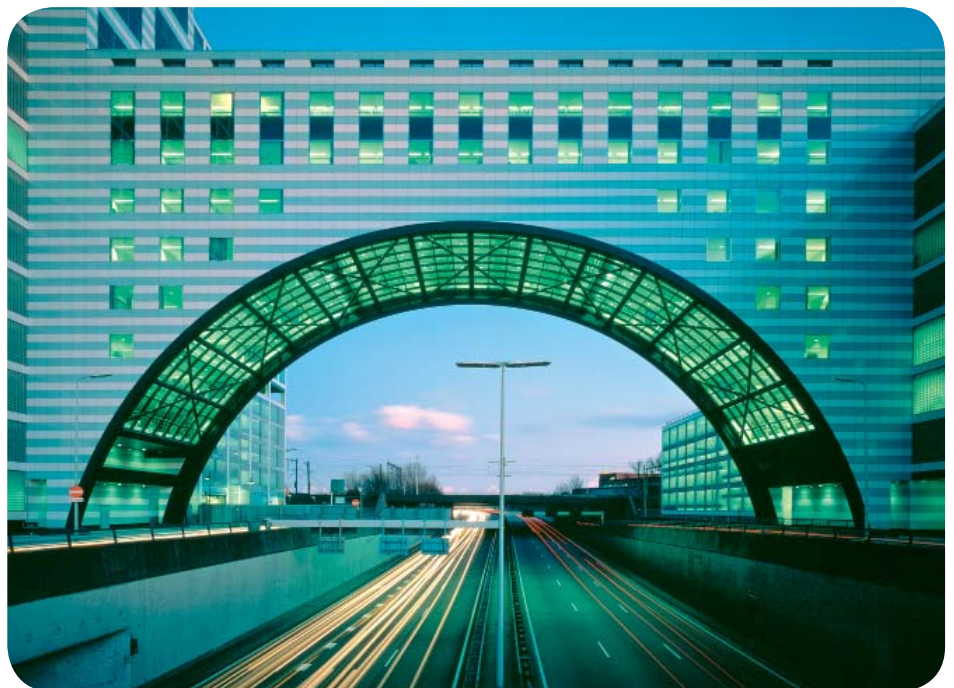
Quality and Longevity:

10 years guarantee for Pilkington fire-resistant glass products

Pilkington now offers 10 years guarantee on fire-resistant glass of the product lines Pilkington Pyrostop® and Pilkington Pyrodur® sold and supplied by Pilkington Deutschland AG. The guarantee primarily covers significant development of clouds of haze of fire-resistant glass interlayer - a claim which would be associated with significant cost for the building owner or facility management.

Why does Pilkington offer this guarantee?

Pilkington is confident about the longevity and quality of its fire-resistant glass. The technology on which the fire-resistant laminated glass product lines Pilkington Pyrostop® and Pilkington Pyrodur® are based, has been applied in its basic principle for more than 30 years - with continuous modifications and optimisations. In doing so, the product quality was consistently improved - thousands of reference projects world-wide are evidence for all to see.



What does the guarantee cover?

The guarantee covers significant visual defects which are generally referred to as "partial or complete clouds of haze". Other occurrences, such as micro bubbles or visual distortions which may appear in rare cases in fire-resistant glass due to variations during production, are excluded.

What are the basic requirements for the guarantee?

The guarantee relates to fire-resistant glass products of the product lines Pilkington Pyrostop® and Pilkington Pyrodur® sold and supplied by Pilkington Deutschland AG. Potential claims may only be accepted when

Monument conservation meets modern transparent fire protection: EI 30 glazing for more than 15 years in situ - Castle of Bletigheim (GER).

For all to see: EW 30 glazing since more than 20 years. Haagse Poort, The Hague (NL).

the claim has been thoroughly evaluated and the glazing and handling guidelines have strictly been followed and are subject to the General Conditions of Sale and Supply.

What can a customer expect in the case of a genuine defect?

If the quality expert approves a claim, the customer will be entitled to "glass only replacement" of the same type and same fire resistance class, stated on the original order documents.

Which glass types and installation situations does the guarantee cover?

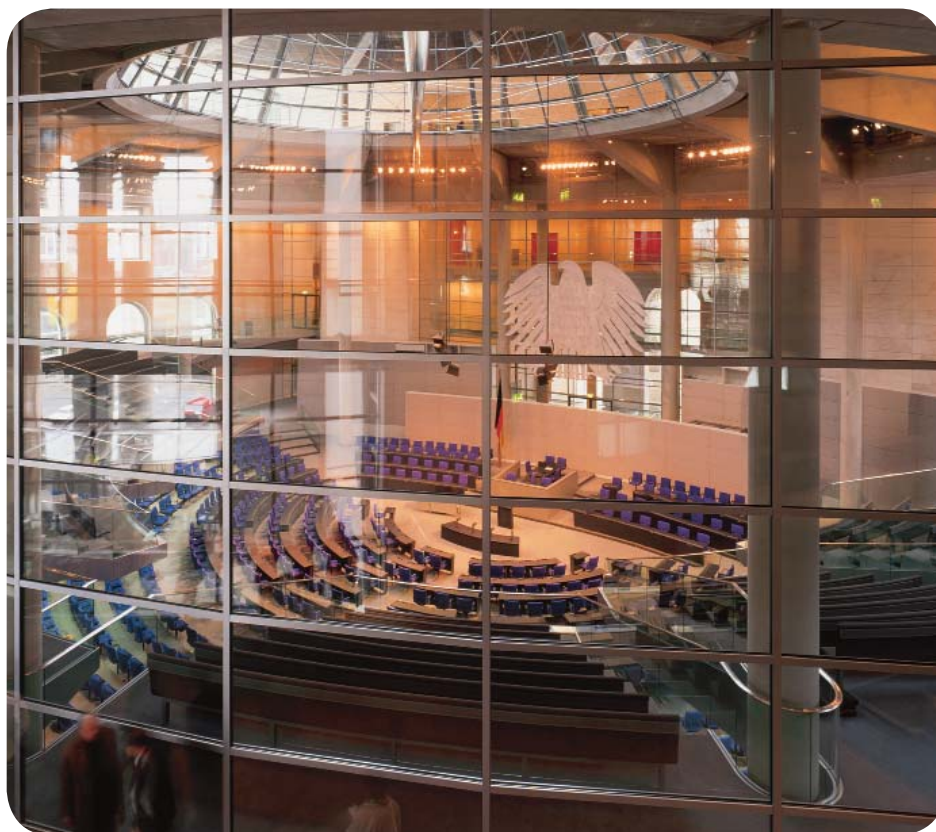
The guarantee covers all circumferentially framed glass types Pilkington Pyrostop® and

Evidence of longevity, German Parliament, Berlin:
A reference project with various Pilkington fire-resistant glass applications which have been fulfilling their protective function for more than 20 years without developing clouds of haze.

Pilkington **Pyrodur**[®], both monolithic as well as insulated glass units, regardless of the glazing and of the framing system into which it was installed. This includes all fire-resistant glass in doors, partitions, façades, roof and horizontal/sloped glazing.

Where can I find out more about the 10-year guarantee on Pilkington fire-resistant glass?

The complete, legally binding guarantee declaration is found in Chapter 5.1 of the special conditions for fire-resistant glass **Pyrostop**[®], Pilkington **Pyrodur**[®] and Pilkington **Pyroclear**[®], as referred to in the General Conditions of Sale and Supply. ■



New compositions for Pilkington **Pyrostop**[®] EI 30, Pilkington **Pyrodur**[®] E/EW 30 and E/EW 60:

Higher light transmittance – more neutral in colour

Following the successful completion of an optimization process to develop Pilkington **Optifloat**[™] clear, based on market requirements for improved performance and in line with our customers' desire for clearer float, the fire protection business unit has completed the transition to incorporate brighter float in its Pilkington **Pyrostop**[®] and Pilkington **Pyrodur**[®] types.

Pilkington **Optifloat**[™] clear provides the benefits of improved light transmittance and

energetic performance and provides a glass substrate as part of the monolithic Pilkington **Pyrostop**[®] for classification EI 30, and Pilkington **Pyrodur**[®] EW/E 30 and EW/E 60 with a clearly visible added value.

Light transmittance for EI 30 and EI 60 compositions is now the same

Monolithic Pilkington **Pyrostop**[®] compositions for EI 30 classification have the same light transmittance and a more neutral colour in comparison to compositions for EI 60 classification comprising extra clear low iron

Pilkington **Optiwhite**[™] following the change-over in production to the clearer float glass. The improved light transmittance and optimized neutral colour is a benefit which is clearly visible. Especially fire-resistant glass compositions in combination with low-E coatings provide a noticeably higher light transmittance, as do a large number of other insulating glass combinations. Please refer to the product data sheets for a detailed listing of all relevant technical data. The DoP (Declaration of Performance) certificates which are available online have also been updated ■

Roche Building 1, Basel (CH):

High specification interior for the tallest building in Switzerland



Photo: Strähle / Marc Eggimann, Basel.



The 178 m tall "Building 1" on the Roche compound in Basel was built according to the design of the renowned architecture office Herzog & de Meuron. The skyscraper narrows towards the top of its 41 stories and has space for 2,000 employees under one roof. The high specification interior design with floor to ceiling transparent doors and partitions had to be able to incorporate the complex performance requirements such as fire-resistance and noise control without being visible. The glass wall system 2300 designed by Strähle Room Systems comprising Pilkington Pyrostop® glass does easily fulfill the exceptional aesthetic and functional requirements of the building.

The objective of Herzog & de Meuron was to design a building typology which supports the organizational structure of the various functional units and which actively encourages communication and provides attractive workplaces for the employees. The offices were equipped with flexible glass wall systems. "With its exterior bound to tradition, Roche's "Building 1" follows the demand for constantly changing requirements for the work environment on the inside. "Building 1" is innovative due its inner structure which puts the movement patterns and communication needs in the focus", is how Pierre de Meuron describes the aspirations of the building's interior design.

The building itself reflects this innovative and communicative aspiration in its internal partitioning. This is why areas used by a large number of people, such as the auditorium with a seating capacity of 500, the restaurant and the central meeting rooms, are located on the lower floors. From the fifth floor upwards offices follow on. In the East and the West, two-storied and three-storied communication



The transparent, flush wall systems by Strähle integrate numerous individual requirements, such as fire protection, noise protection and access control. Photo: Strähle / Marc Eggmann, Basel.

zones are located which are linked via spiral staircases. They are accessible for employees for breaks, meetings with few people and informal chats. A part of the communication zones are the terraces which have been created by the recesses. They provide ample space for catching fresh air. On floor 41 the Top-Floor-Cafeteria attracts employees and visitors alike with amazing views of Basel and the surroundings.

Complex list of requirements

The office areas are light flooded and feature flexible partitioning. The modular floor plan and the design of the ceilings in combination with repositionable glass wall systems ensure a simple rearrangement of single, team or open plan offices. The requirements for the design and the functionality were high. Essential elements of the high specification partitioning design was a flush glazing for the doors and the fixed wall segments featuring a white coloured structural glazing. Depending on the location and the specific use the glass walls had to be adapted to varying heights, noise reduction requirements ranging from $R_{w,P}$ 44 dB

to $R_{w,P}$ 54 dB whilst meeting fire resistance requirements. All walls and doors of the communication zone, for example, comply with the fire-resistance requirement EI 30, that is to say forming an effective barrier to flames and providing thermal insulation from the heat in the event of a fire for 30 minutes. The extra-large fire-resistant walls of the auditorium also provide load-bearing performance to prevent people from falling from a height. The fire resistance performance of the glass wall systems had to be verified by submission of official approvals issued by Association of Canton Fire Insurances (VKF).

Additional tests performed on EI 30 door systems

The glass wall system 2300 by Strähle features a consistently flush, homogenous look. The wall elements comprise glass panels on the inside and the outside which are bonded to slim profiles. They can be equipped with monolithic toughened or laminated safety glass depending on the requirements for impact safety, barrier loading and noise reduction.



In order to come up with the same flush look for the door system and fixed partitions of the communication zones without any visible frames, Strähle developed a special solution. Toughened glass panes with white coloured printed edges where bonded onto steel profiles from both sides. A multi-layer intumescent laminate fire-resistant glass Pilkington **Pyrostop®** was installed in the cavity of the wall elements. A total of 11 fire tests with durability tests were successfully completed at the fire test laboratory of the Institute for Window Technology (ift) and certify the required fire resistance performance of the single- and double-leaf doors.

In addition to the high level of functionality of the standard wall elements, the manufacturer of the partitioning system had to demonstrate the ability to manufacture and to install large volumes with short lead times and a high level of precision. A high level of skills and know-how was needed to deliver complex functional doors comprising glass and to implement project specific design solutions in accordance with the specifications from the architects. Strähle was able to meet these ambitious challenges with

its highly variable system 2300 and years of experience with large-scale projects, which all required project specific solutions. "The Decision process was also influenced by taking a look at reference projects", explains Rüdiger Wobst, Project Manager in charge at Drees & Sommer. The Strähle wall has convinced due to its high-quality looks and the quality of finish. "In addition, it was the only one able to fulfill the fire resistance requirements" according to Mr. Wobst.

The office area is structured into single-person and group offices. The room structure can be adjusted to new situations variably. High sound insulation performance ensures an optimum of working climate. Photo: Strähle / Marc Eggimann, Basel.



Glass walls and doors to the communication zones fulfil the requirements EI 30 (Strähle all-glass system 2300 / Pilkington **Pyrostop®**). The EI 30 double-leaf doors with white, enamelled outer panes are a special construction tested as part of 11 regulatory fire inspections and durability tests at the independent institute ift Rosenheim. Photo: Strähle / Marc Eggimann, Basel.

High end finish in white

The twin shell, all-glass system 2300 with floor to ceiling glass doors creates a luxury environment with its flush glazing comprising extra clear low-iron glass, printed edges in white colour and slim profiles reduced to a minimum to fulfill the static requirements – irrespective of the varying fire resistance and noise reduction requirements achieved by use of 6 mm and 8 mm thick toughened or laminated safety glass. The separation and office walls with screen printing provide an additional level of discretion.

The glass doors along the corridors around the central service area in the core of the building with lifts and escape staircases include special features. They are in the main EI 30 doors between fire compartments. Depending on their location in the building, they are equipped with automatic door opening devices, door closers, push bars as well as automated

systems for access control and time logging. The interior design characterized by white colour and glass can also be found in the lift lobby area. In contrast to the black coloured steel doors and the lift recess, the walls of the lift on each floor have a glass in the form of a wave which is installed as a cladding in front of the concrete wall. In total of 700 linear meters of extra clear monolithic safety glass formed individually for "Building 1" of Roche to the plans of Herzog & de Meuron. The glass waves, wall and door elements blend in to form a harmonious unit. This minimalistic styling using shapes facilitates the high end finish architecture, geared towards the wellbeing of the employees, and where required, for the safety.

Demanding site logistics

Not only did the interior fit out of the 178 m high Roche tower pose the typical challenge of managing the flow of material in the vertical direction. This project also required tailored local logistics. "Since the "Building 1" is located in a built-up area, there were practically no storage or warehouse areas. Also the traffic load had to be kept to a minimum in due

Floor plan of a general floor: Access and exit to communication zone (3) as well as between lift lobby (2) and the adjacent offices (1) are all equipped with EI 30 glazing and EI 30 door systems. Floor Plan: Strähle.



Fire protection requirements could be integrated into the door and separator design without any visual deviation. Photo: Strähle / Marc Eggmann, Basel.

consideration of the local residents" describes Rüdiger Wobst of Drees & Sommer. As a consequence, the suppliers had to head towards a given checkpoint located at the outskirts of Basel. Following the registration, the Heavy Goods Vehicles (HGV) were scheduled for timed deliveries at site. "The fact that we kept control of the complex management of the logistics

was mainly due to the reliable time management of our partners", knows Mr. Wobst. The deliveries of the glass walls by Strähle alone, from its factory which is based in Waiblingen close to Stuttgart, took more than 200 HGVs. ■

Roche Building 1, Basel (CH)

Builder:

F. Hoffmann-La Roche AG, Basel (CH)

Architect:

Herzog & de Meuron, Basel (CH)

General planning:

Drees & Sommer Schweiz,
Basel (CH)

Internal partitions and glass doors:

Strähle Raum-Systeme GmbH,
Waiblingen (D)

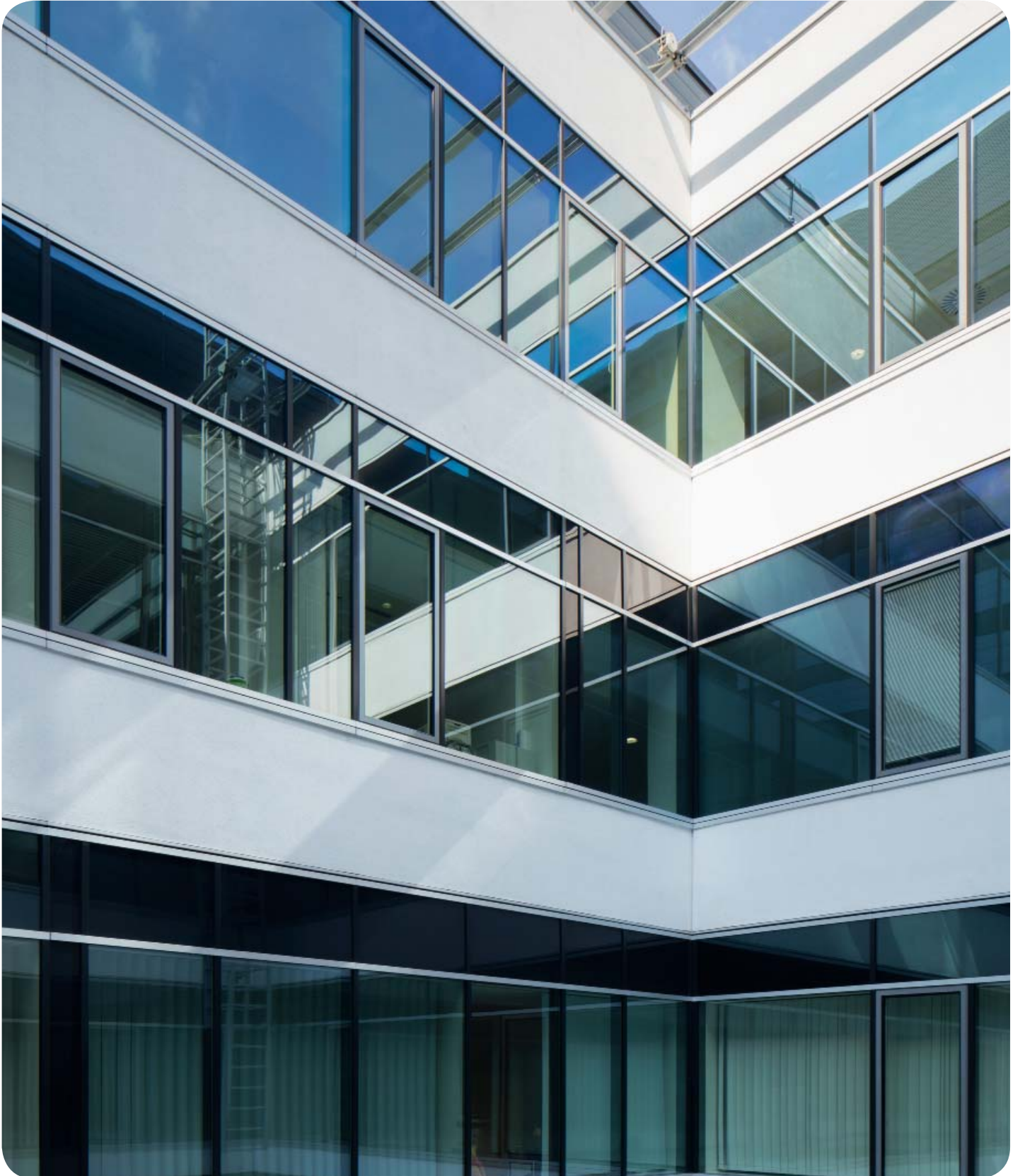
Transparent fire protection:

approx. 500 m² glass walls for fire resistance class EI 30 with Pilkington **Pyrostop**[®]; approx. 120 EI 30 single- and double-leaf fire doors with Pilkington **Pyrostop**[®], system designed by Strähle all-glass system 2300



Hospital of the J.W. Goethe University, Frankfurt, Germany:

"Healing Architecture"





The extensive renovation of a hospital when in operation presents a particular

challenge due to the level of technological and logistical complexity. Prof. Christine Nickl-Weller, architect and head of the specialist area of studies "Designing hospitals and buildings for the health industry" at the Technical University of Berlin, compared this process once with the maintenance of an airplane where even the smallest details need to perform flawlessly. Light and ease of orientation are two elementary components of well-researched strategy with which the concept of "Healing Architecture" was implemented at the University Hospital in Frankfurt.

The contribution of architecture to the human wellbeing, positive and negative, is considered a proven fact. In the best of cases, the term "Healing Architecture" can be used for hospital buildings; in worse cases, one refers to "Sick-building-Syndrome". It is common knowledge



Ward and plinth building: A covered roof connects the ward building with the central building 23 and refers to the glazed entrance hall which forms the interface between university and hospital sections.

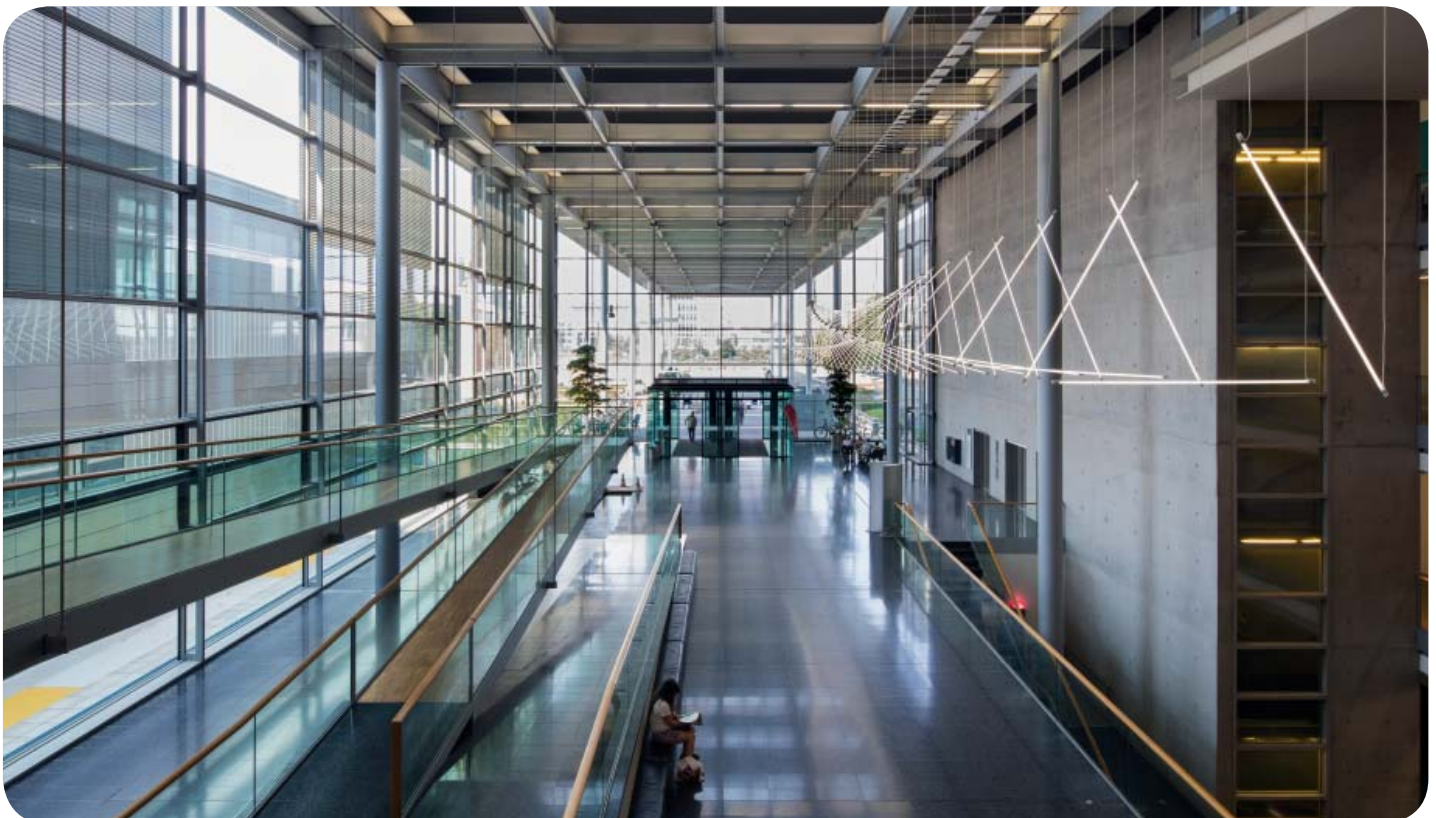
in construction industry that a well designed hospital can increase the satisfaction of the employees and improve the wellbeing of patients and visitors. Whether and if rooms, especially those in hospitals, can actually foster people's healing processes, is currently being

researched by scientists of the TU Berlin in the specialist area of studies "Designing hospitals and buildings for the health industry", headed by architect Prof. Christine Nickl-Weller.

Please turn the page



Entrance area of the plinth building: A light-flooded reception hall replaces the former entrance from the 1970s with its locked-in / boxed-in atmosphere.





The architectural implementation of patient-related requirements in regards to openness, brightness, safety and comfort presents a significant challenge for technologically and logistically highly complex and dynamic operations such as hospitals. The level of complexity may perhaps be comparable to

open-heart surgery. In practice, Mrs. Nickl-Weller and her planning team at Nickl & Partner Architekten AG, Munich, Germany, have demonstrated repeatedly (and have won awards in doing so) what they specifically understand to be healing building and room climate, a good example of which is the

Award-winning "Healing Architecture": With their new definition of employee and patient-friendly hospital architecture, Nickl & Partner were declared "Winner" at the Iconic Awards in 2015. (left: Courtyard 6, right: Courtyard 3)

renovation and new built construction of the plinth level of the main building 23 at the University Hospital in Frankfurt.

Research put into practice

In the 1970s, the University Hospital in Frankfurt was a very modern hospital. The entire construction project was aimed to modernise the hospital in terms of design and appearance and to meet the requirements of the renowned high-level medical services in Frankfurt. Two research and laboratory buildings as well as a lecture hall as central place for education, research and development form the border of the campus which opens to the banks of the Main River. A covered roof connects the structural components and marks

The link bridge to the ward (first construction section) was achieved using two glass access routes with bright, friendly rooms and wide corridors.



Fixed window construction "Schüco Firestop F 90" with Pilkington **Pyrostop**® 90-361.

the transparent entrance hall as an interface between University and Hospital operations. Light and ease of orientation, two very simple, elementary components, determine the concept of the extensive renovation and reconstruction of the University Hospital. Especially the high degree of daylight penetration through the façades and inner courtyards, the colourful walls and the use of differentiated materials provide and facilitate orientation.

Construction section 2, plinth levels

The 4-storied plinth levels of the main building 23 include the emergency room, the medical treatment areas as well as supply and technology. The plinth levels were completely gutted and replaced by new buildings. Two new main access routes at the interface to the first building section east, the high-rise slab, and along the wards, create bright and friendly rooms and generous access corridors. The functional areas align with the main route as pavilions. Atriums are arranged at regular distances to each other and reach all the way to the basement level. The garden for the patients is being redesigned in an expanded atrium. The daylight areas made possible by the atriums create a pleasant ambience for patients and hospital staff.



Structuring and daylight through atriums

On the inside, the building consists of atria with glass façades. Clarity, openness and minimalistic design are the key principles here. Restraint, formal order and creative uniformity mirror the attempt to make complex spatial context understandable and provide people especially in difficult situations with orientation through the building in a simple manner.

The second construction section with building 23 D, E, F completes the architectural concept of forming medical centres and close off the entire ensemble around the newly created pavilion garden. Three connected pavilions provide

standard care for patients in 258 beds and intensive and/or intermediate care in 82 beds.

The diagnostics area includes radiology and nuclear medicine as well as ENT and an eye clinic. There is a pharmacy in accordance with GMP standards (Good Manufacturing Practice) and eight operating theatres as well as an MRI and a CT. The main element of the design is the main access route which provides well organised access and logically separates visitors from patient and personnel traffic. The patient garden forms the roof over the courtyards of the hospital which are lit by the atria and a narrow glasslite.



Inner corner application EI 90 of one of the main access routes (link bridge).

Please turn the page



Renovation of the external façade of the ward

One part of the renovation and modernisation of the University Hospital carried out by Nickl & Partner was the replacement of the glazed façade of the ward during full operation. The glazed wall had to fulfil energy-related requirements and meet the new creative criteria. The objective was to make use of the renovation in order to create a building with a recognition value for the campus. The replacement of the façade of the operational ward presented a logistical challenge. A covered roof connects the ward building with the central building 23 and leads on to the glazed entrance hall which forms the interface between university and hospital sections.

Mullion-transom façade EI 90 below the link bridge (bottom right).

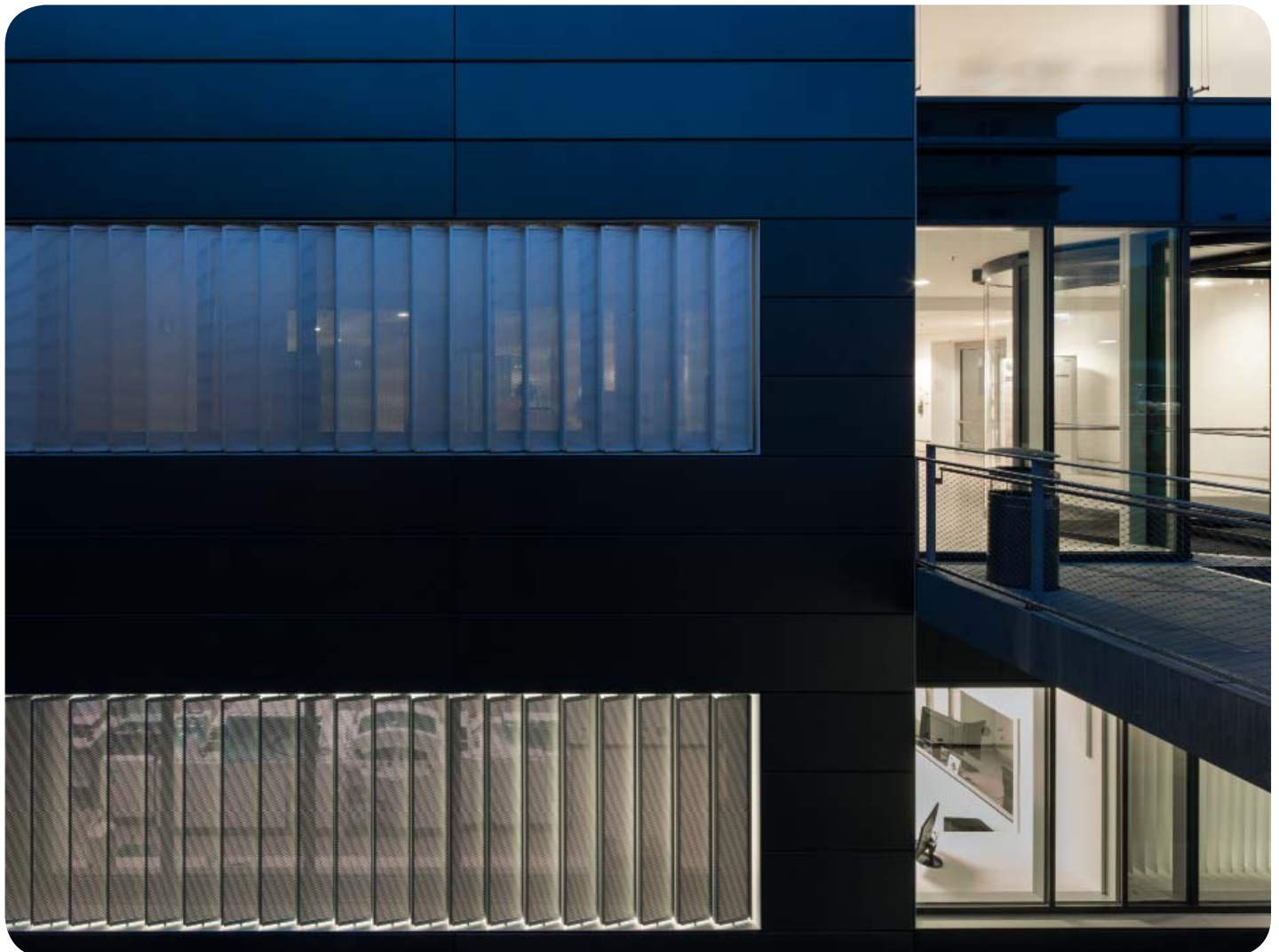
Three additional functional buildings

As part of the upgrade, the hospital -campus was extended by a new lecture hall building as well as two research and educational buildings in the immediate vicinity. The building reflects the clear, urban design of the building complex with simple geometric forms and a restriction on the maximum height.

An umbrella made of glass surrounds the research wing. The building is characterized by the addition of simple geometric forms which have been derived from the logic of the processes taking place inside the buildings. Both lecture halls are also enclosed and connected by a transparent climate shell. Being cubes made of coloured reinforced concrete, they appear as a house inside the house.

Fire protection re-assessed

As part of the extensive renovation programme and the associated dissolution of the existing means of fire protection for the hospital in Frankfurt, all measures for fire and smoke protection were re-assessed in accordance with the relevant regulations and technical requirements. It was possible to create individual freedom, e.g. when defining fire compartments and organising escape routes and rescue access, due to a holistic view as part of a holistic fire protection concept. This concept was developed by HHP Wester Beratende Ingenieure GmbH, Bielefeld. In doing so, not only was compliance with the Hospital Construction Ordinance (KhBauVO) achieved, but additional special decrees, regulations and technical rules for health and safety, accident prevention as well as for

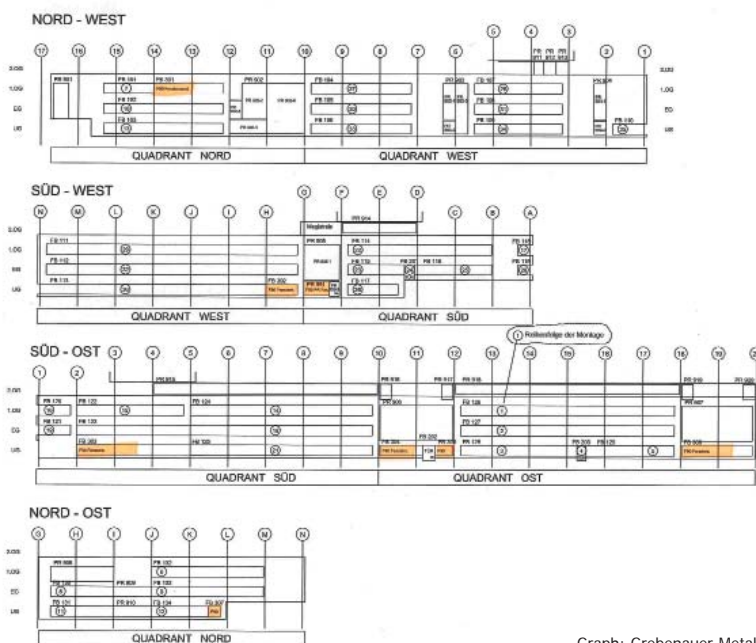




Floorplan: ground floor of the plinth building (second construction section): Extensive areas flooded with daylight are made possible by inner atriums. Graph: Nickl & Partner.

building area for a period of 90 minutes. The fire-resistant glass invisibly forms part of the façades (mullion-transom system) and fixed windows. For the mullion-transom façade "Jansen VISS-TV F 90" and for the fixed window elements "Schüco Firestop F 90" glazed with Pilkington **Pyrostop®** 90-361 were used. Comprising Pilkington **Optiwhite™**, an extra clear low-iron glass, the units blend in well with the adjacent, non-fire-resistant façade areas. The fabrication and installation of the façades in the plinth levels was carried out by Grebenauer Metallbau Schreiner GmbH, a member of Schreiner-Gruppe.

Location plan of the EI elements in the façades of the plinth building (yellow colour)



Graph: Grebenauer Metallbau

handling of hazardous substances were taken into consideration.

Burning challenges met with brilliant solutions

In line with the creative principle of light, unobstructed vision and ease of orientation, the passive fire protection measures in the patient and functional areas were largely kept transparent. Extensive glazing of all outer façades and atrium façades could be kept

glazed even where increased fire resistance requirements had to be met. Inside corner areas which require sections of the wall to be fire-resistant have been glazed as well as façades adjacent to each other where the wall forms part of an extended fire wall. In other areas façades are next to escape routes and rescue access ways. In both applications, fire-resistant glazed wall systems with a fire resistance classification of EI 90 reliably prevent the spread of fire to the neighbouring

Hospital of the J.W. Goethe University, Frankfurt, Germany 2. Construction section, plinth construction

Building Owner:

State of Hesse, represented by the Hessian Building Management

Architect:

Nickl & Partner Architekten AG, Munich

General planner:

ARGE Uniklinikum FFM

Metal construction:

Grebenauer Metallbau Schreiner GmbH, Grebenau

Fire risk assessment:

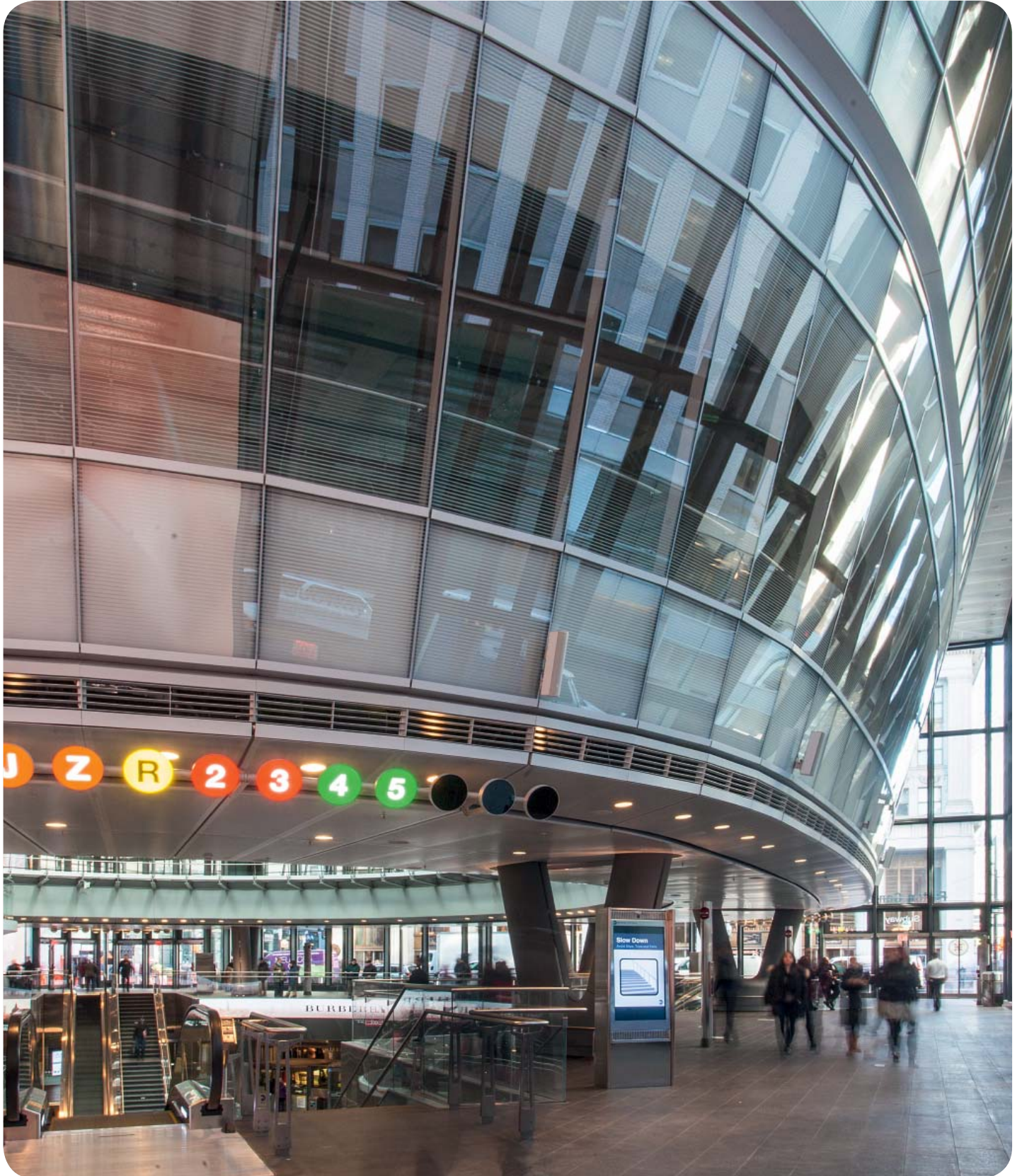
HHP West Beratende Ingenieure GmbH, Bielefeld

Fire protection glass:

EI 90 glazing with Pilkington **Pyrostop®** in some areas of the façades of the plinth levels; fixed window elements "Schüco Firestop F 90" and mullion-transom façade "Jansen VISS-TV F 90" glazed with Pilkington **Pyrostop®** 90-361 with low-E and solar control coating.

Fulton Center, New York City (USA):

Manhattan's Modern Gem





New York City's new Fulton Center transit hub represents the latest generation of buildings for public transport, featuring light-filled, wide open spaces combined with a high level of fire safety. The transparency of the overall design relies on fire-rated curtain wall systems using Pilkington Pyrostop®. Pilkington's exclusive North American partner Technical Glass Products (TGP) designed and supplied the entire system glazings which were matched with the non-fire-rated curtain wall systems for a consistently sleek design.

When New York City was planning one of the first subways in the U.S. in the 1800s, a very real challenge was convincing people that going underground would be safe and pleasant. If those subterranean-fearing Victorian era

citizens could see Manhattan's Fulton Center transit hub opened in late 2014, they would be amazed at the light-filled, wide open space. Located in the Lower Manhattan Financial District, the 16,700 m2 Fulton Center integrates five subway stations served by nine subway lines, and includes retail and office space. The Metropolitan Transportation Authority predicts the center will serve as many as 300,000 transit riders daily.

Daylight Streams Through Giant Glass Eye

A defining visual feature of the Fulton Center is a 16 m diameter glass oculus (Latin for "eye") that streams light into a grand atrium. Beneath the oculus is the "Sky Reflector Net," an artwork by James Carpenter Design Associates, Grimshaw Architects and Arup with 952 perforated aluminum panels that transmit sunlight 34 m down into the Fulton Center's lowest levels.

Within the grand atrium is a two-level circular enclosed space that will house restaurants and retail. Matching the curve of the oculus, some members of the project team affectionately call this space the "doughnut." To keep with the light-filled aesthetic of the rest of the Fulton Center, the designers wanted this space to be glazed to allow in daylight from the oculus and Sky Reflector Net.

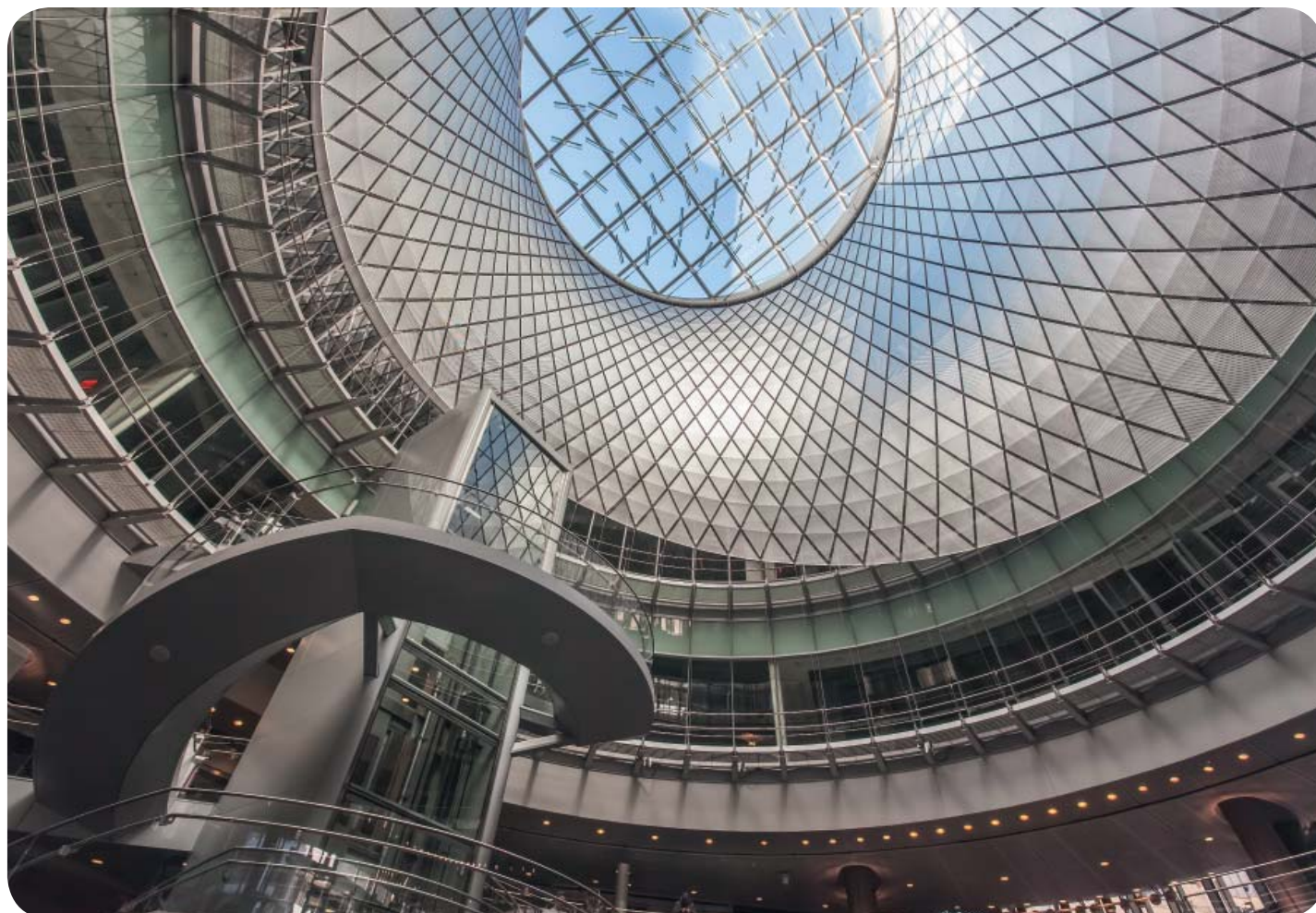
Challenges in Design and Fire Safety

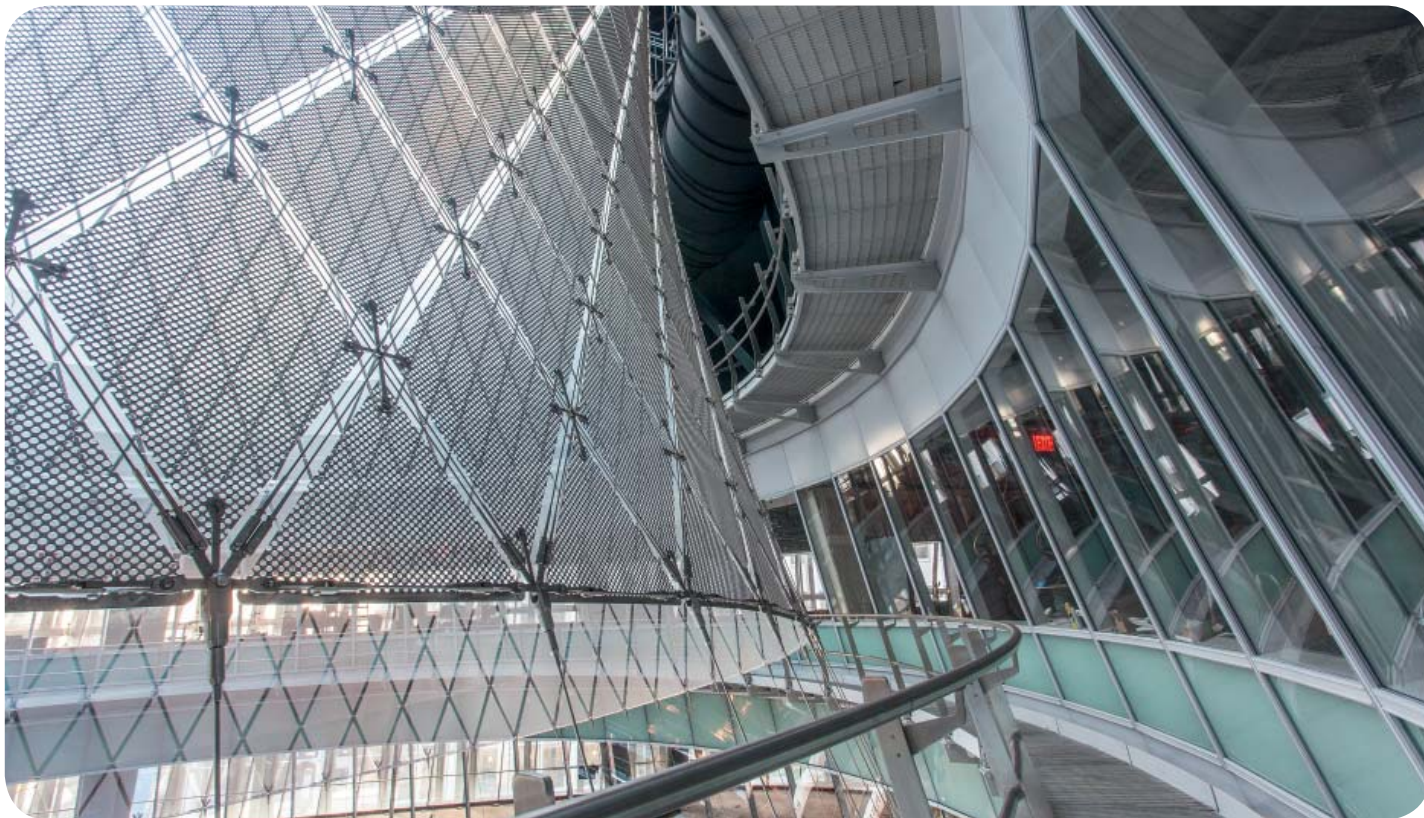
Designing and installing the glazed curtain walls for the doughnut required overcoming several complexities. In addition to its curved form, the doughnut's walls also slant upward to match the angle of the oculus, which

Please turn the page



"Oculus": Daylight streams through the "eye in the sky" and the "Sky Reflector Net" below into a grand atrium





The doughnut's walls slant upward to match the angle of the oculus, which creates an inverted plane.

creates an inverted plane. To successfully achieve this design, Technical Glass Products (TGP) worked with the project team to develop custom captured horizontal steel mullions that fit the distinctive shape, for a flush and plumb surface appearance, with adequate spacing between each curtain wall segment.

Another challenge of the project was matching the aesthetics of the fire-rated curtain walls on the doughnut's upper level (third floor) and in a prominent elevator core with the non-fire-rated curtain wall system on the doughnut's lower level. To achieve a seamless aesthetic, the designers chose TGP's matched curtain wall systems.

Matching Fire-Rated With Non-Rated

To create suitable curtain walls in the Fulton Center, TGP used steel framing elements. Steel frames can be formed from tubes, instead of sheets, and shaped in an extrusion-like process that allows for a wide range of narrow mullion

profiles. Because the same manufacturing method can be applied to fire-rated frames using steel back elements, it was possible for the fire-rated curtain wall frames to match the slender frame profiles of the non-rated system. The specially designed frames were combined with Pilkington Pyrostop® fire rated glass in two different ratings – 60 minutes integrity and

insulation for the curtain walls and 120 minutes for the elevator core. Apart from their excellent fire-safety properties the glazings feature an extraordinary high level of

Curtain walls on the upper level (third floor) are fire-rated 60 minutes integrity and insulation and match perfectly with the design of the non-rated curtain walls. TGP combined Pilkington Pyrostop® fire rated glasses in customized curtain walls out of their Fireframes Series.



Some of the fire-rated insulated glass units (IGUs) using Pilkington **Pyrostop**® were combined with the same decorative sand blasted finish used on the non-fire-rated glass.

transparency which perfectly fits the optics of the non-rated curtain walls. Andrew Anderson, associate principal of Grimshaw Architects, explicitly praised the uniform design and at the same time emphasized TGP's added-value services in the course of the project: "Because the interior spaces are flooded with light, a crucial part of the design aesthetic was glazed curtain walls with clean sightlines," Anderson said. "That's easy enough to achieve with non-rated curtain wall assemblies, yet TGP's fire-rated curtain walls provide the same crisp, modern look. Their technical expertise and service enabled us to achieve a consistent look across the curtain wall assemblies."

Further maintaining the uniform appearance between the two systems, TGP worked with Grimshaw's design team to develop fire-rated insulated glass units (IGUs) using Pilkington **Pyrostop**® with the same decorative sand blasted finish and a ClearShield™ protective

Prominent elevator core also uses fire-rated curtain walls with Pilkington **Pyrostop**® rated 120 minutes of integrity and insulation.



coating applied to the non-fire-rated glass. This project also had the logistical challenge of delivering materials at the right time and in the right way to the crowded Lower Manhattan building site that has experienced vast redevelopment following the September 11,

2001, terrorist attacks. Tight coordination between TGP and the project team partners was crucial for successful curtain wall completions.



Fulton Center Transit Hub, New York City

Architects:

Grimshaw, New York City

Glazing Contractor:

Enclos, New York City

System Supplier for Curtain Walls:

Technical Glass Product (TGP), Seattle

Fire-Rated Products:

Pilkington **Pyrostop**® rated 60 minutes of integrity and insulation in Fireframes Curtainwall Series on third floor façades (523 m²); Pilkington **Pyrostop**® rated 120 minutes of integrity and insulation in Fireframes Curtainwall Series as elevator core (102 m²)

TGP Company Profile:

Specialists for Glass Related Products and Services



Since 1980, Technical Glass Products (TGP) has been supplying specialized glazing materials and systems for commercial and institutional buildings. Its motto, "one source, many solutions," reflects a commitment to providing products and services to help solve challenges faced by architects, general contractors and glaziers. The company has two business lines: 1) fire-rated glass and framing, and 2) specialty architectural glazing. TGP has offices in Seattle and Toledo, USA; Toronto, Canada; and Dubai, UAE.

Fire-Rated Glass and Framing

In North America TGP is the recognized leader in the fire-rated glass and framing industry.

Chicago Art Institut, Chicago (USA) – EI 60 Fireframes Aluminium System of TGP comprising Pilkington **Pyrostop**®.



"TGP's core values of service, teamwork, integrity and innovation are always at the center of every interaction, business practice and employee development effort", asserts TGP President Jeff Razwick.

the Fireframes® family of steel, aluminum, wood, curtainwall and glazed floor framing; and heat-resistant glass ceramic for gas and wood-burning fireplaces and stoves. TGP also supplies a range of specialty architectural glass and framing products, including the Pilkington **Profilite**™ channel glass system – U-shaped cast glass channels in an exterior frame suitable for dramatic lighting effects and daylighting.

In-House Support for Architects and Designers

In addition to its product offerings, TGP has an in-house design and engineering team that works with architects and designers to meet building code requirements for life safety and a host of other challenges. They offer AIA-registered continuing education, project consultation, product specifications, CAD drawings and rapid-response quoting. ■

The company is the sole supplier of transparent fire-rated wall panels incorporating Pilkington **Pyrostop**®. Other TGP products include



TGP

TECHNICAL GLASS PRODUCTS®
one source. many solutions.®

Technical Glass Products

8107 Bracken Place SE
Snoqualmie, WA 98065

USA

Phon: +1 (0)800 426 0279

Fax: +1 (0)800 451 9857

sales@fireglass.com

www.fireglass.com

Hurricane-rated fire-rated glass:

Resisting Fire and Wind-Borne Debris

There are numerous application specific types of fire rated glass in the Pilkington range. A very specific type is currently in its final stage of development in the USA - a Pilkington Pyrostop® glass type which adds hurricane-resistant performance to the basic functions of fire resistance. The product is strongly requested in the most hurricane prone regions along the Gulf of Mexico and the East Coast. Pilkington partner Technical Glass Products (TGP) directs the testing and documentation in close cooperation with the Pilkington R&D center in Germany.

Although wind-borne debris protection for buildings is a common requirement in wind and storm prone regions of the U.S., there are no typical "hurricane classes" which might lead to clearly defined ratings. Requirements are mainly based upon the respective local wind zones, which for example in the state of Florida range in seven different degrees from wind speeds below 161 km/h (100 mph) up to 241 km/h (150 mph) and more.*

Large missile testing

To prove their capability under these difficult circumstances, building products must be subjected to either a small or a large missile test. Large missile impact tests simulating large wind-borne debris, such as tree limbs, sign posts and other large objects, are required for products such as curtain walls, entrances and storefronts installed up to 9 m (30 feet) above grade. To simulate potential



Missile impact tests with hurricane-rated fire-rated Pilkington Pyrostop® glass at Underwriters Laboratories® (UL) in Northbrook, Illinois: the wood "missile" shot at the glass at 56 km/h (34 mph) simulates the impact of large wind-borne debris. Photo: TGP

impacts, a 51 mm x 102 mm (2" x 4") timber "missile" is shot at the glass at 56 km/h (34 mph). After that, wind pressure is simulated by building up different grades of pressure on the glass in 9,000 individual cycles.

Local partnership

Building up strong partnerships with national and local glass and system specialists is crucial in the development of fire-rated glass types with additional regionally or nationally demanded properties. In this case TGP does the testing and the documentation, working closely with Pilkington in Germany to develop a fire-rated glass which can also successfully pass the hurricane testing. TGP will then be responsible

to take the approved system to market, including marketing and promoting it, conducting discussions and specifications with architects, and coordination and manufacturing for projects.

Multifunction as basic principle

While hurricane-rated fire-rated glass represents a highly specific type of an already special glass, it also reflects the general philosophy behind Pilkington fire rated glass: the capability to offer a comprehensive range of multifunctional glass types which are not only adaptable to individual fire ratings and application fields but also to additional standardized demands in safety, energy efficiency and individual design.

* Testing and approval of building products refers to several American Standards applying to building protection against the impact of wind and debris such as ASTM E1886, ASTM E1996 (both national in the U.S.) and TAS 201, 202 and 203 for Florida.

International activities of Pilkington's fire protection business unit:

Different markets – different fire protection standards



The level of protection for human lives or assets in regard to the fire safety

in buildings is not yet harmonized on an international level. Nils Brinkmann, Commercial Director of Pilkington's specialist business unit for Fire Protection products of Pilkington Deutschland AG, provides an insight into the activities of his teams to develop new geographical markets in view of their individual characteristics. At this moment there is a special focus on South America and India as well as on Singapore and Taiwan.

Q: Which are the criteria you have used to identify new geographical markets worth to be focused on?

Nils Brinkmann: We have concentrated our efforts in markets where we can make use of our corporate Pilkington or NSG Group network of companies where contacts to the national players in the building industry already exist. In addition, there has to be a national building code as well as national standards for fire testing in the markets – authorities and official bodies must be aware of the need to improve the safety standards and be willing to introduce or amend standards to implement the highest level of fire safety.

Q: How do you analyze the markets in terms of the level of fire safety to assess the chances for a market entry?

Nils Brinkmann: A launch of our products in each market needs to be commercially feasible

which to a high degree depends on existing standards and quality of building. There has to be a realistic chance of launching our range of fire-resistant glass products in the market within a relatively short period of time. Before taking any actions we carry out a survey of the market. We have defined a questionnaire which takes into consideration various aspects. Are there local manufacturers of fire doors and partitions? Are there manufacturers of framing systems? What are the relevant local building codes and what is the required level of fire safety? Are there local fire test laboratories and do there exist fire test standards? What are the typical price levels for fire-resistant building products and is the market looking for high quality products for use in interior walls? We aim to collect as much information as we can to get a comprehensive and precise picture of the market before we start any activities.

"We make use of the worldwide presence of the NSG Group with its network of companies to obtain well researched market surveys and to manage the local distribution of our fire-resistant glass products."

Q: Which markets did you recently identify as being worth developing for sales activities?

Nils Brinkmann: We have made considerable progress in Brazil and Argentina. In Argentina, for example, fire test standards exist and the first fire tests according to the national



Nils Brinkmann, Commercial Director Fire Protection Glass of Pilkington Deutschland AG.

standards have successfully been completed. In addition we are negotiating with long-term partners who are manufacturers of profile systems who have shown an interest to develop these markets in close cooperation with us. The advantage for them is that they can rely on the NSG Group's Team in South America which is managing the sales activities in Argentina, Chile and Brazil. They have individuals in each market who are well familiar with the local requirements and regulations and have recently looked into the fire protection segment.

"We have to take into consideration market-specific architectural trends as well as procedures for fire testing and product approval."

Q: You mentioned India as another market to focus on in regard to the international sales activities. What are the specific challenges you are faced with in India?

Nils Brinkmann: Our task is to create awareness for the need for fire safety and to drive the implementation of higher safety standards which then in turn lead to an increase in demand for high performance fire-resistant glass. According to the existing National Building Code (NBC) of 2005, glass products which comply with E and EW classifications are sufficient to satisfy the existing levels of fire safety for partitions and compartmentation walls. We need to promote the use of fully insulated fire-resistant glass products by educating specifiers and architects to create awareness about the benefits. Our aim is to influence the officials involved in formulating the standards to raise the level of fire safety in the revised NBC which is to be published soon.

Q: Can you illustrate the current practice in India by looking at an example of the local building code?

Nils Brinkmann: In high rise buildings or skyscrapers it is mandatory in India in accordance with the building regulations that save shelters are built in every few stories. Such zones are referred to as 'Refuge Areas'. In line with the NBC such areas must be encased with glazed walls which provide EW 120 performance (reduced heat radiation). According to our experience and international research activities this presents a significant safety risk in the case of fire. In the event that the fire is coming close to the shelter the glass will not be able to protect from the dangerously high levels of heat radiation. The refuge area could turn into a death trap for those inside. When this topic is concerned, architects and building authorities have to understand the need for a fire-resistant glass which not only is able to form a barrier to hot

smoke, fumes, flames and gases (integrity performance) but for a glass which provides full insulation performance, like Pilkington's product line Pilkington **Pyrostop®** does.

Q: You have mentioned Taiwan and Singapore as further potential markets. What can you tell us about fire safety levels there?

Nils Brinkmann: Both are referred to as "Tiger States", with economies which are technology driven achieving impressive growth rates year on year, a highly developed infrastructure and high level of construction activities. The level of fire safety reflects this level of sophistication. Well known and acclaimed architects, a lot of which have studied and gained working experience abroad, are aware of international standards and "import" American or European standards. They also follow the trend of modern, transparent architecture. They are involved in many of the projects currently being built. We are able to provide years of experience and can assist building professionals with comprehensive knowledge about transparent passive fire protection. Part of our activities is to conduct fire tests on a regular basis at local test laboratories and to provide trainings. By having signed up a local processor for our range of fire-resistant products who has invested in dedicated processing equipment, we are able to provide an excellent level of service to the market, adapting to the required lead times, local building regulations, as well as project specific requirements.

"A successful launch in a market depends highly on a good cooperation with local championing partners and product ambassadors"

Q: What are the success factors according to your views and experiences to be able to successfully supply high performance fire-resistant glass to international markets?

Nils Brinkmann: Key to our success is the high visual quality of our fire-resistant glass products which in effect makes them hardly noticeable. They do not differ from ordinary glazing systems. The challenge: High performance fire-resistant glass such as Pilkington **Pyrostop®** needs a significant effort of technical and professional support in terms of educating people about its use. Well trained, educated and experienced representatives and system partners in the markets to champion our products are of great importance as well as well-informed officials and architects who act as ambassadors or promoters of our products because they are convinced about their consistent reliability and longevity. These individuals are key to influence and shape the way a market takes towards transparent passive fire protection. We are confident about each of the three focus markets having a significant growth potential for high performance fire-resistant products. ■

BRANDSCHUTZ transparent
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Pilkington Deutschland AG
SBU Fire Protection Glass
45801 Gelsenkirchen

Responsible:

Vedran Matos, Silke Stein
Phone: +49 (0) 209 168 23 20
Telefax: +49 (0) 209 168 20 56

Editorial Team:

Nils Brinkmann, Andreas Deil,
Dr. Dieter Koch, Frank Körbel, Vedran Matos,
Volker Sigmar, Silke Stein

Photos:

HGESch Photography, Hennef
Technical Glass Products, USA
Strähle Raum-Systeme GmbH, Waiblingen /
Marc Eggimann, Basel
Werner Huthmacher, Berlin
Nicki & Partner Architekten AG, München
Greibenauer Metallbau Schreiner GmbH,
Greibenau

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Pilkington **Pyrostop**[®]
Pilkington **Pyrodur**[®]
Pilkington **Pyroclear**[®]

Pilkington Deutschland AG
Haydnstr. 19 · D-45884 Gelsenkirchen
Telefon +49 (0)209 168 0 · Telefax +49 (0)209 168 20 56
fireprotection@nsg.com
www.pilkington.com/fireprotection

