

Esdec chose Magnelis® steel FlatFix Wave / Fusion and ClickFit EVO series



To whom this concerns,

Esdec Solar Group has deliberately chosen to use Magnelis® steel, a product from the steel giant Arcelor Mittal. This steel is seen in the Esdec Series ClickFit EVO, FlatFix Fusion and FlatFix Wave.

In brief reason and benefits for the use of Magnelis® steel:

- Magnelis® is a steel grade with a unique coating for a long-lasting protection against corrosion
- Coating consists a mix of zinc, aluminium and magnesium. One important feature is the self-repairing protection on cut edges, usually the area where corrosion starts
- Esdec regularly tests the Magnelis® products for corrosion to EN and ISO standards (saltspray and ammonia). Under normal conditions Magnelis® steel exist at least 20 year
- Knowing this, Esdec is able to give a product warranty of 20 year. For details see www.esdec.com
- Magnelis® steel is almost the standard in solar ground and roof mounting constructions
- Magnelis® steel is excellent machinable and available in several material variants. See e.g. the Esdec ClickFit Roof hook or Esdec FlatFix Wave
- Environment: Magnelis® steel consists less zinc what means (less raw material, reduced zinc runoff in soils) and is 100% recyclable



For detailed information see attached manufacturer's brochure from Arcelor Mittal.

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**QUICK
RELIABLE
INNOVATIVE**

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ArcelorMittal

Magnelis®

An innovative metallic coating that offers protection in the harshest environments



Magnelis®

The harshest environments need the toughest skin protection

Magnelis® is an exceptional, new metallic steel coating providing surface protection in a variety of applications against long-term wear and tear.

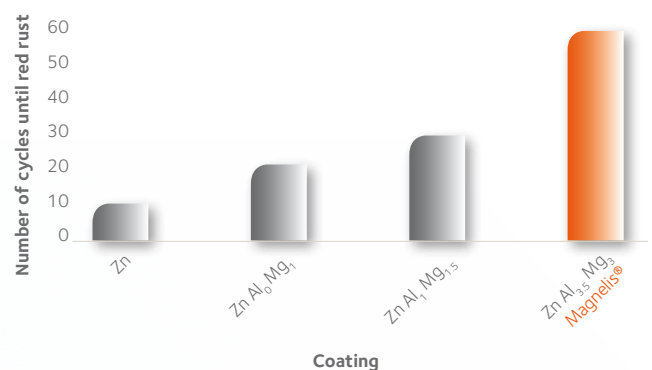
This unique coating offers a combination of attributes. Magnelis® provides:

- > **The best corrosion resistance performance; up to 10 times better than galvanised steel**
- > **The best suited protection to withstand harsh environments**
- > **The most cost-effective alternative to the post-galvanised process**

The chemical composition of Magnelis® has been optimised to provide the best corrosion-resistance results.

Magnelis® is produced on a classic industrial hot dip galvanising line, but dipped in a molten bath with a unique metallic chemical composition of zinc with 3.5% aluminium and 3% magnesium. The 3% magnesium is crucial as it creates a stable and durable layer across the entire surface and gives a far more effective corrosion protection than coatings with a lower magnesium content. As such, ArcelorMittal's Magnelis® offers significantly superior performance than alternative European products.

Corrosion resistance in cyclic test for different Zn, Al, Mg compositions



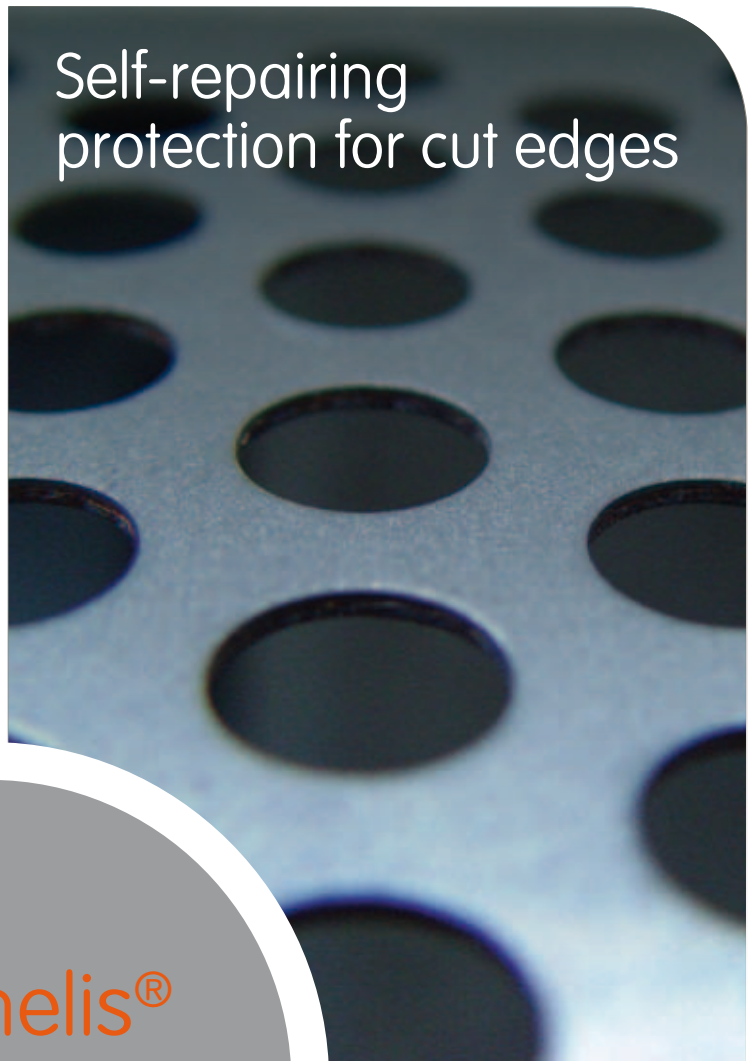
10 µm of coating submitted for an alternating cycle of 8 hours: fog cycle (5% NaCl)/dry cycle/humidity cycle
Source: ArcelorMittal R&D

Magnelis® has a natural dark grey, spangle-free smooth aesthetic aspect. Magnelis® is available with a standard environmentally friendly E-Passivation® (translucent CrVI-free temporary protection) or can be oiled on request.

Environmentally friendly



Self-repairing protection for cut edges

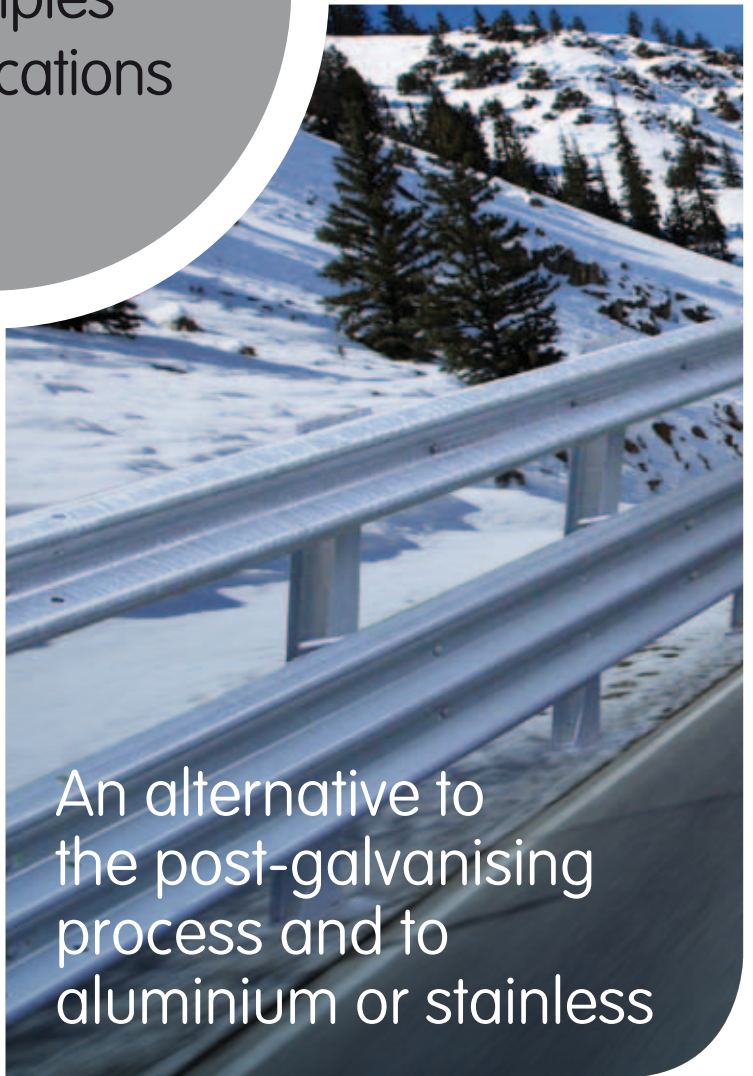


Magnelis[®]
examples
of applications

Superior corrosion resistance in chloride and ammonia environments



An alternative to the post-galvanising process and to aluminium or stainless



Magnelis®

Key benefits

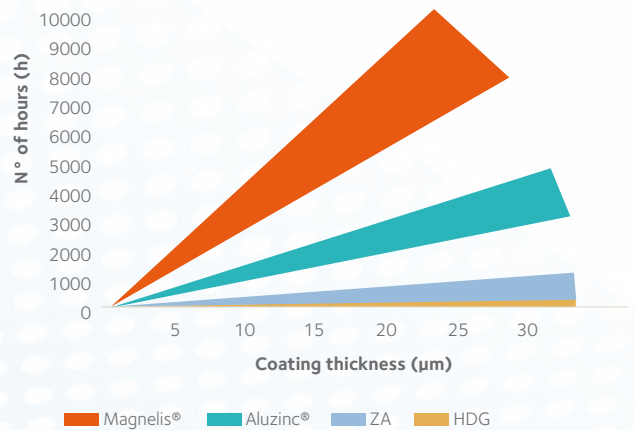
Superior corrosion resistance

Nothing offers better protection than Magnelis® in chloride or ammonia environments. Due to its unique chemical composition, Magnelis® provides superior corrosion resistance than standard hot dip galvanised steel.

The destruction of coating that occurs in an ammonia environment is seven times less with Magnelis® than with a standard zinc coating. In addition, Magnelis® guarantees a longer-lasting, active coating protection over time.

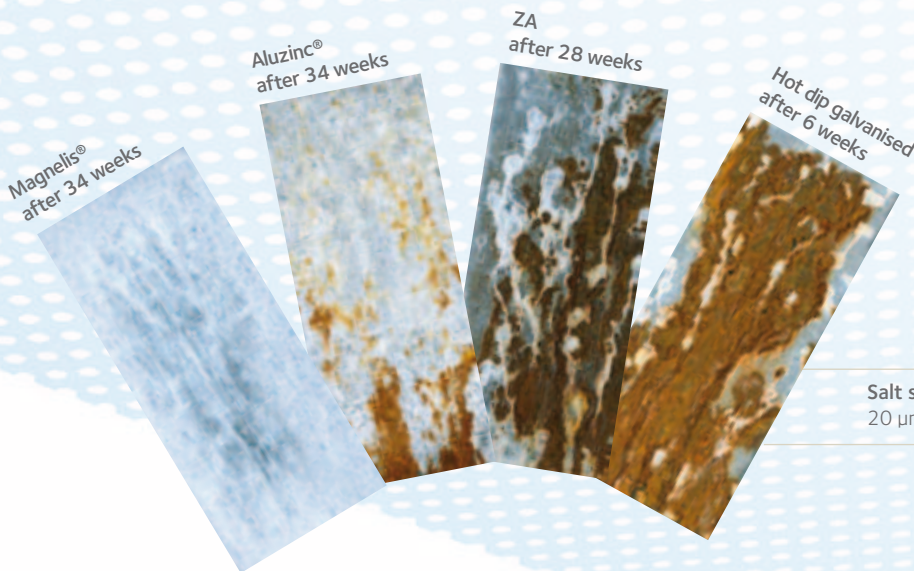
Over an eight-month period, a range of metallic coated products were submitted to salt spray tests. The results clearly highlighted the superior corrosion resistance performance of Magnelis® over other metallic coatings. No red rust was observed on the Magnelis® sample.

N° of hours before appearance of 5% red rust



Corrosion resistance by salt spray test (average):

Magnelis®: > 200 h/µm - Aluzinc®: ±100 h/µm - ZA: ± 25 h/µm
Hot dip galvanised (HDG): ± 8-10 h/µm

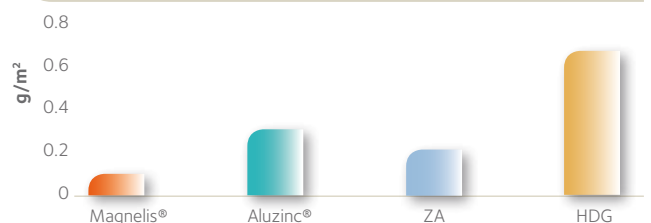


Salt spray test
20 µm coating per side

In highly alkaline environments (pH between 10 and 13), Magnelis® demonstrates superior corrosion resistance compared to other metallic coatings.

Due to its chemical composition, the product has better quality characteristics in terms of barrier protection against corrosion in an ammonia environment.

Weight loss in harshest environments



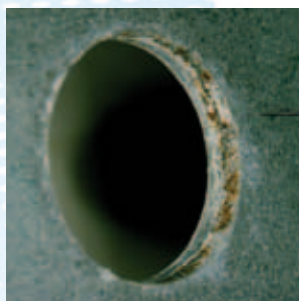
Measurement of mass loss

pH: 11.7 - Solution with 5% NH₃ - T: 20°C - Test duration 24 h

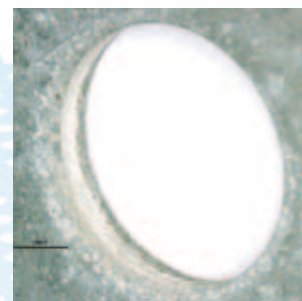
Self-repairing protection on cut edges

In addition to being fortified by a cathodic protection equivalent to zinc coating, Magnelis® protects exposed cut edges with a thin zinc-based protective film with magnesium, which prevents corrosive reactions.

The nature of this film varies depending on the environment and the properties according to the aluminium and magnesium content.



6 months
30-40% red rust - 60% white rust



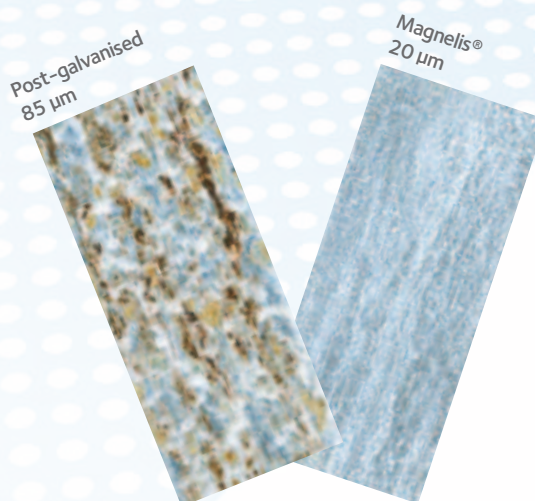
16 months
10% red rust - 70% white rust

Outdoor exposure over different time periods of Magnelis® ZM250 with 2 mm thickness in Brest (France)
Marine category C5-M (the most severe)
Institut Français de la Corrosion

An alternative to post-galvanising and other metals

Magnelis® offers a real advantage over post-galvanised products (with a ZM coating weight greater than 250 g/m²) and even over high value products such as stainless and aluminium.

Depending on the environment to which it is exposed, Magnelis® delivers a significant coating weight reduction of 2 to 4 times less than post-galvanised products, while still performing significantly better in terms of corrosion resistance and cost-effectiveness.

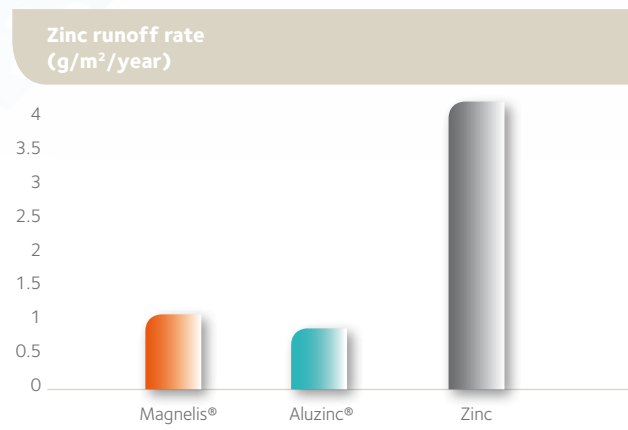


Salt spray test 2000 hours
Post-galvanised 85 µm coating Magnelis® ZM250/20 µm coating

Environmentally responsible

The application of Magnelis® ensures the preservation of natural resources since it uses less zinc than pure zinc coatings. Moreover, like Aluzinc®, Magnelis® reduces considerably the zinc runoff* in soils.

***Runoff rate:** the rate of dissolution of a material from its surface into the external environment (in g/m²/year). In our case: the quantity of zinc washed from the surface by falling rain water.



Brest (France)
Maritime category C3 (average)
Institut Français de la Corrosion

Magnelis®

Excellent workability

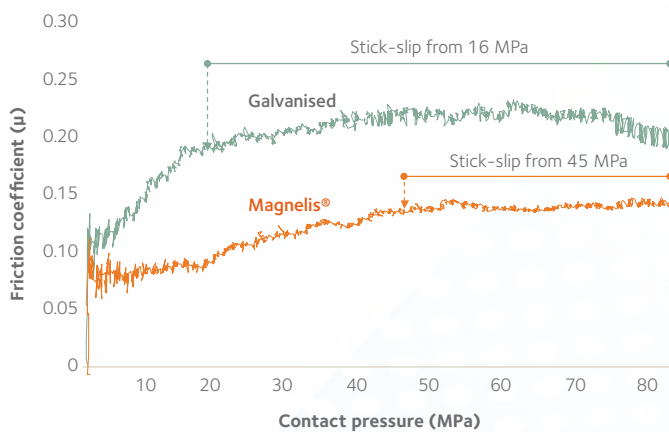
Thanks to its highly resistant, adherent metallic layer, Magnelis® can be formed in a variety of methods, including bending, drawing, profiling etc.

By decreasing the amount of metallic coating, while safeguarding corrosion resistance levels, spot welding is consequently improved.

A protective oxide barrier covers the weld, preventing the development of red rust. Thinner coating facilitates processing and delivers substantial savings.

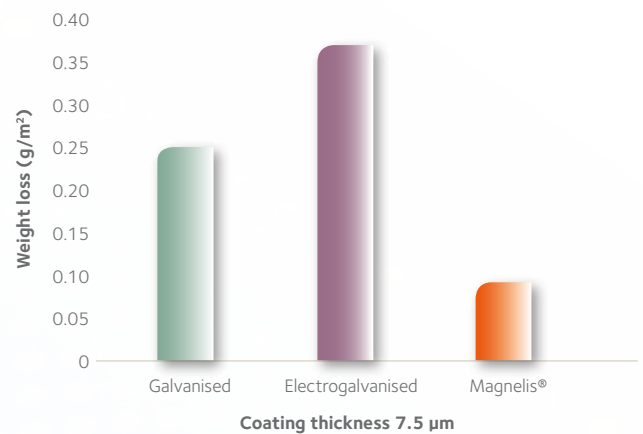
Magnelis® performs three times better than standard galvanised steel, reduces powdering effect and loses less coating weight in processing tools.

Friction test



Oil fuchs 4107S in excess
Comparison between Galvanised and Magnelis® steels

Powdering behaviour comparison



Lubrication: Fuchs 4107S in excess
Powdering behaviour comparison between metallic coatings expressed in weight loss (g/m^2)



Metallic coatings features comparison

Product features	HDG Zn	ZA	Aluzinc®	Magnelis®
Anti-corrosion properties				
In a chloride environment (marine site, swimming pool)	Reference	+	++	+++
In an ammonia environment (stable, farm, greenhouse)	Reference	+	=	++
In an SO ₂ environment (acid industrial environment)	Reference	+	++	+
Temporary protection (transport, storage)	Reference	+	+++	+++
Edge protection (heavy gauge, perforated sheet)	Reference	+	-	+++
Corrosion of a deformed part (bent or stamped)	Reference	+	-	++
Forming properties				
Bending & roll-forming	Reference	=	-	+
Drawing	Reference	+	-	+
Assembling properties				
Spot welding (equivalent thickness)	Reference	-	--	=
Aspect				
Visual appearance	Reference	-	+	=

= Equivalent + Superior - Inferior

Range

Magnelis® coating range	ZM90	ZM120	ZM175	ZM195	ZM250	ZM310
Coating thickness (µm/per side)	7	10	14	16	20	25
Steel grades	DX51D to DX57D +ZM HX260LAD to HX420LAD +ZM		S220GD to S390GD +ZM		H240D +ZM	
Surface aspect	MA		MB			
Surface treatment	C (E-Passivation® CrVI-free)		O (oiled)			
Thickness range	From 0.45 mm to 2 mm					
Width range	Up to 1630 mm					

We regularly broaden our range of Magnelis®.
For other dimensions please consult our sales network.

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Credits

Cover: © Fotosearch

p.3: Greenhouse – Photographer: Philippe Vandenameele. Perforated sheet and stable – Photographer: Didier Bridoux. Crash barrier – Courtesy of Tubosider

p.4-5: Samples after salt spray test – ArcelorMittal Global R&D

p.6: Magnelis® samples – Photographer: Jeroen Op de Beeck

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