

The panoramic window of building Q1

Q1 (headquarters) is the heart of the ThyssenKrupp Quarter and marks the end point of the water basin that stretches from Altendorfer Strasse across the Quarter site. Flanked by buildings on either side, the cube appears like a force field, energizing and ordering its urban environment. Like its neighboring buildings, Q1 is composed of several L-shaped elements that seem to embrace the central atrium. On the north and south sides the L-shapes frame two oversized panoramic windows: The 25.60 m wide and 28.10 m high openings have neither frames nor muntin bars. They seem to consist of a single oversized glass pane. This effect is crucial to the overall appearance of the building, for the two large glass surfaces together with the glass gaps in the 3rd and 10th stories give the building its tension-filled plasticity.

Transparency was the order of the day in designing and constructing this custom glass structure. The first question to be answered was how big can a single glass pane be if it is not held by a frame but supported by point fixings. The engineers came up with a pane size of 2.15 m wide and 3.60 m high. The silicone joints between the individual panes were to be as narrow as possible, and this brief was met.

Naturally, a slim support structure was vital to maximize transparency, which is why the panoramic windows are supported by vertically and horizontally pre-stressed cable nets. Pre-stressing in two axes made it possible to eliminate complicated transitional details to the adjacent facade structures. But it's not just the two panoramic windows that contribute to the amazing amount of light that floods the atrium: Like the panoramic windows, the large window opening in the atrium roof is supported by a cable net. Its dual-curved outer skin measures approximately 21.0 x 21.0 m.

The side panoramic windows consist of double glazing attached to the cable structure by point fixings. Due to the considerable weight of the eccentrically connected 2.16 x 3.60 m glass panes, pairs of steel cables are used to support the weight loads. In the vertical direction, with a grid dimension of 2.16 m, the pre-stressed cables have a diameter of 30 mm. They are fixed to a three-story steel truss below the building's 11th floor. The horizontal net structure, attached at the ends to the story floors, also consists of pre-stressed steel cables, but with a diameter of 32 mm. Here the grid spacing is around 3.60 m.

The high pre-stressing requires the use of materials displaying high strength and stiffness. For example, the horizontal pre-stress per story is 34 t, while the vertical pre-stress per

connection is 2 x 15 t. To transmit these forces the engineers chose carbon steel of grade S355. Compared with stainless steel, carbon steel displays higher strength and lower thermal expansion. The cables have a tensile strength of 1770 N/mm².

All the above technical features make the overall structure appear surprisingly light and filigree. Another key factor in this was the choice of glass: On the one hand it had to have solar control, while on the other it had to be clear with as little tinting as possible. To achieve the aim of maximum-possible transparency, a custom solution featuring insulated clear glass panes was selected. The structure is as follows:

- 12 mm single-pane safety glass
- 16 mm inter-pane space
- 2 x 8 mm laminated safety glass,
- 1.52 mm PVB film for solar control

The type of glazing chosen and the reduced support structure have resulted in an only 45 mm thick membrane that appears completely dematerialized. Despite being so thin, this membrane meets all thermal insulation requirements.

The panoramic window is a high-tech steel and glass structure that symbolizes the innovative capabilities of ThyssenKrupp.