



## **Correct use of metal fabrics in architecture**

The technological expertise of manufacturers can make or break a project

**At the start of the 1990s, Dominique Perrault harnessed the architectural design potential offered by metal fabrics during construction of the new National Library of France (BNF) in Paris. In collaboration with the GKD Group (GKD), he created twelve different exterior and interior applications for the same number of different metal fabrics. Metal fabric is today globally established in high-end construction projects, and many weaving operations are now catering to this market. However, the technical weavers at GKD remain the undisputed innovation and technological leaders to this day. The company's leading role is based on its full-scope offering that includes planning, calculation, metal fabric production, preassembly, and installation assistance. Last but not least, the mid-sized manufacturer responds to previously unformulated market requirements with foresight, offering new metal fabric types and solutions that are developed in-house.**

Since the discovery of metal fabric for the field of architecture, GKD has continuously extended the spectrum of effects and functions. To implement creative forms of expression and meet contemporary requirements of modern building technology, the company has also developed a whole host of integrative system solutions in cooperation with architects and metal fabricators. For example, metal fabric is now making valuable contributions to the energy balance, comfort, sustainability, room acoustics, security, and cost-effectiveness in more and more applications. Expertise during the initial



consultation is critical in making optimum, application-specific use of the virtually unlimited potential offered by this construction material. With experienced engineers and architects, GKD guarantees comprehensive consulting for everyone involved throughout all project phases, i.e. architects, metal fabricators, and the end customer. The certainty of being in the best hands with the business that is now being managed by the third and fourth generation of the founder family starts with a fast response following the first contact or delivery of samples within just one day. With open consulting on the material selection, planners already receive valuable support in the early quotation phase to ensure that the desired aesthetics and functionality cannot only be achieved, but also secured in the long term. Aspects such as selection of the most suitable alloy based on location when using stainless steel fabrics, the fineness of the fabric, the viewing distance, weight, form of the desired cladding, the color and color accuracy, transparency, light transmission, heat transfer coefficient, wind protection and sound insulation are systematically examined and addressed by the experts at GKD to define the most suitable fabric type and design in collaboration with the customer. The material selection and metal fabric type, as well as parameters such as wire diameter, open area, and spacing are the determining factors for building-specific matching.

### **Secured fabric design**

Cable, rigid, and spiral mesh fabrics are the market standard. Beside stainless steel, GKD also offers these fabric types in aluminum and non-ferrous metals. Cable mesh fabrics produced from these metals can trace any form and are tensible. With rigid mesh fabrics produced from pre-crimped stainless steel or aluminum wires (PC mesh), the company also offers an attractive alternative to common products such as expanded metal or perforated plate. The individual fabric elements are easy to install as homogeneous cladding using



a frame construction. Spiral mesh fabrics produced continuously from flat wires offer impressive flexibility and three-dimensionality. GKD regularly demonstrates its virtually limitless hunger for innovation and development expertise with bold material combinations, as well as novel marriages of color, cables, wires, or forms of this fabric. The requisite pre-structural calculations – whether for standard fabrics or custom models – are also part of the GKD service, just like the g-values for building-specific coordination of the transmission factor. Indeed, the experts have access to all specifications required for calculation of the suitable GKD metal fabric from dedicated tensile tests and g-values pursuant to DIN. GKD is also the only manufacturer of metal fabrics that has general building approval (abZ) from the German Institute for Structural Engineering (DIBT) for the most common cable and spiral mesh fabrics used in both interior and exterior facades, freely suspended ceilings, and vertical fall guard protection applications. This eliminates the need for approval on a case-by-case basis, which in turn guarantees faster planning in line with official construction requirements and implementation of corresponding construction projects. Comprehensive material tests, such as X-ray fluorescence analysis, tear resistance, and surface tests during the incoming goods inspection, as well as mechanical tensile tests for checking the preassembled metal fabric also serve to underline the leading expertise.

### **Innovative web technologies**

A large number of examples throughout the world impressively underline this expertise. For construction of the **Kunsthalle Mannheim museum of modern and contemporary art**, GKD spent many months working with everyone involved to develop an innovative fabric for the facade cladding. Thanks to a varying degree of transparency of the glazed areas and the facade, this woven membrane maintains its textile appearance, even when viewed from great distances. Its production required truly exceptional weaving expertise. Here,



GKD wove three millimeter thick stainless steel wires and stainless steel tubes with a diameter of 25 millimeters into four-wire warp wire groups produced from untreated stainless steel at various pitches and in various sequences. In order to achieve the stipulated pattern of the tubes on the building and, at the same time, compensate for the differences in tension caused by the various thicknesses of the weft elements using weaving technology, complicated calculations were required to program the digitally adjustable loom. Following protracted decision-making processes, a very specific warm bronze color was chosen for the fabric. Securing this exact color homogeneously across the entire area – despite use of various components produced from cables, wires, tubes, and tube side closures – was no less challenging. However, this was made possible by GKD's many years of experience with coating technologies and their effect on the respective building. The wires were then coated in a continuous process, while the tubes were painted together with the closures in a spraying process, and all weft elements were then interwoven with the untreated warp wires.

### **Color and processing expertise**

This confident handling of materials, various woven fabric components, and color was also impressively demonstrated in the headquarters of high-tech giant **Tencent** in Shenzhen, China. A huge golden net produced from untreated stainless steel warp wire groups, into which golden-anodized aluminum wires and tubes were interwoven with alternating spacings, clads the galleries of the three-story atrium above the lobby. Golden-anodized aluminum wires and tubes were interwoven in warp wire groups produced from untreated stainless steel with alternating spacings. With homogeneous color throughout and precise alignment, the elegant metal fabric was also used to produce fully functional fall guard protection. For the freely suspended interior facade of the **Hermès flagship store** in Bangkok, stainless steel wire was



painted in a continuous process and interwoven with untreated warp wires. Beside this high-grade refinement of the Sambesi fabric, the challenge here also involved tracing the crescent-shaped, angled glass facade like a curtain, while compensating for height differences of up to twelve centimeters. To achieve the dimensional accuracy and angularity of the woven elements required for this, GKD developed new processes in-house for cutting to size, preassembly and installation. For cutting the material to size, the forms were projected onto the fabric on the 30 meter long and eight meter wide fabrication tables using a laser. The fabric was then trimmed at an angle ready for installation and preassembled with flat profiles for attachment. This made it possible to suspend the panels from the ceiling on site in a curved shape over two storeys at precisely coordinated lengths and widths, and to attach them to the floor without any tension.

### **Tailor-made installation concepts**

The shell of the **Grand Théâtre des Cordeliers** in Albi, France – which was produced from aluminum strips anodized in a pale golden tone – is another example of the perfect interaction of weaving expertise, refinement, and attachment means. GKD developed a custom form of its Escale spiral mesh fabric for the three-dimensional facade with various counter curves and different heights. Each of the almost 5,000 spirals was produced and installed at an individual length. To prevent deformations in the sophisticated steel construction due to the wind forces that occur, while still ensuring that the forces are reliably dissipated to the substructure, GKD employed an intelligent installation concept to specify how and in what order the fabric panels were fitted. The solution took the form of special cables, which GKD drew into the fabric, as well as precise definition of their mounting and joints. GKD also developed an innovative new metal fabric technology for the sculptural ceiling design in the **Pavillon Dufour**, the new main entrance to the Palace of



Versailles. Working to the "random principle" stipulated by architect Dominique Perrault, aluminum rods of various length, which are anodized in three different shades of gold, were slid into curved, spiral-shaped flat wires. The semicircular roofing that connects the parking garage and main terminal at **Adelaide Airport, Australia**, is yet another impressive example of the combined consulting, development, weaving, preassembly, and installation expertise of the technical weavers. For this twisted steel construction, each of the 270 panels produced from the Tigris stainless steel fabric was designed individually and the necessary tension calculated. All panels were then attached to the double inclined substructure at a different angle of inclination using the Fusiomesh attachment technique developed by GKD. The canopy that projects from the **Capital Gate Tower** in Abu Dhabi, the most inclined building in the world, and connects the main entrance with the stands in a large curve was no less challenging. For this airy metal fabric canopy construction, all 580 panels produced from Tigris fabric were curved at various angles – in the most extreme case by up to 25 degrees. GKD developed, wove, and supplied four different types of the fabric to ensure a consistent and identical appearance of the fabric openings in the veil.

Countless construction projects with GKD architectural fabrics on all continents serve to underline the leading role enjoyed by the technical weavers. The company's key to success has always been its unique interaction of technical expertise, state-of-the-art weaving technology, and the avowed will to transform even seemingly unsolvable tasks into reality.

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### **GKD Group**

As a privately owned technical weaver, GKD - Gebr. Kufferath AG is the world market leader in metal, synthetic and spiral mesh solutions. Three



independent business divisions bundle their expertise under one roof: Industrial Mesh (woven metal mesh and filter solutions), Process Belts (belts made of mesh and spirals), Architectural meshes (façades, safety, interior design and transparent media façades/Mediamesh® made of metal fabrics). With its headquarter in Germany and six other facilities in the US, South Africa, China, India and Chile – as well as its branches in France, Spain and worldwide representatives, GKD is close to markets anywhere in the world.

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