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The European Stainless Steel Development Association

# Renovation of the Atomium in Brussels

The first World Exposition after the Second World War was held in Brussels in 1958. The design of the country pavilions was marked by a move away from traditional methods of construction. An urge to exploit new freedoms, the advances of technological progress, and the search for an architectural language of the future brought forth broad-spanning constructions that were lightweight and transparent.

The Belgian pavilion, called the Atomium, was designed by engineer André Waterkeyn. His bold idea of building a giant, walk-in sculpture of an iron atom – enlarged 165 billion times – was intended as a homage to the peaceful use of nuclear energy and the flourishing Belgian steel industry. At a time when the arms race was gathering pace and the whole issue of nuclear power was becoming ever more controversial, the exhibitions held inside the Atomium focused on scientific themes.

The Atomium is steel-framed and has nine interconnecting spheres which seem to hover above the exhibition park. Originally they were clad with aluminium panels. The sphere at the base (B), around which the entrance area is organised, has a diameter of 26 metres. The central sphere (C) and the other seven spheres are smaller, with a diameter of 18 metres. Stretching between the spheres are long tubular connections, 3 to 3.30 metres in cross section and 22 to 29 metres long; these are supposed to represent the forces acting within the atom. Escalators and stairs are integrated into the tubes for access to the spheres – also a lift transports visitors to the topmost sphere from the base. Originally the 2,500-tonne construction was to be anchored in the foundations only via the

*World Exposition 1958 – Progress in science and technology influenced the design of the country pavilions.*

central tube, but for structural reasons, it was necessary to support three of the spheres on lattice-truss columns (I1, I2, I3).

The Atomium was designed originally as a temporary construction, intended to stand only for the duration of the sixth-month World Exposition. At the end of the exhibition, however, it was decided to keep the structure as a monument to the beauty of technology and the fascinating discoveries of science. Today the Atomium is a unique expression of the age in which it was created and an important landmark on the Brussels skyline.

Over time the aluminium skin lost its sheen, steel components began to rust and joints leaked. The wrong cleaning materials, a lack of corrosion protection and damaging environmental influences such as air pollution, pigeon droppings and storms hastened its deterioration. In 2001 a plan to refurbish the structure was launched. Calculations and on-site inspections revealed that it would be necessary to replace the aluminium panels, acrylic sheet and some structural components.

Because of its excellent material properties, grade 1.4404 stainless steel was chosen for the new cladding material. This grade of chromium-nickel-molybdenum steel has high corrosion resistance and good formability. The 2B mill finish of the stainless steel was then electrolytically polished. As a result, the smooth, reflective surface attracts less dirt, and it has a self-cleaning action when it rains.

Designing and fitting the new skin on the spheres was a special challenge for the engineers and construction firms. The overall look of the structure and its original segmentation were to remain unchanged, and the original spacing maintained between the skin and the loadbearing steel frame. At the same time, the renovated structure had to meet modern standards of thermal, sound and fire insulation. Not least the question of how to fit the panels had to be given due consideration.

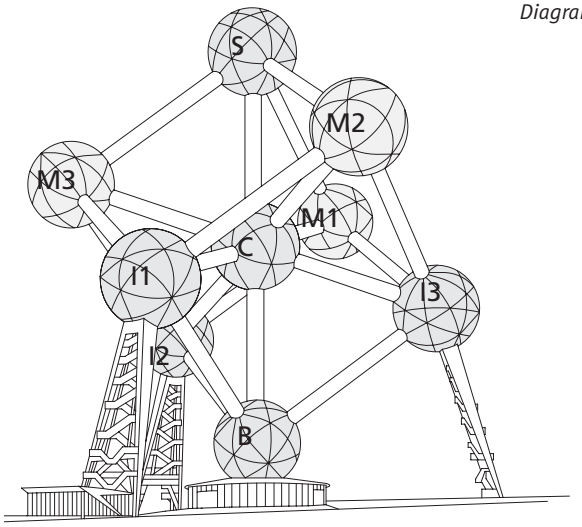
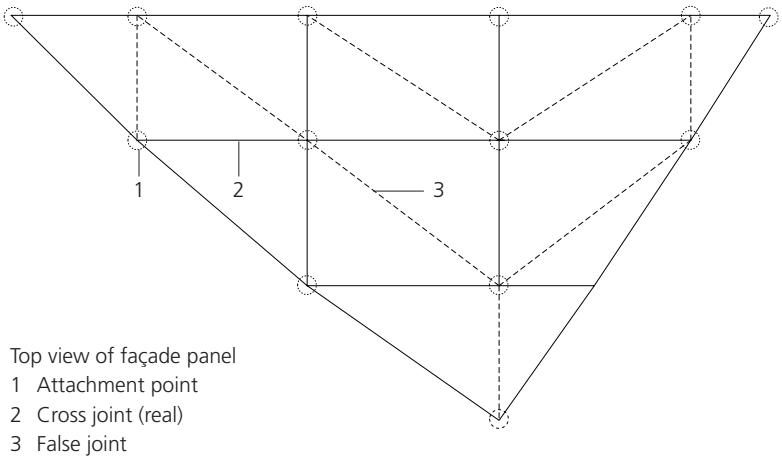



*Diagram of the Atomium.*

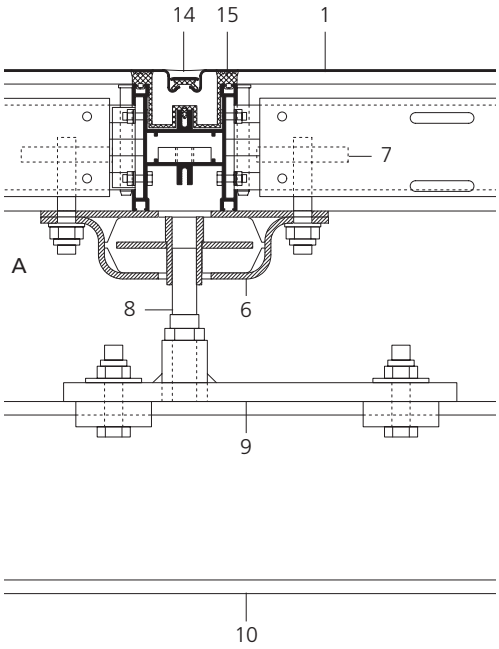
*Over the last 40 years, the aluminium panels on the spheres had lost their sheen and gaps had opened up in the joints.*

The curved panels that make up the new skin are a 10-cm thick sandwich construction of 1.2 mm stainless-steel sheet, an insulating core of rockwool and 1 mm galvanized steel sheet. Only the three spheres (M1, M2 and M3) that are not used for structural reasons were fitted with non-insulated cladding of stainless steel. Thermal-break aluminium profiles connect the stainless and galvanized steel sheet of the sandwich panels. To prevent galvanic reactions between the three different metals and to eliminate the risk of contact corrosion, they are separated from each other by elastomer profiles.

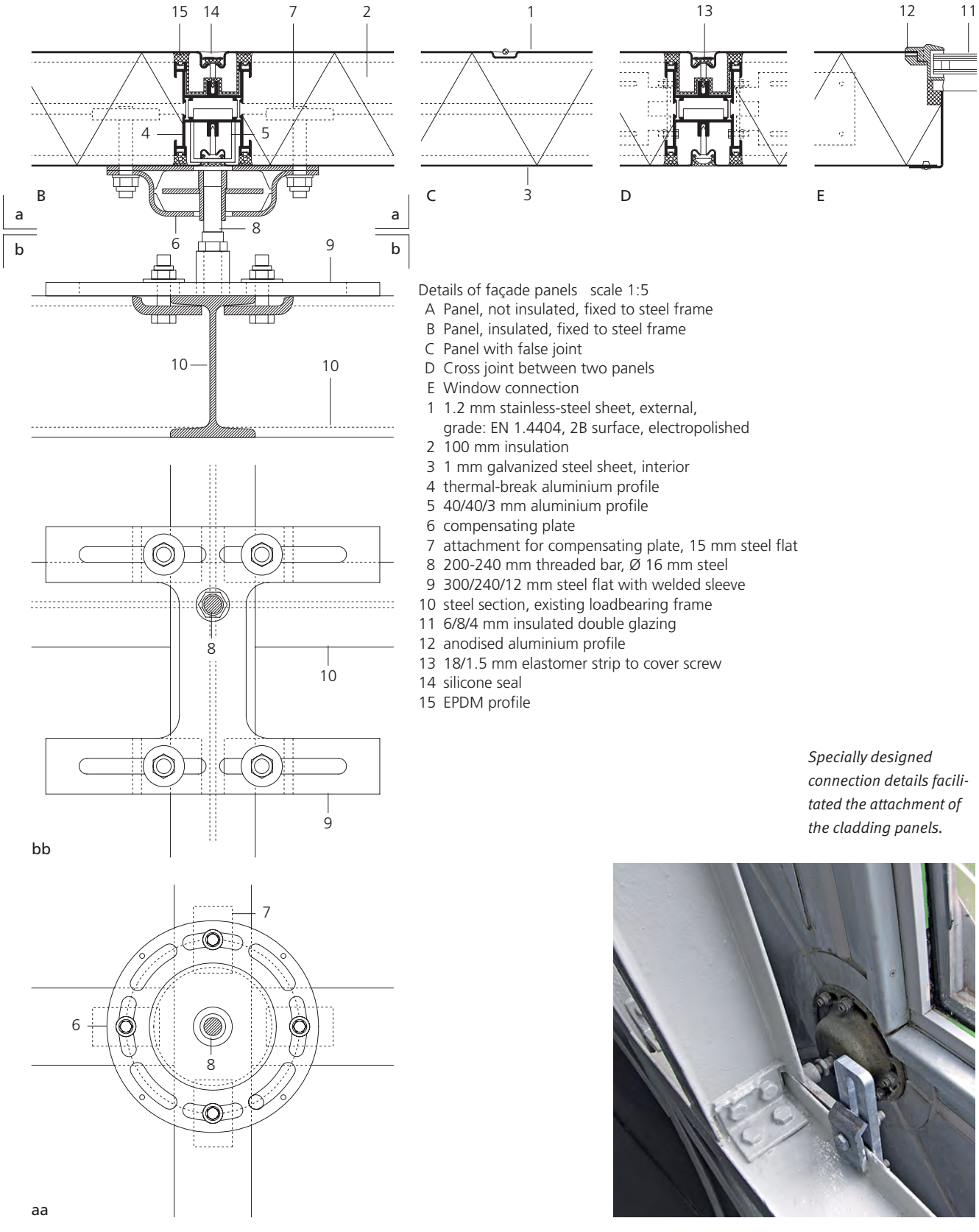
*Actual joints (required for the structural design) and false joints subdivide the triangular panels into 15 smaller triangles. This mirrors the jointing on the original aluminium cladding.*




Top view of façade panel
1 Attachment point
2 Cross joint (real)
3 False joint




Forty-eight large triangular panels were prefabricated for each sphere. In addition to the actual joints on the panels (necessary for structural reasons), further lines were impressed onto the surface of the stainless-steel sheet, to retain the look of the original jointing. Running between the triangular sandwich panels are what are known as the meridians, which wrap around the spheres. During prefabrication strips of LED lights were fitted to the outer side of these lines.




Details of façade panels scale 1:5

A Panel, not insulated, fixed to steel frame
B Panel, insulated, fixed to steel frame
C Panel with false joint
D Cross joint between two panels
E Window connection
1 1.2 mm stainless-steel sheet, external, grade: EN 1.4404, 2B surface, electropolished
2 100 mm insulation
3 1 mm galvanized steel sheet, interior
4 thermal-break aluminium profile
5 40/40/3 mm aluminium profile
6 compensating plate
7 attachment for compensating plate, 15 mm steel flat
8 200-240 mm threaded bar, Ø 16 mm steel
9 300/240/12 mm steel flat with welded sleeve
10 steel section, existing loadbearing frame
11 6/8/4 mm insulated double glazing
12 anodised aluminium profile
13 18/1.5 mm elastomer strip to cover screw
14 silicone seal
15 EPDM profile

*Specially designed connection details facilitated the attachment of the cladding panels.*

While the new panels were being manufactured, the old aluminium panels were removed and the steel frame of the Atomium sandblasted and painted. In total, there was over 50,000 square metres of steel to treat. Some components had to be strengthened or replaced and it was necessary to fit new connection pieces between the tubes and the spheres.

In January 2005 work could then start on fitting the new cladding. To dispense with any complicated scaffolding, the panels for the upper halves of the spheres were hoisted into place by means of cranes, those for the lower halves were brought into position using cables. Each triangular panel is around 16 square-metres in area and weighs roughly 480 kilograms.

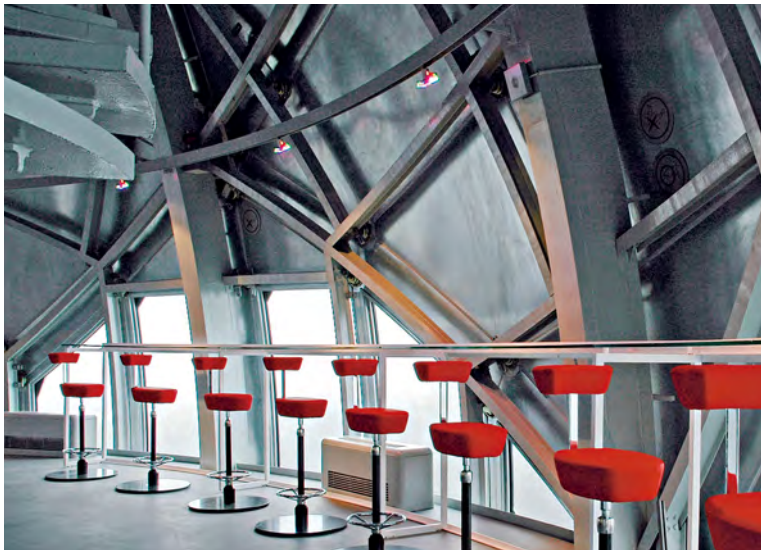
Teams of workers, suspended on ropes, then fixed the panels to the steel frame. The complicated geometry of the spheres and the frame coupled with the need to achieve a perfect alignment and seal prompted the idea of connecting the individual parts of the triangular panels together by means of specially designed compensating plates. These take the form of discs fitted with threaded bars which allow 40 mm of play, to facilitate mounting. H-shaped steel flats with horizontal holes take up the other end of the threaded bar via a welded sleeve, and are attached via clamps to the flanges of the steel sections.

*The curved triangular sandwich panels were manufactured in the workshop and transported to the construction site.*

*Sphere by sphere the aluminium panels were removed, the steel frame cleaned and repaired and the new stainless-steel panels attached.*

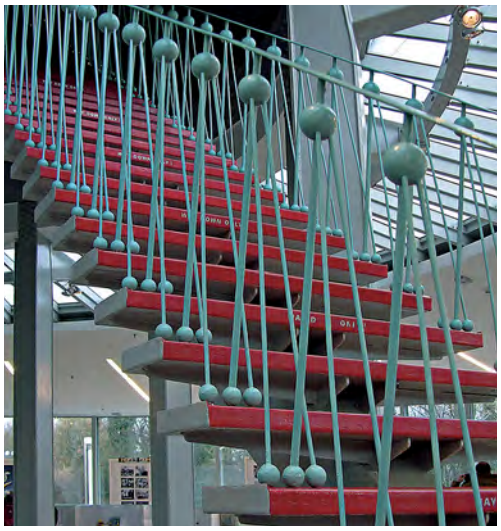
In the interior refit of the Atomium, care was taken to retain the original 1950s design. The loadbearing frame, painted a muted grey, is not hidden behind cladding. Red steps with pale turquoise railings and narrow escalators connect not only the spheres, but also the different levels within the spheres. In total around 3,000 square metres of space is available for exhibitions, conferences, lectures and other events. A restaurant in the uppermost sphere provides an impressive panoramic view of the city through the wrap-around window.

Now fitted with effective fire protection, modern sanitation, air-conditioning and electrical systems, the Atomium meets all today's standards and safety regulations. A new interior lighting concept with a range of installations underlines the different uses of the various spheres. At night external spotlights illuminate the Atomium, and on the structure itself the meridians also light up, just as they did at Expo '58. The newly renovated and refurbished Atomium was opened again to the public in February 2006, just two years after the start of work on site.



*Inside the Atomium, the architectural design also supports the theme of scientific and technological advancement. The loadbearing frame and cladding panels are fully exposed.*

*Small round windows in the connecting tubes give visitors a glimpse of the world outside.*



*The original 1950s staircases and railings featuring 'atomic' sphere motifs were kept, and painted in red and pale turquoise.*

*The new stainless-steel skin on the Atomium makes this 102-metre high landmark stand out even more on the Brussels skyline.*

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Photos: Marie-Francoise Plissart, Brussels (cover, p. 2, p. 5 bottom, p. 7 bottom); Archives de la Ville de Bruxelles (p. 1); Belgo Metal n.v., Wetteren (p. 3); Martina Helzel, Munich (p. 4, p. 6 bottom, p. 7 top); Thomas Pauly, Brussels (p. 5 top); Serge Brison/ Atomium vzw, Brussels (p. 6 top).

*On show in the original entrance pavilion around the base of the Atomium is an exhibition of 1950s design. The new reception area, with ticket desk, information, cloakroom and toilets, is accommodated in a new pavilion made of steel and glass.*