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Fixing of façade panels

Invisible is wonderful

Thanks to KEIL's undercut technology, the façade of Daniel Libeskind's spectacular residential construction in Berlin is kept firmly in place.

Sapphires are rare gemstones. They can be found in Sri Lanka, India, the USA, Australia or Nigeria – but nowadays also in Berlin. Here, in the district Mitte, the beating heart of the capital, Daniel Libeskind created the *Sapphire*, a residential complex as spectacular and as rare as the crystal after which it was named by the star architect., The multi-storey building, sparkling and multi-faceted like the jewel of the same, name stands out from the purely functional residential buildings of the streets.

This association is mainly due to its façade: the complex shape with many asymmetrical elements and a complete lack of right angles, with extraordinary visual axes and perspectives immediately brings to mind a cut gemstone. Even the colour of the exterior panelling resembles the bluish shimmer of a sapphire. The completely ventilated façade is covered in bioactive, self-cleaning porcelain stoneware tiles with a textured metallic surface. More than 3,600 of these ceramic elements were produced by Italian stoneware specialists Casalgrande Padana according to Daniel Libeskind's designs; 3,100 of which were cut to measure and accurately fitted into the complex surface structure of the outside panelling.

Invisible fixing system

This unique façade was only made possible by a fixing technology, which makes the fastening of the panels invisible and therefore keeps the surface free from distracting visible fixing points. The undercut technology of fixing specialists KEIL was the system of choice. The family-owned company, which is located near Cologne, realised the potential of the undercut technology at an early stage and took an important part in promoting its development. No other supplier in this segment holds as many European Technical Assessments (ETAs) as KEIL. KEIL and Casalgrande have been keeping a longstanding and successful partnership. Many challenging façades have been implemented in cooperation, for example the façade of the Vanke Pavilion at the Expo in Milan. Moreover, Casalgrande hold their own ETA with the KEIL undercut anchor as the officially approved fixture.

KEIL's undercut technique, however, is as simple as it is ingenious. By means of a patented drilling system a blind hole with an expanded base is drilled into the backside of the façade panel. Subsequently, the KEIL undercut façade anchor is inserted into the hole. This anchor guarantees a positive-locking fixing, which is free of expansion force. The insertion of the undercut anchor and the assembly of the agraffe are carried out in one single process. As soon as the panel is equipped with agraffes, it can be mounted directly on the supporting construction. The advantages are obvious: The hidden undercut façade anchor keeps the aesthetics of the façade panel free from visible drill holes and other distracting elements, allowing high-quality façade panel

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surfaces to be securely fastened and at the same time shown off to their best advantage. The KEIL undercut system is considered to be a particularly safe and approved fixture, even for thin-walled façade panels, like those used on the *Sapphire*.

The undercut technique also offers economic benefits like durability and low maintenance costs as well as a reduction of cleaning costs, as the fastening on the backside makes dirt stains a thing of the past. The fixture is purely mechanical and can be carried out regardless of the weather conditions. Furthermore, KEIL undercut anchors are compatible with nearly any available panel material on the ventilated curtain façade, be it ceramic, porcelain stoneware, natural stone, fibre cement, glass fibre concrete, solid surface material, synthetic material/HPL, glass ceramic or glass fibre reinforced, high-strength concrete. Therefore, this kind of fixing technology offers countless creative possibilities like closed or open joints, elegant, traditional, modern, filigree or unconventional designs. It allows for the implementation of even the most daring façade projects, like the *Sapphire*.

Complex project

But even for the specialists at KEIL's, the Sapphire was not a run-of-the-mill project. "With his expressive architecture, Libeskind presented all partners with big constructional and technological challenges," KEIL product manager Georg Miebach confirms. "We had to bring this particular architectural creativity and outstanding design in line with building regulations and authorisation requirements. During the preliminary stages, we closely coordinated particularly tricky constructional details again and again with the detail planners of the façade engineering company Medicke in order to ensure that the undercut anchor made in Germany can warrant licence-compliant attachment. We delivered a total amount of nearly 15,000 undercut anchors, every single one of which could carry a weight of up to 900kg."
The geometry of the façade allowed for only 500 elements in the default format 60cm x 120cm. The remaining 3,100 ceramic panels had to be cut to measure according to precise worksheets from the construction plans. The cutting was not carried out at random, but so as to ensure the texture on the panels could be assembled precisely and seamlessly.

A structural analysis determined the number of system drillings with an expanded base – so called undercut drillings - which were necessary for an expansion-force-free assembly with KEIL undercut anchors. These drillings are located on the backsides of the thin ceramic elements and cannot be seen from the front. The panels with default measurements required four of these drillings, the elements with special measurements, however, up to eight, depending on the dimensions and the particular mounting situation of the individual façade component. Given the fact that there were so many special elements, an identification code was assigned to the backside of every single ceramic panel to ensure that they could be exactly positioned on site. In order to meet the schedule, the ceramic panels were delivered in 15 separate shipments. The material had to be packed onto special pallets, some of which could only carry 15 panels. The complete delivery lasted nine months, the entire cladding was mounted within only four months.

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The mounting, the detailed construction documentation including 3D-planning and the manufacturing of all components was carried out by Metallbau Medicke in Glauchau, a façade engineering company, whose experienced technicians are familiar with demanding construction projects. However, Marcus Medicke, managing director, also considers the *Sapphire* one of the biggest constructional challenges his company has ever faced. “This façade certainly was one of the most complex projects we have ever implemented. And this applies in several respects: the raw material of the façade cladding, the supporting construction and the ambitious architectural design. We have broken new constructive ground and created lots of new mounting solutions for the future. The cooperation with the attachment specialists at KEIL also went extremely well.“

Thanks to the “cut” by Daniel Libeskind and the extraordinary efforts of all companies and service providers involved, the Sapphire has turned out to be a unique housing complex, whose façade is a work of art in itself.

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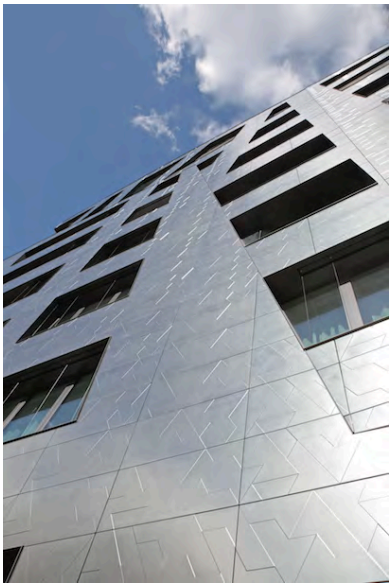
Sapphire Berlin
Photo: André Baschlakow

Sapphire Berlin
Photo: Corrado Ravazzini



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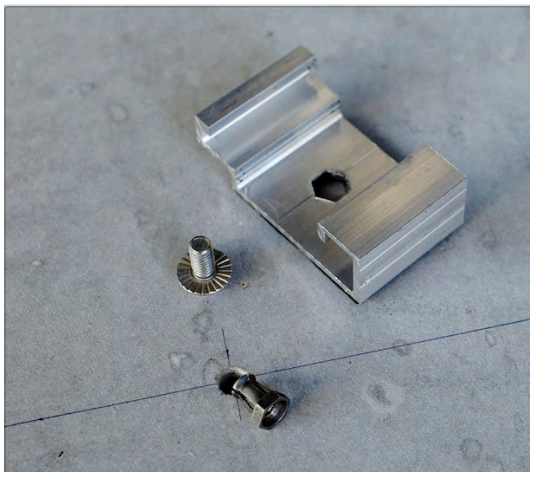
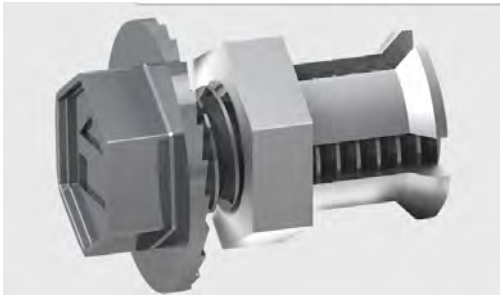


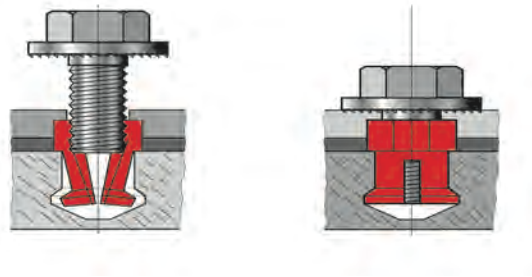
The attachment points are one the rear of the panel and are thus no longer visible after the installation
Photo: KEIL Befestigungstechnik

Easy insert of the facade panel
Photo: KEIL Befestigungstechnik

Vanke Pavilion
Photo: Hufton+Crow



The undercut anchor consists on an anchor sleeve and a hex screw
Photo: KEIL Befestigungstechnik



Undercut system: When the screw is inserted, the anchor sleeve settles into the undercut hole with a positive fit and free from stress
Drawing: KEIL Befestigungstechnik

Sapphire Berlin
Photo: Corrado Ravazzini