

# Indaten®

A magical steel, in harmonious dialogue with nature

Like a fine wine, Indaten® weathering steel is enriched by air and enhanced with age. When exposed to the natural environment, this magical steel develops a beautiful patina that serves as protective armour and makes way for the steel's trademark purplish brown colouring. As a maintenance-free material that can last for 80 years, Indaten® weathering steel has been the product of choice for buildings, bridges and sculptures since 1930.

## Weathering steel, in brief

Indaten® develops its patina following exposure to the atmosphere. The first oxide layer appears within a few weeks, with the final colour being achieved within one to two years. The finish can last, without maintenance, for at least 80 years. The steel can also be pre-oxidised.

The primary alloying material in weathering steel is copper, at concentrations up to 0.55%. The copper produces a homogeneous and regenerating protective layer over the surface, which slows corrosion and ensures the integrity of the underlying steel.

## The Indaten® advantage

Combining durability and natural beauty – that's the Indaten® advantage. Unlike other building materials, Indaten® weathering steel does not need the extra expense of corrosion protection. That's because it protects itself, naturally! When exposed to the natural environment, this fine-grain, high-strength structural steel develops its unique, purplish brown oxide layer – known as the patina – that serves as a suit-of-armour, protecting the steel from the corrosion that other materials succumb to.

- No painting or chemicals necessary
- Aesthetically pleasing
- Natural protection against corrosion
- Reduced construction time
- Less maintenance costs
- Eco-friendly and 100% recyclable
- Longevity

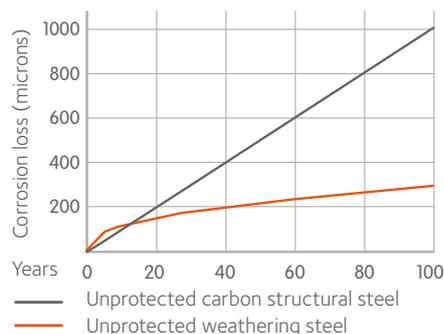


## Applications

Indaten® is the material of choice for many architectural, decorative and green building projects. Its durability, low-maintenance and unique aesthetical appeal make it ideal for cladding, bridges, chimneys, pylons, doors, decorative screens, floors, sculptures... and so much more! In fact, Pablo Picasso didn't hesitate in choosing the natural and long-wearing finish of weathering steel when building his famous sculpture that still stands today in Chicago's Daley Plaza.

## Functionality

The protective layer is built when the steel surface is exposed to an alternatively wet/dry environment. Building an optimal protective layer greatly limits corrosion rates and prevents a reduction of the steel's overall thickness (see graph below).



Corrosion losses weathering steel versus carbon structural steel

## All about the aspect

The patina's aspect depends on time, the average temperature of exposure and wetness. The aspect is also influenced by such things as the concentration of SO<sub>2</sub> or chloride content in the air. For example, when used in an industrial environment, the patina tends to develop a darker colour than when used in rural areas.

Over time the patina will transform from its red-orange colour to a dark, purplish brown coloration. Although the process can take up to two years, it can be accelerated with sandblasting. In fact, to ensure a homogeneous colouring of the patina, sandblasting is encouraged.

## Welding and joining

Indaten® 355 enjoys excellent performance with all common welding processes. However, when using weathering steel, specific fasteners are required. It is highly recommended that you avoid having your weathering steel come into contact with aluminium, copper, zinc or stainless steel. Always use an elastomer to prevent contact between the bolt and the panel. The best solution is to use fasteners made of weathering steel.

## Brand correspondence

Indaten® satisfies the requirements for EN 10025-5:2005 standard.

## The details

In your design, be sure you avoid:

- Permanent humidity and condensation
- Extreme industrial atmospheres
- Corrosive fumes
- Marine environments
- Contact with de-icing salt

Additionally, to ensure a nice aspect, proper management of run-off water is required to avoid staining (e.g. using gutters, drainpipes etc).

*Inside Design Tip: When using weathering steel, always use specific fasteners.*

## Main properties

Grade	Cr (%)	Cu (%)	P (%)	T (°C)	Min KV (J)	Thickness (mm)	EN 10025-5:2005	ASTM equivalence
Indaten® 355A	0.3-0.8	0.25-0.55	0.06-0.15	0	27	1.7-26.5	S355J0WP	A242 A606 T2 A606 T4
Indaten® 355D	0.4-0.8	0.25-0.55	< 0.030	-20	27	1.5-20	S355J2W	A588 grade A



## We're here to help you

Our engineers and researchers are here to support and help you maximise the durability of your building. For further information, visit [www.arcelormittal.com/industry](http://www.arcelormittal.com/industry) or contact us at

[fce.technical.assistance@arcelormittal.com](mailto:fce.technical.assistance@arcelormittal.com)

You can also visit ArcelorMittal's steel construction website [www.constructalia.com](http://www.constructalia.com)

## Case study: Luxembourg showcases Indaten® at World Expo pavilion

One of the latest creations in weathering steel was Luxembourg's national pavilion at the Shanghai Expo in 2010. Designed by architect François Valentiny, the Indaten®-built pavilion created a dramatic dialogue between the visitor and nature – making it one of the most striking buildings on the 5.3 km<sup>2</sup> Expo site. The pavilion took the form of an enlarged, single-family house surrounded by a fortress-like wall. The hardness of the weathering steel was softened by trees planted on top of the enclosure, a hanging garden along the inner core, and a pond covered by giant steel lily-pads.



### A magical product

After having worked with the material on a number of previous projects, Valentiny naturally chose weathering steel for the Expo pavilion. According to the architect, his choice to use the steel was heavily influenced by both the purpose of the building as well as a consideration for its lifespan. "For a pavilion with a life of six months, steel or wood are ideal because they are easy to construct and recycle."

The 5.6 by 1.5 metre sheets of weathering steel were milled at ArcelorMittal's Fos-sur-Mer plant in France and shipped to Shanghai, where the pavilion was assembled by local engineers. "For the Chinese engineers, weathering steel is a magical product," recalls Valentiny. "It's something high-level; something they believe should be respected."

### A versatile material

Weathering steel was used for the exterior, floor and roof of the pavilion – a signature of Valentiny's design philosophy. "I like to use the same surfaces on the walls, the roof and the ground, and there are a limited number of materials you can do that with," he says. "Along with wood and glass, weathering steel is one of them."



Towering above the pavilion's entrance was the Gëlle Fra, or Golden Lady, the iconic statue that typically adorns Luxembourg City's Constitution Square. Emphasising the weathering steel's natural aurora, for Valentiny the contrast between the oxidised steel and the golden statue produced a surreal feeling: "When you looked at it at night, the steel looked like gold".

### Made to last

While the Gëlle Fra may have returned home at the end of the Expo, the pavilion has made China its permanent home. Donated to the Chinese steel producer Hunan Valin Group, it will be reconstructed as an exposition space for the company's products – proving that the weathering steel will continue to endure.

### Credits

Images: Pierre Engel, Nigel Young, Foster + Partners

### Copyright

All rights reserved. No part of this publication may be reproduced in any form or by any means whatsoever, without prior written permission from ArcelorMittal. Care has been taken to ensure that the information in this publication is accurate, but this information is not contractual. Therefore ArcelorMittal and any other ArcelorMittal Group company do not accept any liability for errors or omissions or any information that is found to be misleading.

As this document may be subject to change at any time, please consult the latest information in the product document centre at [www.arcelormittal.com/industry](http://www.arcelormittal.com/industry)