Under tinted acrylic sheets as an outer “skin” lies the thermal insulation material with unrivalled performance that adapts to all shapes.

FOAMGLAS® cellular glass insulation performs like a true “polarskin” on the envelope of the building.

The setting image of the historic city of Graz creates an exciting interplay with the shimmering “skin” of the building created from acrylic scales.
Inorganic cellular glass insulation will ensure its survival.

**Kunsthaus Graz, New Museum**

It has been a long journey and Graz finally has its Kunsthaus: an organic object with a flickering acrylic-light-skin and exhaust jets on its back that seems to float. This building was developed to participate in the global art exhibition business and was created using computer design concepts. For the survival of this unique, biomorphic building, the long term function and technical performance of the materials used are essential.

Futuristic, avant-garde or from another planet? The “friendly alien” with its striking biomorphic structure is the result of the manifest fascination of its creators for the “animal presence of architecture” and cannot be described in any way as traditional architecture.

The designers, the London architects Peter Cook and Colin Fournier, in collaboration with Architektur Consult, used what can be described as “extraterrestrial language” for the shape of the building. Beneath the bluish, shimmering skin of the Kunsthaus – floating like a bubble of air – there is a thermal insulation material which is seemingly less spectacular, but nevertheless is efficiently demonstrating its high-tech performance. FOAMGLAS® cellular glass insulation may be earth-bound but it is endowed with space-age characteristics. Kunsthaus Graz, is also known as the “space-lab”, and its designers created an impressive synthesis of their innovative language of form and the historic ambience of the Mur district. The exciting interplay between the new biomorphic structure on the bank of the Mur and the old Clock Tower on the Schlossberg is already becoming the city’s trademark. It creates strong international appeal where the past and the future meet in a productive dialogue between tradition and avant-garde. The City of Graz was Cultural Capital of Europe in 2003 and with the Kunsthaus in its location in the west of the city, it creates an effective catalyst for positive change in an area of the city that was previously disadvantaged.
Kunsthaus Graz meets the most up-to-date requirements for museums on the international loan circuit. It will not maintain a collection of its own nor a permanent exhibition and has no permanent displays or research facilities. Its purpose is to provide an up-to-date art cluster with powerful synergy between the exhibition venue, new media, photography, events and other means of presenting contemporary art.

With this mind, the unique shape of the building is more easily understood. Working on this project, the designers and the city council not only imagined and illustrated "Architecture as a work of Art" but built it too.

Graz was looking to create a sensation: with Kunsthaus the winds of change are set. Kunsthaus - a new roofing experience.

With FOAMGLAS® the whole of the country can have new roofs.

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Kunsthaus Graz

**FOAMGLAS®**

**COLIN FOURNIER** commenced his education at the Beaux-Arts in Paris and studied architecture and urban planning at London’s prestigious aa (Architectural Association).

In the 1960’s he worked with Buckminster Fuller, one of the most brilliant inventors and earliest environmentalists.

Several years later, Fournier was teaching at the aa, when he received an offer to join the American company Ralph Parsons in Pasadena, California (one of the largest urban development companies in the world that can handle large international projects). Fournier joined the company and, as planning director, worked on different projects, amongst which was Yanbu a new town in Saudi Arabia.

On winning a competition, he was Bernard Tschumi’s partner for the overall planning and design of the Parc de la Villette in Paris. In 2000, Peter Cook and Colin Fournier won the international competition for the Kunsthaus Graz.

Currently he lives and works in London as professor of Architecture and Urbanism at the Bartlett School of Architecture, UCL, University College London. Working as an architect, a planner and as an academic, has given Fournier an acute appreciation of the city and sense of quality. A recent trip to Melbourne has allowed him to wear his “planner’s hat”. “Melbourne has a distinctly refined feeling. It has some of the best qualities found in European cities” he says.
The Kunsthaus meets the most up-to-date requirements for museums on the international loan circuit. It provides everything its managers need to participate in the global art exhibition business at the highest level.

Kunsthaus, an adventurous footprint for young digital architecture, manifests a fascinating presence linked as it is to the historical monument of “Eisernes Haus”. The facade of this 19th century industrial building was completely renovated as part of the new construction work, because it is classified as one of the oldest cast-iron constructions.

With regard to both - urban planning and to its purpose - the Kunsthaus functions as an effective bridge-head in the Mur district at a point where the past and the future meet. Functionally and technically, the Kunsthaus meets the most up-to-date requirements for museums on the international loan circuit. It provides everything its managers need to participate in the global art exhibition business at the highest level.

Kunsthaus, an adventurous footprint for young digital architecture, manifests a fascinating presence linked as it is to the historical monument of “Eisernes Haus”. The facade of this 19th century industrial building was completely renovated as part of the new construction work, because it is classified as one of the oldest cast-iron constructions.

The new museum structure adjoins the “Iron House” (Eisernes Haus) whose cast-iron construction is one of the oldest of its kind in Europe and is classified as a historical monument. “Iron House” was carefully and skillfully renovated as part of the construction work on the Kunsthaus.
Innovative language of shape and technical challenge

The Kunsthaus project had a long and chequered history, resulting in a design competition, where Peter Cook and Colin Fournier developed the winning scheme. The result was, that the new art museum – resembling a living organism – would not only have to be built but be kept breathing. The bubble-shaped museum is a unique development and a technical challenge at every level.

To handle this project, a working team was set up for the general planning (ARGE Kunsthaus), combining the following organisations: • Spacelab Cook-Fournier GmbH (established in Graz), • the structural engineering office Bollinger + Grohmann from Frankfurt/M. and • Architektur Consult ZT GmbH from Graz (with the partner architects Peyker, Domenig, Eisenköck). It goes without saying, that ARGE Kunsthaus had to attract the right specialists and products to ensure the project became a reality.

The biomorphic form of the building culminates in a very complex roof-shape. It was obvious, that all partners and manufacturers involved in the engineering and construction work had to cooperate in a close and professional way to make this project succeed.

The very demanding roof shape – with a series of nozzles covering the entire roof – required close cooperation between project manager, contractor and the respective product manufacturers.

Kunsthaus Graz was built to a breathtaking time scale and neither trouble nor expense was spared to find innovative and cost-effective solutions under the pressure of the deadlines. With sound pragmatism, exciting experimental architecture has been built which will attract many visitors.

The “Needle”, a projecting, glass enclosed structure, offers a spectacular view of the Old Town of Graz and can be used for special events. This lounge with luxurious furnishings and seating accommodation, journals, books and a small bar creates a bright, pleasant atmosphere.
Spacial concept for 11,000 m² of usable floor space

From the glass-walled foyer a moving ramp – called the “Travelator” – transports the visitors into the upper exhibition rooms. The travelator breaks through the “skin” which is curved inside to form the ceiling of the lobby. This physical ascent represents the design vision of metaphoric ascendency from everyday life into the world of art. At the first floor there is an art school for children and a large exhibition hall.

The way up to the upper large exhibition hall from this floor is also via the moving ramp. For the interior finish of the upper exhibition hall a special stainless steel fabric has been chosen, which follows the triangular metal structure of the construction. The interior space is characterised by a total of 16 nozzles, projecting outwards and lit by fluorescent tubes, set in concentric circles. In total the new building provides about 11,100 m² of usable floor space.
The domed exhibition hall on the upper floor

Spanning up to 60 m, the upper exhibition hall is a column-free space. It is landscaped by a series of nozzles projecting outwards. On the ceiling, the interior skin of steel fabric is visible.

The nozzles admit daylight and ventilation. The interior skin – a steel fabric – doubles and goes over the triangulated bearing structure of the building.

The travelator also leads to the 2nd floor.
The special shape of the object

"Like a 'blue Bubble' the perspex clad building floats above its glass-walled ground floor. The Museum’s organic shaped footprint spills around a number of historic buildings in the neighbourhood. A series of nozzles which cover the entire roof, appear to have been 'plucked' out of the building’s skin”, – this is how the Kunsthaus brochure describes the biomorphic shell of the building.

Orthogonal surfaces are almost non-existent. For this reason, a thermal insulation material was specified that could easily be cut to shape and is considered to be very versatile: FOAMGLAS® cellular glass insulation.

Independent of whether the substrate is orthogonal or curved, FOAMGLAS®-slabs can be fully bonded to the support, and provide high resistance to uplift and loads. For a project like Kunsthaus, which in itself is a particularly special shape, these criteria were fundamental.

Under the perspex skin, weather resistant cellular glass insulation insulates like stylish “polarskin”

The triangulated bearing structure has both main and secondary girders, which are metal clad and insulated, and has to be resistant to all static and dynamic stresses. Dead load, external area load (compression, uplift) and single loads (e.g. on mounting points) are distributed via the structure and the thermal insulation.

For example high compressive strength and deformation-free FOAMGLAS® cellular glass insulation is the prerequisite for the safe installation of the perspex skin and the fluorescent lights that create the media facade.

The steel structure is composed of triangular elements of different size which are linked by metal cladding, onto which the FOAMGLAS® insulation system is mounted. The outer envelope of the building is made of a sealing skin on top of the cellular glass insulation, applied as waterproofing beneath the open joint perspex skin, creating a closed, vapour-proof system to the interior. In some sections of the facade, more transparent acrylic sheets are incorporated and the underlying metal skin, equipped with cellular glass insulation, is replaced by thermopane glazing to admit daylight.

In vertical and strongly curved sections, each second row of FOAMGLAS®-slabs is secured with additional mechanical fixing, known as ceiling fixings. These are z-profile fasteners which allow the insulation slab to be fixed without thermal bridging.
Installation of FOAMGLAS®-slabs on vertical and strongly curved surfaces

The steel structure, the metal cladding and basic waterproofing form the substrate for the cellular glass thermal insulation. In vertical and strongly curved sections, FOAMGLAS®-slabs are fully bonded with PC® 88 cold adhesive, with filled joints and sealing coating. In these sections, each 2nd row of FOAMGLAS®-slabs is secured - free of thermal bridges - by additional mechanical fixing, called "ceiling fixings".

To secure the waterproofing - in this case a self-adhesive cold bonded waterproofing - PC® fixing plates are bonded as interfaces to the insulation with PC® 88 cold adhesive. By means of these plates, the waterproofing is secured to prevent slip down in the event of higher temperatures. The PC® fixing plate is a patented element of the FOAMGLAS® metal roof system, used mainly to secure standing seam sheets without cold bridges and without through-fixing on top of cellular glass insulation. This fixing technique was adopted here to secure the waterproofing against slippage.
Installation of FOAMGLAS®-slabs on the roof

- FOAMGLAS®-slabs are installed, after the basic waterproofing of the building. For the special shaped roof, that is for the sections with little slope, the insulation slabs, 120 and 160 mm thick, were cut-to-fit the slope of the roof and afterwards fully bonded with special, stabilised hot bitumen* (115/15 or 110/30), filled joints and sealing coating. To secure the FOAMGLAS®-slabs on steeper sloped surfaces, every second row of slabs is secured with additional z-profile ceiling fixings. On top of the FOAMGLAS® insulation, a first layer of bituminous waterproofing is torch-applied, followed by a self-adhesive cold bonded waterproofing, type *Vaeplan® VS Zuschnittbahn* from the manufacturer Hirler GmbH (D - Mörfelden). Cold bonded self-adhesive waterproofing without any fire safety insert are required to have a fully bonded bituminous waterproofing with respective fibre reinforcement as insert, type V 13 or V 100 (which means with glass fibre reinforcement of min. 60 gr/m²) to meet fire safety specifications.

*) Stabilised bitumen is a type of bitumen with special consistency and less fluid when heated.

To fit the outline of the roof, FOAMGLAS®-slabs can be cut to triangular or trapezoidal shapes. At the base of the picture, you can see the ceiling fixing, that allows for additional thermal-bridge-free securing for the cellular glass slabs.

To fix cellular glass slabs in a defined position, each second row of slabs is additionally secured with ceiling fixings. These z-profile fixing elements allow FOAMGLAS® slabs to be secured without through-fixing and thus without thermal-bridging. They can be used on steep slopes, vertical surfaces or even overhead, on ceilings.
Cut-to-fit and precision sawing of cellular glass slabs by means of simple cutting and sawing tools.
The tubes projecting from the roof deck are used later to fix the outer perspex skin cladding.

Irregularities in the insulation layer are smoothed, using a planing tool.

**System technology and benefits:** use of simple tools, compact bonding, resistant to uplift-forces and deformation-free
FOAMGLAS® - a versatile insulation system, for every requirement

Why – apart from the ease that the material can be cut-to-shape – have planning manager and public owner alike chosen FOAMGLAS® thermal insulation?

Long service life, safety in use and for the environment as well as best financial efficiency are the main criteria that make FOAMGLAS® the best performing thermal insulation for the shell of the building.

FOAMGLAS® qualities unrivalled by competitive insulants

FOAMGLAS® cellular glass insulation is 100% based on glass. The main raw material is silicate sand and about 66% of recycled glass (selected post consumer waste such as vehicle glass and window glazing) is used in its production and this percentage is increasing. Moreover: FOAMGLAS® meets the most stringent demands for an environmentally sound material. With high thermal efficiency in the long term, the inorganic insulation material is unrivalled in performance whatever the building system.

Cellular glass itself creates a vapour-barrier due to its closed cell structure. FOAMGLAS® is water- and vapour-proof, deformation-free and with high compressive strength, resistant to common stresses and loads in construction on the long term.
The benefits of glass material

Free from deformation (no shrinkage, no bulking), resistant to acids, not attacked by rodents, vermin proof, non-combustible are the product qualities that make inorganic and rot-proof cellular glass the ideal insulation material. As in all public spaces, fire protection is a prime asset for the Kunsthaus.

In order to meet these criteria internally, different products were specified, for the construction itself and for the internal finishing, for example: non-combustible floor covering, non-combustible wall and ceiling covering, and last but not least non-combustible insulation material.

Ecology and economy.

Overall financial efficiency

For contemporary insulation systems, global cost-efficiency plays an important role. FOAMGLAS® - both the material and the systems, provide proven performance to make both ends meet: ecology and economy.

The unrivalled service-life and uncompromised function of the system without thermal loss make cellular glass the first choice insulation for sustainable construction.

The Kunsthaus in Graz provides the best evidence to support this claim.

In order to avoid the build-up of high temperatures beneath the perspex clad, a white polyolefin waterproofing was applied as sealing skin. It is a self-adhesive cold bonding membrane, bitumen-compatible, type VAEPLAN® VS Zuschnittbahn, with non-woven polyester and film glue, by the manufacturer Hirler GmbH. This waterproofing is available in the colours RAL 1013-1015. According to the recommendations of the manufacturer, when applied to cellular glass insulation (Euroclass A1) a first layer of bituminous waterproofing with specific fire-safety fibre reinforcement, is required on top of the insulation, because this type of sealing skin is not provided with a fire-safety lamination.

The layer beneath the open joint perspex cladding (outer skin) is the sealing skin (polyolefin waterproofing), which has to carry off the rainwater.
The light and media façade

The scale-like “skin” of the building - covering the large 4,800 m² envelope of the building - consists of more than 1,300 perspex sheets of different sizes and curves which are fixed on top of the insulation/waterproofing build-up.

The manufacture of the individual perspex sheets was controlled by computer, based on a three-dimensional data model. For each sheet, an individual form was produced which served as a mould for the spherical curve of the perspex sheet. The cutting was only done after the sheet had been thermocast. Each of the 20 mm thick, blue-tinted transparent acrylic sheets is cut-to-shape for a specific position on the envelope of the building and does not fit elsewhere.

A light and media installation transforms the acrylic façade of Kunsthaus using a low resolution computer display, known as a “communicative display skin” (BIX). The concept is a comprehensive integration of media technology into architecture. Beneath the perspex skin, standard circular fluorescent light tubes are installed which turn the blue bubble into a house-sized low resolution screen. Each ring of light functions as a pixel which can be controlled by a central computer. This electronic display screen is one of the biggest yet downloaded by the Berlin based design group realities:united. It can display simple image sequences and varying text streams.

International attention guaranteed

The architecture of Kunsthaus will be a sensation well beyond the event “Cultural Capital of Europe, 2003”. This museum creates an exciting engine to drive the local culture and to participate in the global exhibition business.

A multitude of visible and invisible clusters contribute to this powerful synergistic effect, one of which is FOAMGLAS®.

Tourists to the Kunsthaus building site have been quite impressed by the insulated “blue bubble”. Visiting the building site at night, they have been taking souvenirs, by cutting a piece of “Kunsthaus” from the cellular glass material and the perspex sheets.

### FOAMGLAS® applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Area (m²)</th>
<th>Description</th>
<th>Thickness (mm)</th>
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<tbody>
<tr>
<td>Sloped roofs:</td>
<td>108</td>
<td>FOAMGLAS® T4 slabs, 160 mm</td>
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<tr>
<td></td>
<td>179</td>
<td>FOAMGLAS® T4 slabs, 140 mm</td>
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<td>Special shaped roof:</td>
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<tr>
<td>Special shaped roof:</td>
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<td>FOAMGLAS® T4 slabs, 120 mm</td>
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<td>Interior insulation, with plaster work:</td>
<td>1217</td>
<td>FOAMGLAS® T4 slabs, 70 mm</td>
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<tr>
<td>Interior insulation, ceiling:</td>
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<td>FOAMGLAS® T4 slabs, 60 mm</td>
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<td>Flat roof:</td>
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<td>FOAMGLAS® T4 slabs, 90 mm</td>
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<td>Vehicular access flat roof:</td>
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<td>FOAMGLAS® TAPERED®, type F,</td>
<td>average thickness 60 mm</td>
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<tr>
<td>Interior insulation, ceiling:</td>
<td>518</td>
<td>FOAMGLAS® T4 slabs, 60 mm</td>
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<tr>
<td>Vehicular access flat roof:</td>
<td>490</td>
<td>FOAMGLAS® TAPERED®, type F,</td>
<td>average thickness 120 mm</td>
</tr>
</tbody>
</table>

Total surface: approx. 7,200 m²
If you legally want to acquire a limited edition FOAMGLAS® “Objet d’Art”, please contact us. Of course we would also be pleased to deliver from our palette of FOAMGLAS® insulation systems for building and industry applications.

TECHNICAL DATA:

Project: Kunsthaus Graz, Südtirolerplatz/Eisernes Haus, A - Graz
Client: Kunsthaus Graz AG, Grießgasse 11, A - 8020 Graz
Architects: • Competition design Cook P./Fournier C., Spacelab Ltd., Mariahilferstraße 1, A - 8010 Graz Spacelab UK, Mariahilferstraße 1, A - 8010 Graz • Boiling/Grohmann, structural engineer Kaiserallee 41, D - 60 Frankfurt/Main • Partner architects: Architektur-Consult, Graz (Peyker, Domenig, Eisenköch)
General planner: ARGE Kunsthaus, spacelab Architektur-Consult, Maria Hilferstraße 1, A - 8020 Graz
Building physics: Pfeiler, Werner - Zivilingenieur für technische Physik, Wielandgasse 36, A - 8010 Graz
Project Management: Lechner, Hans • ZT-GmbH, Lerchenfelderstr. 85, A - 1070 Vienna
Steel structure/cladding skin: Stahl-Fassaden u. Lüftungsbau GmbH, Bernau 52, A - 8152 Stallhofen
Consultance FOAMGLAS® system: Pittsburgh Corning Österreich GmbH, Erich Senoner Hauptstraße 33, A - 4040 Linz-Urfahr Tel.: + 43-676-317 98 58 Fax: + 43-1 546 800 569 essenoner@foamglas.at and Pittsburgh Corning Schweiz AG, Wydengasse 4, Postfach 255/7, Studen Tél.: +41-32 374 20 20 Fax:+41-32 374 20 60
Construction: 2003

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8 unique material properties of cellular glass interpreted as “Objet d’Art”.

In a competition devised by a European professional association of architects, artists were invited to work with cellular glass material as a medium. The most interesting objects were presented in an exhibition that created international interest. We would like them to be rediscovered in this context.
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Kahn, Boulogne • Musée Gadagne, Lyon • Musée des Insectes, Micropolis, St. Léons/Rodez • Centre de la Magie, Blois • Musée de la Duville, Caudry • Musée Ste Croix, Poitiers • Passerelle Futuroscope, Poitiers • Palais Monclar, Aix-en-Provence • Océanopolis 1 et 2, Brest • Archives Départementales, Orléans • Bâtiment archives SAGEP, Lyon-sur-Seine • Musée de la Mine, Saint Georges d’Hurtières • Musée des Arts et Industrie, Saint-Etienne • Musée de Toulouse – Tombes Égyptiennes, Le Mans • Musée des Beaux-Arts, Angers • Musée de la Tapisserie, Aubusson • Musée Aurillac • Musée Volcania, Saint-Ours-lès-Roches (Auvergne) • GREAT BRITAIN: Hampshire Transport Museum • Lowes Park Museum, Hamilton • New Zoology Building, Natural History Museum, London • Tate Gallery, London • British Library, London • Ruskin Museum, Cumbria • USA: Guggenheim Museum, New York • Diamond Building, New York • Yeshiva University Library, New York • Archives Building Illinois, Illinois • Birmingham Museum of Art, Birmingham • Yale University – Beinecke Library, Massachusetts • Harvard University – Lamont Library, Cambridge • Hillman Library, University of Pittsburgh, Pittsburgh • Vermont University – Bailey Museum, Burlington • South Mall Library & Museum, Albany • National Archives, Washington • Antioch Branch Library, Merriam • Arlington Heights Library, Arlington Heights • Baltimore City Library, Baltimore • Camden County Library, Camden • Croton Library, Croton on Hudson • Emporia U-W Allen White Library, Emporia • Grove Mall Library, Roxbury • Hoover Library, West Branch, Watson Library, Kansas University, Lawrence • Lincoln Library, Springfield • New Appling County Library, Barxley • Oak park Library, Overland Park • Queensboro Community Library, Bayside • Truman Library, Independence • CZECH REPUBLIC: Bauhaus - Müllerova Vila, Prag • Moravská Galerie, Brno • USA: Guggenheim Museum, New York • Diamond Building, New York • Yeshiva University Library, New York • Archives Building Illinois, Illinois • Birmingham Museum of Art, Birmingham • Yale University – Beinecke Library, Massachusetts • Harvard University – Lamont Library, Cambridge • Hillman Library, University of Pittsburgh, Pittsburgh • Vermont University – Bailey Museum, Burlington • South Mall Library & Museum, Albany • National Archives, Washington • Antioch Branch Library, Merriam • Arlington Heights Library, Arlington Heights • Baltimore City Library, Baltimore • Camden County Library, Camden • Croton Library, Croton on Hudson • Emporia U-W Allen White Library, Emporia • Grove Mall Library, Roxbury • Hoover Library, West Branch, Watson Library, Kansas University, Lawrence • Lincoln Library, Springfield • New Appling County Library, Barxley • Oak park Library, Overland Park • Queensboro Community Library, Bayside • Truman Library, Independence •
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FOAMGLAS® insulation applications are detailed in technical specifications covering various project stages: Design, Specification, Tender and Installation. These specifications are available on request from any Pittsburgh Corning subsidiary or their approved representatives.

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