ArcelorMittal Europe - Long Products
Sections and Merchant Bars

ArcelorMittal

Office Building
ArcelorMittal in Esch/Alzette

Location

Esch-sur-Alzette, the second-largest town in Luxembourg, is situated in the south of the country, at the heart of the iron and steel region. It has good access to the capital and can be easily reached by public transport. Today, the "Capital of steel" redevelops on former industrial site a new city centre including a campus of University Luxembourg. The site of ArcelorMittal Office Building, part of the former gardens of a palace, lies immediately next to the ArcelorMittal research centre on the outskirts of the town.

ArcelorMittal Head Office at Esch-sur-Alzette, Luxembourg

Building

In the context of an international competition in 1990, the entry submitted by Gottfried Böhm's office in Cologne was awarded a "special purchase" to the same value as the first price. The office was subsequently commissioned to revise its design. The building consists of two eight-storey wings, each of which contains 24 standard office units (modules) per floor, with open common areas in the centre. Electronic data processing equipment, service installations, central control systems, storage and archive rooms and a deliveries point are housed in the basement. Further mechanical services equipment is installed on the roof of the building.

The two wings of each 40 x 18 m are laid out at an angle of 140° to each other. The common areas in the middle of these wings are divided up by 60 m² covered courtyard wells extending the full height of the building. Incorporated into these open wells are 30 m high wind-bracing elements.

Lifts, fire-escape staircases and toilettes are situated at the outer end of each of these wings. Conference rooms, tea kitchens and a third staircase in a round tower also fulfil a linking function at the pivot between the two wings Galleries leading from the entrances at the ends of the wings, extend round the research centre in front of the building and link up with the old tower, which is the only surviving part of the former palace. The tower now forms the new main entrance to the complex. The building has a volume of roughly 50,000 m³ (61,000 m³ including the galleries and tower).

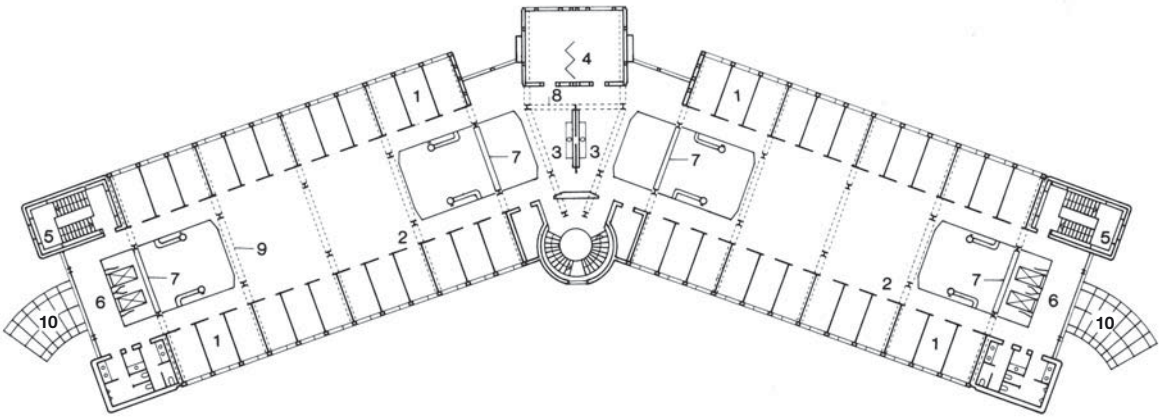
Architect Office Böhm, Cologne
Prof. Gottfried Böhm and Jürgen Minkus

Structural engineers: Schroeder & Associés, Luxembourg and Arne Hill AS., Oslo/Paris

Time schedule

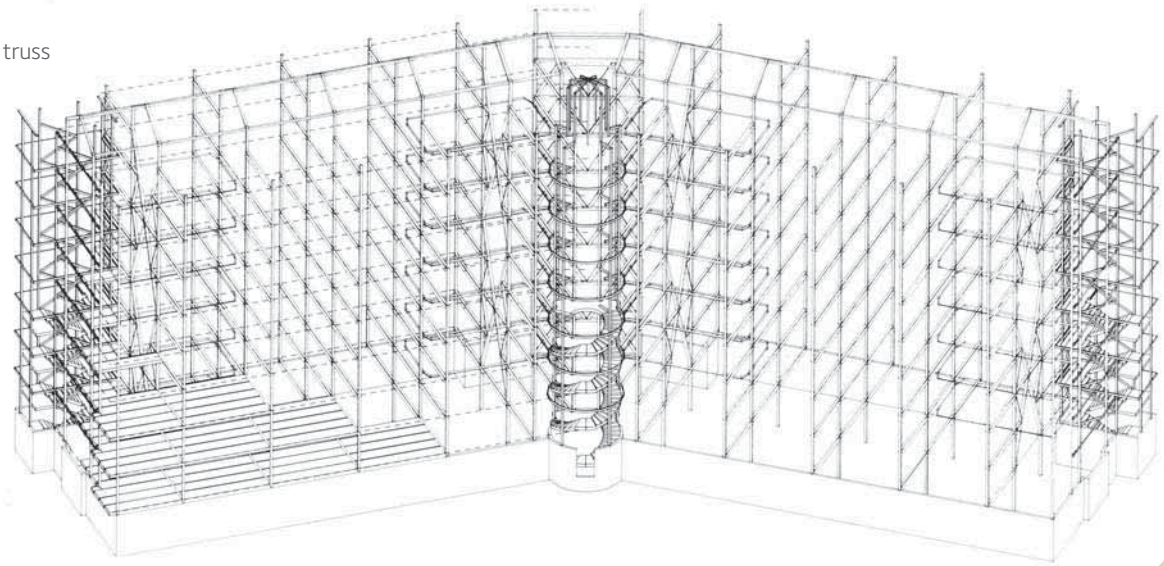
March 1991: Beginning of the construction
March 1992: Erection of the steelwork
August 1993: Building is finished

Volume:	61,000 m³
Surface:	15,000 m³
Dimensions:	2 x 40 m x 18 m
Storey height:	3.00 m
Grid:	6.00 x 7.20 m
Storey:	R +7



Plan view scale 1:600

1 office
2 common areas
3 tea kitchen
4 conference room
5 fire-escape staircase
6 lift
7 lateral wind-bracing truss
8 longitudinal wind-bracing truss
9 integrated floor beams
10 galleries



Frame

The building has a steel frame based on a 6.00 x 7.20 m grid, with seven rows of four columns in each wing. The bearing structure is supported by steel pile foundations. The columns are connected to Integrated Floor Beams (IFB) — a system developed by ArcelorMittal.

Horizontal loads are transmitted by the floor slabs to one longitudinal and four transverse wind bracing trusses. In the plane of these trusses the beam/column connections are rigid or semi-rigid.

Prefabrication and erection

A decisive aspect in achieving a short assembly period, and thus reducing the overall construction time, is the extent and precision to which the elements can be prefabricated at works. A requirement for this is, in turn, a precise process of planning at all stages. If these two conditions - detailed planning and a high degree of prefabrication - can be met without difficulty, steel structures represent an unrivalled form at building. As a rough measure for a short construction period, it should be possible to erect a floor area of 2,000 m² a week with a single crane.

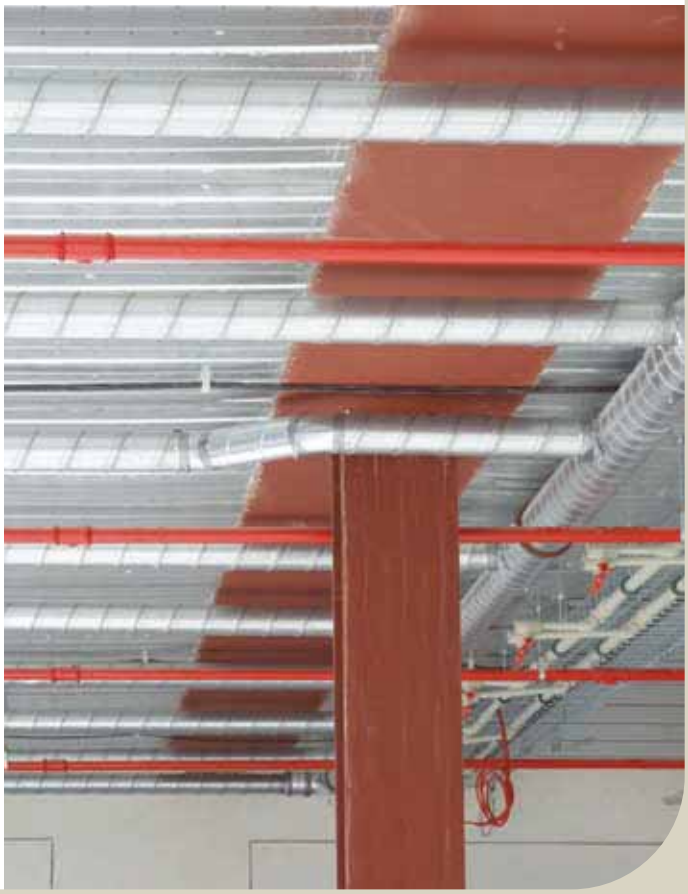
Advantages of prefabrication ⇛ shortened construction time

Construction time of the steel structure:	8 months
Construction time of a conventional structure:	12 months
Time advantage for the steel structure:	4 months

Early rent income through shorter construction time =
800 €/unit x 384 units x 4 months = 1 228 800 €
(Fabrication cost + erection of steel structure = 1 473 750 €)

IFB (Integrated Floor Beams)

The IFB flat slab floor system permits an uninterrupted floor area without down stand beams. The floor beams are built up sections consisting of a ½ IPEA 500 in HISTAR 460 steel grade and a 10 mm thick bottom flange. They have an asymmetric cross-section with a wider lower flange. Prefabricated prestressed concrete hollow core slabs are laid between the girders. The gap between these and the beams is filled with in situ concrete. This flat slab floor, using easy-to-assemble prefabricated elements, has a monolithic load-bearing behaviour. Its construction height is kept to a minimum of 30 cm, and a maximum of flexibility is given to the fixing of service pipes and ducts.



Combined office system

This is one of the first large-scale applications of a combined office design system in Europe. The underlying principle is that small single or double office spaces on the outer faces of the building are combined with a large common area in the middle, which is used for meetings, communication, storage and equipment. The advantage of this system is that quieter, individual working areas can be linked with areas for open communication with a minimum of mutual disturbance between employees.

Internal finishing

The standard office spaces are separated by metal stud partitions with clerestory strips of glazing. Tracks for fixing shelving are integrated into the partitions. The interior walls to the open office areas are fully glazed. The grid is based on a module of 2.40 m. Floors are covered with a rubber finishing. Perforated steel sheet acoustic panels are suspended beneath the red-colored precast concrete slabs. The ceiling fixed cooling convectors, the hot water central heating and the lighting can ail be individually regulated by users.

Cladding

The cladding to the building consists of lightweight metal and glass with integrated daylight-deflecting solar shading strips. The top-flung flaps used for ventilation are glazed with solar reflecting glass. The apron walls are clad with enamelled glass. The corrugated stainless steel façades of the staircase and WC towers are purpose made.

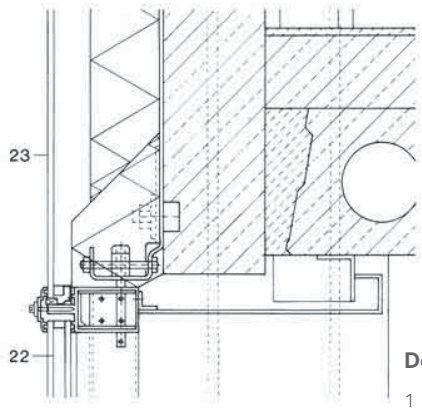
Standard office module

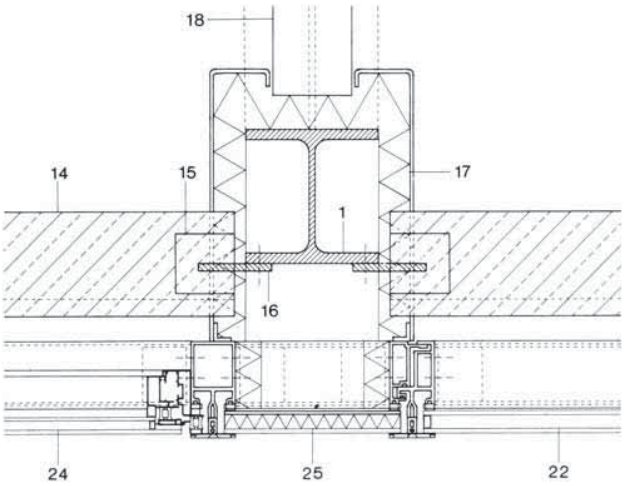
Dimensions: 2.40 m x 4.20 m = 10.08 m²
Module by floor: 2 x 24
Total: 384 modules

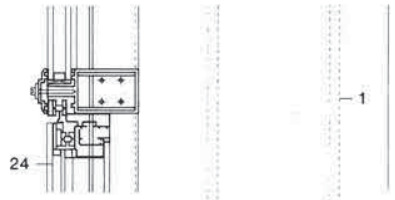
Acoustical insulation

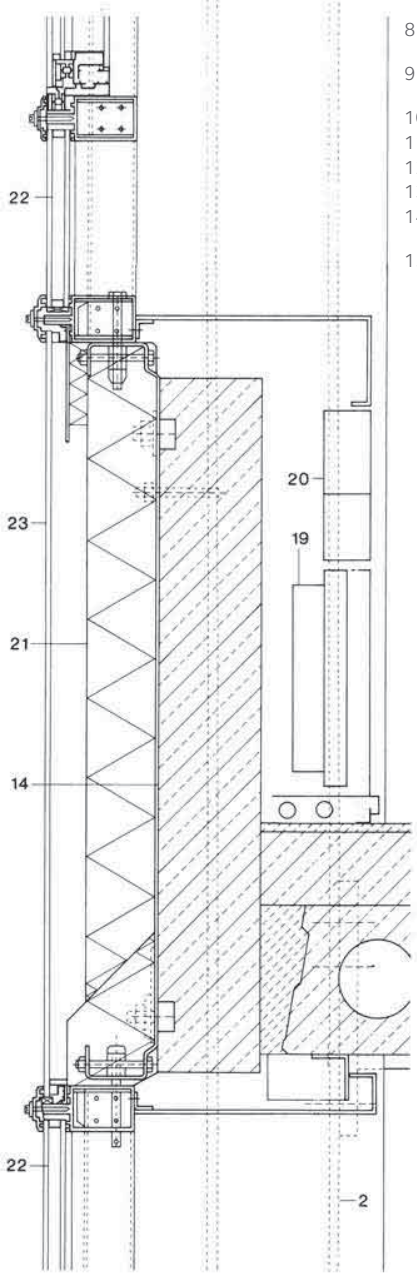
Slab: > 17 dB

Internal metal partitions:
Office to office: 38 dB
Office to common area: 35 dB



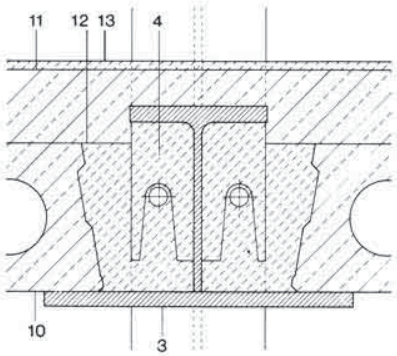


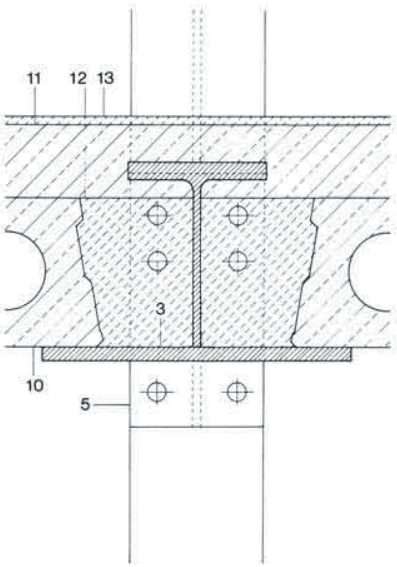


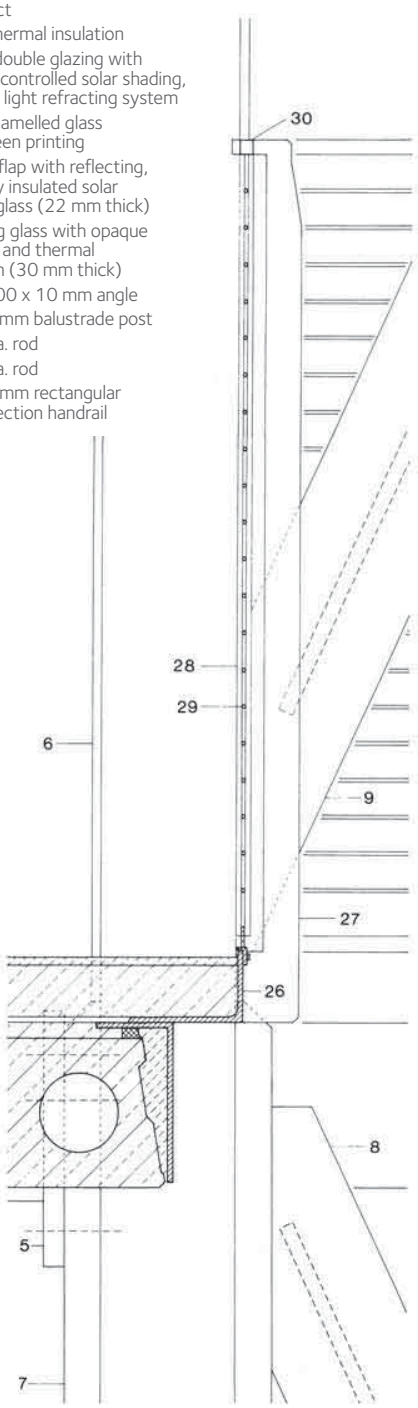


Detail sections: 4th floor scale 1:10

1 façade column: I-girder HE 180 B
2 façade column: I-girder HE 180 M
3 integrated floor beam: I-beam 500 mm deep cut in half, with 10 mm high-strength steel lower flange welded on
4 normal connecting plate
5 connecting plate bolted on in plane of wind bracing
6 internal column I-girder HE 220 A
7 internal column I-girder HTM 220 X 230
8 wind-bracing truss. I-girder 220 x 93 mm
9 wind-bracing truss: I-girder 220 mm deep
10 20 cm hollow slab floor
11 10 cm reinforced screed
12 concrete topping layer
13 floor covering
14 precast concrete unit with socket inserts for fixing
15 80 x 80 x 100 mm concrete poured after fixing
16 150 x 100 x 10 mm steel plate
17 thermal insulation and lining to façade column
18 office partition
19 convector
20 cable duct
21 10 cm thermal insulation
22 30 mm double glazing with optically controlled solar shading, including light refracting system
23 6 mm enamelled glass with screen printing
24 opening flap with reflecting, thermally insulated solar shading glass (22 mm thick)
25 reflecting glass with opaque covering and thermal insulation (30 mm thick)
26 150 x 100 x 10 mm angle
27 20 x 50 mm balustrade post
28 8 mm dia. rod
29 6 mm dia. rod
30 20 x 50 mm rectangular hollow section handrail







Fire Safety

The striking feature of the fire protection in this building is an ingenious system of active and passive measures:

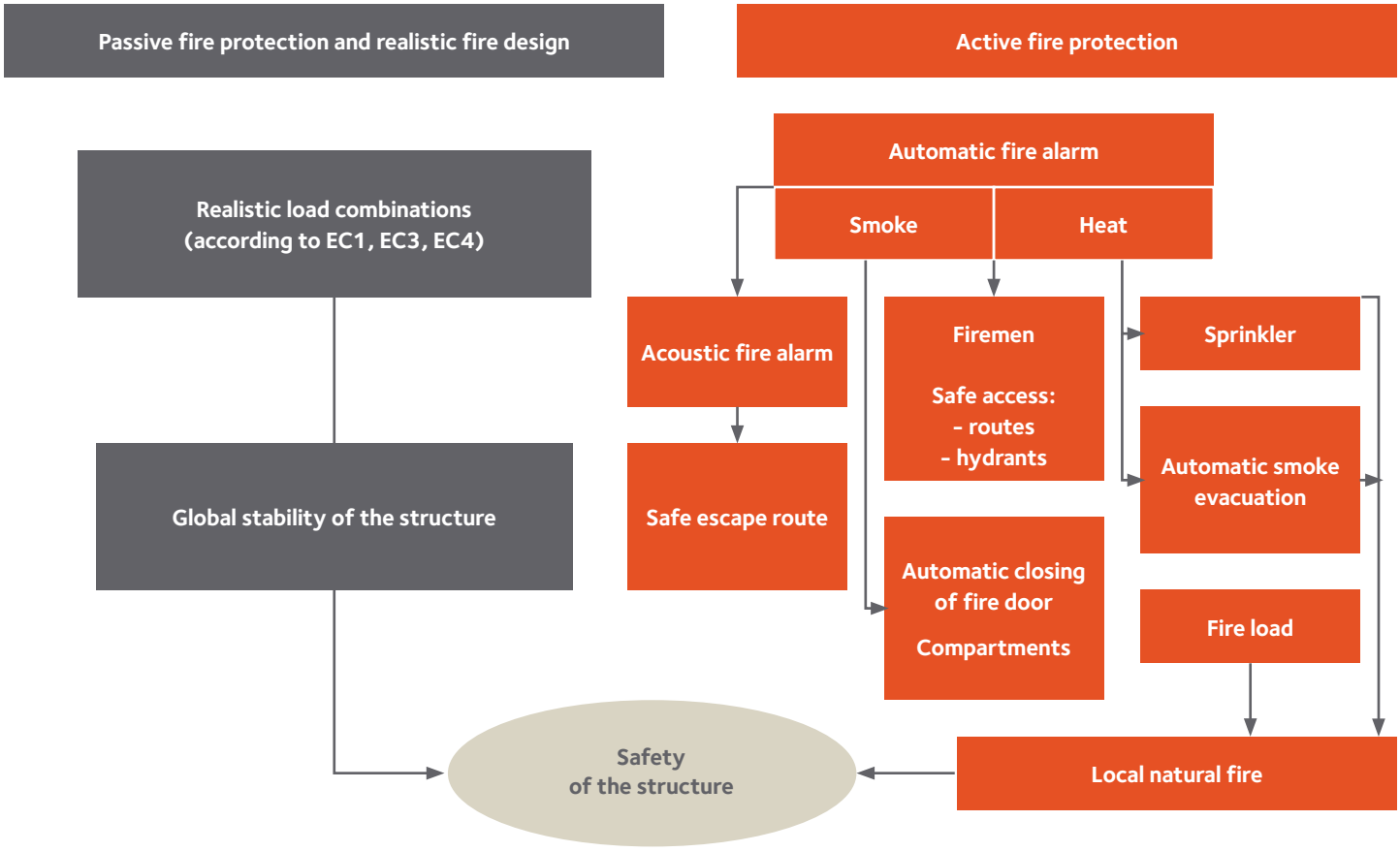
- Short routes to the staircases
- Structural separation of staircases from the main load-bearing skeleton frame
- Optimal ventilation by means of automatically opening smoke exhaust system of 2x2.4m²/wing in the roof
- A sprinkler system (water reservoir of 25,000 and 2 x 7650 liters) that reacts to thermal defectors

The Natural Fire Safety Concept, as included in the Eurocodes, has been used in order to verify the global stability of the structure under fire and this, without adding any supplemental passive measures. The principle characteristics activated for the design are the following:

- The overall behaviour of the structure under a natural fire according to Eurocodes 1, 3 and 4
- Reduction of the fire loads according to the passive and active measures used for human safety
- The additional framing effect of reinforced beam/column connections in the direction of the transversal wind bracing
- Thermal insulation of the columns in the façade
- Shear reinforcement bars at the support of prefabricated slab elements

All of those measures made it possible to leave the steel structure visible and unprotected.

Natural Fire Safety Concept



Technical data

Thermal insulation of façade elements: 1.7 W/m²K

Technical equipment:
Heating (hot water + convectors + ventilation): 2 natural gas boilers of 1163 kW

Cooling (ventilation + ceiling convectors):
Cooling power 2 x 630 kW (revamped in 2009 with 3 x 300 kW)

Ventilation:
By 2 towers situated at the roof level for the office
Independent devices for others technical rooms

Natural gas consumption: 220* kWh/m² year (1 m³ = 10.12 kWh)

Electrical consumption for cooling and ventilation: 63* kWh/m² year

* Mean value for 2006, 2007 and 2008

Technical advisory

We are happy to provide free technical advice to optimise the use of our products and solution in your projects and to answer your questions about the use of sections and merchant bars. This technical advice covers the design of structural elements, construction details, surface protection, fire safety, metallurgy and welding. Our specialists are ready to support your initiatives anywhere in the world.

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To facilitate the design of your projects, we also offer free software and technical documentation that you can consult or download from our website:

sections.arcelormittal.com

ArcelorMittal has also a website dedicated to a full range of products for the construction market (structures, facades, roofing, etc.):

www.constructalia.com

Finishing

As a complement to the technical capacities of our partners, we are equipped with high-performance finishing tools and offer a wide range of services, such as:

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- flame cutting
- T cut-outs
- notching
- cambering
- curving
- straightening
- cold sawing to exact length
- welding and fitting of studs
- shot and sand blasting
- surface treatment

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