



Main advantages

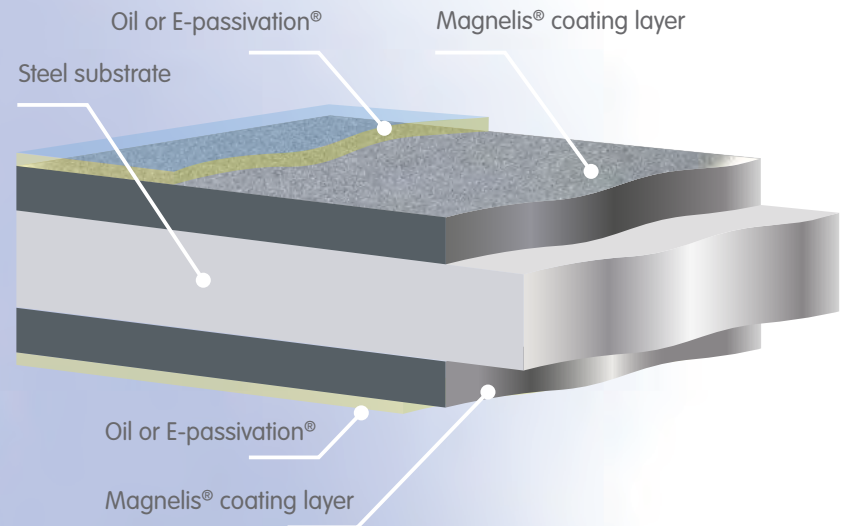
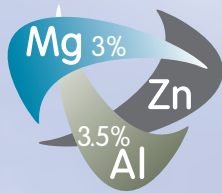
- Excellent corrosion resistance: three times better than galvanised steel (based on outdoor tests)
- Self-healing effect ensures excellent edge protection
- Best and most cost-effective alternative to post-galvanised steels
- Wide feasibility range
- Excellent processing properties
- Environmentally friendly

What is Magnelis®?

Magnelis® is an exceptional metallic coating which provides a breakthrough in corrosion protection. Magnelis® is also the best choice for a wide variety of applications.

Thanks to its unique composition, Magnelis® provides an unprecedented level of surface and cut-edge protection, even in the most hostile environments.

Magnelis® is produced on a classic hot dip galvanising line, but the molten bath has a unique chemical composition including zinc, 3.5% aluminium, and 3% magnesium.



*Magnelis® has a naturally dark grey aspect.
It is available with an environmentally friendly
E-passivation® or it can be oiled on request.*

Magnelis®
provides outstanding
corrosion resistance,
even in harsh
environments

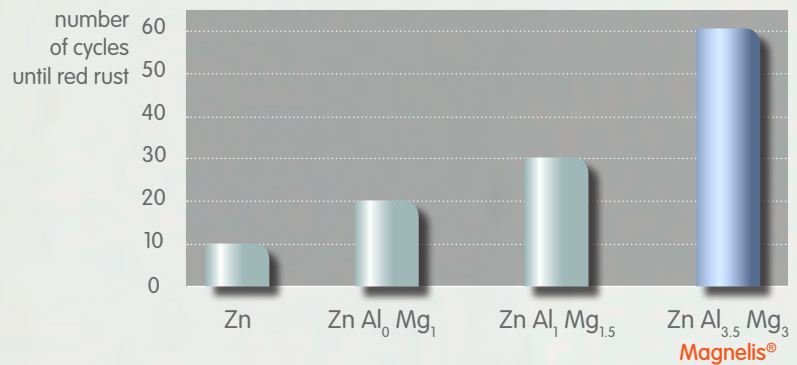


Outstanding corrosion performance

Magnelis® resists corrosion for longer than standard galvanised products and it outperforms coatings containing less magnesium.

The specific composition of Magnelis® (3% Mg and 3.5% Al) is crucial as it leads to a stable and durable layer across the entire surface and edges of the steel. This provides more effective corrosion protection than coatings with a lower magnesium content.

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



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



Magnelis® offers
deformed surfaces
extra protection

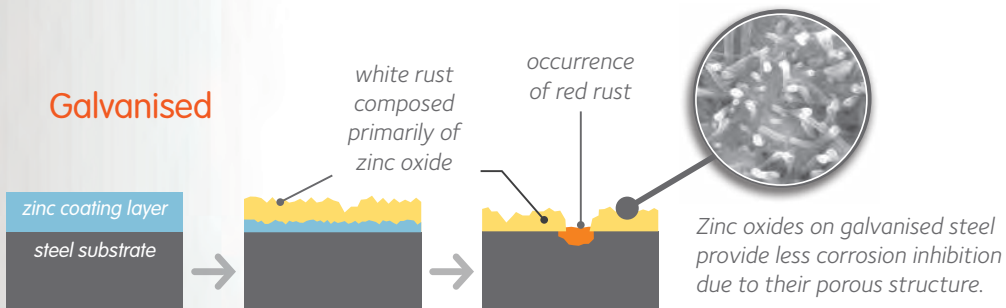
Corrosion protection mechanism

The specific composition of Magnelis® (3% Mg and 3.5% Al) is crucial as it leads to the formation of a very dense, stable, and durable layer of protection. The compact layer of Magnelis® acts as a barrier to corrosion, preventing the underlying steel from coming into contact with the ambient environment. The result is highly effective corrosion protection, even in the harshest environments.

Best protection for deformed areas

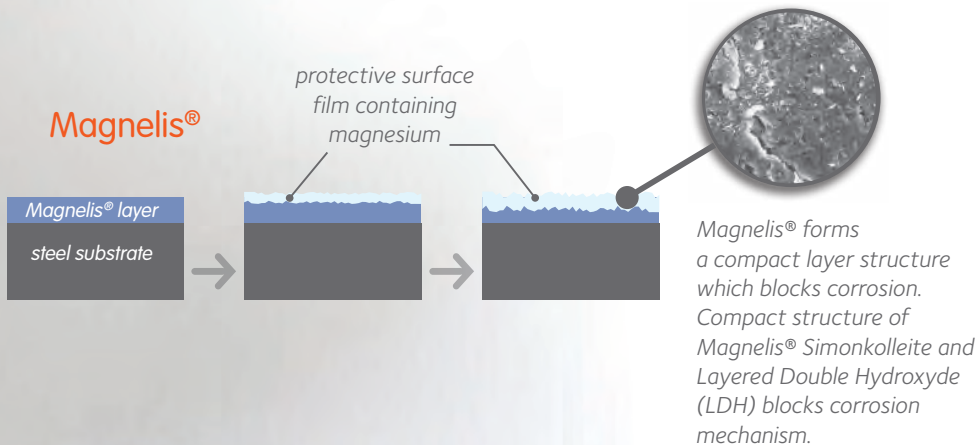
Magnelis® will even form a dense layer on highly deformed zones. This gives deformed steel shapes the same protection as flat surfaces. This is a key advantage of Magnelis® compared to other metallic coatings.

Galvanised



Galvanised

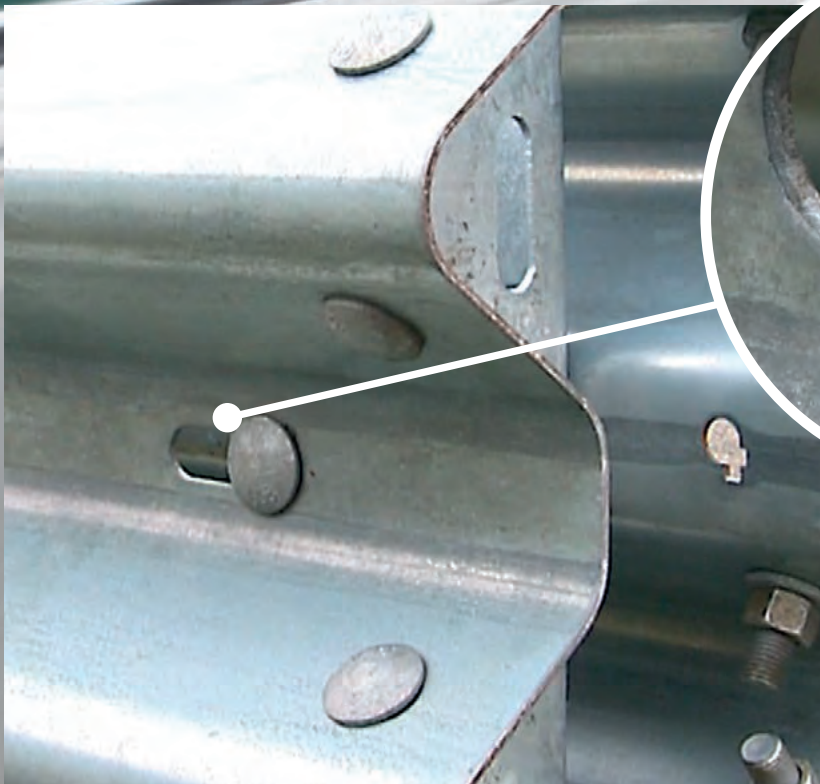
Magnelis®



Magnelis®

No red rust observed after 1440 hours of salt spray testing on Magnelis® cup, where the galvanised cup is completely corroded.

The self-healing effect of Magnelis® ensures the protection of uncoated edges, scratches and perforations



The perforated zone on a safety barrier is protected by the self-healing effect of Magnelis®.

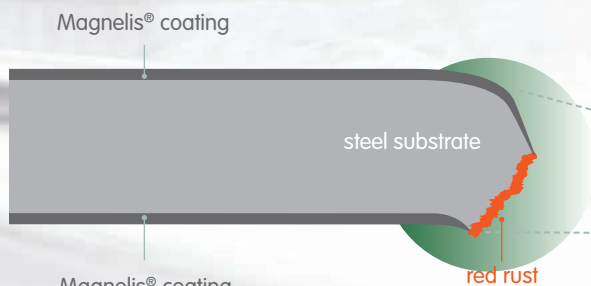
Edge protection with self-healing effect

When exposed to the environment, Magnelis® forms a very dense zinc-based protective film, unlike galvanised where the film is very porous.

This unique dense film is also formed on edges, welds, perforations and scratches. In case some red rust was present on these uncoated zones, the red

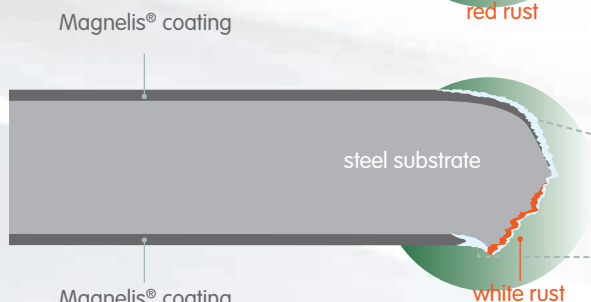
rust will be gradually covered by the Magnelis® film.

It is almost impossible for the environment to penetrate this film. The result is that Magnelis® provides perfect protection of the whole structure, even on the uncoated edges, scratches and perforations.



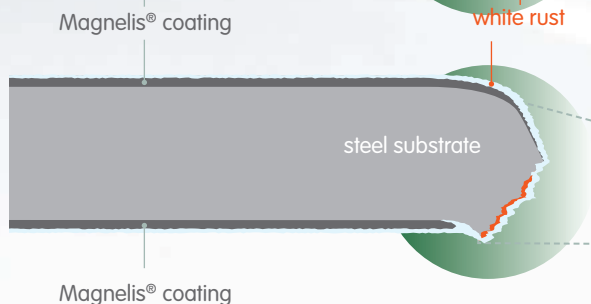
Initial exposure period (up to several weeks)*

The exposed cut end of the substrate is oxidised and forms red rust.



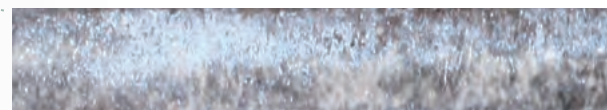
Subjected to rain and condensation (beyond several weeks)*

The zinc-based film containing magnesium on the coating layer migrates over the cut end.




Long exposure period (after more than a year)*

Disappearing of red rust and increasing of white rust.



** The speed of the self-healing may depend on the environment.*

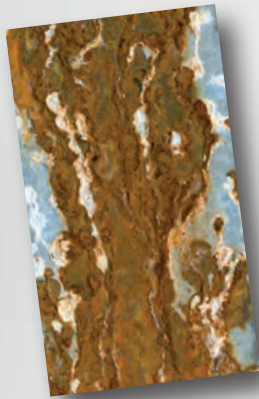
A woman with dark hair tied back, wearing a white lab coat and safety glasses, is seen from the side, working in a laboratory. She is positioned in front of a fume hood, which is emitting a thick layer of white vapor. The background consists of a brick wall with various pipes and conduits. The overall scene is brightly lit, typical of a laboratory environment.

The superior corrosion resistance of Magnelis® has been demonstrated in accelerated laboratory testing and proven through outdoor tests

Magnelis® samples are tested in the laboratory.

Corrosion resistance, accelerated corrosion tests

Magnelis® versus pre-galvanised
(salt spray test)

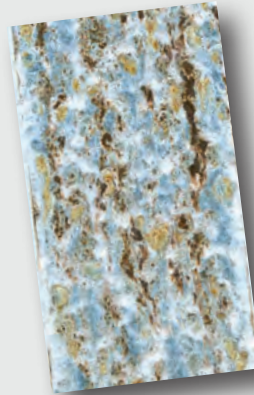


Hot dip galvanised 20 µm
after 6 weeks



Magnelis® 20 µm
after 34 weeks

Magnelis® versus post-galvanised
(salt spray test)

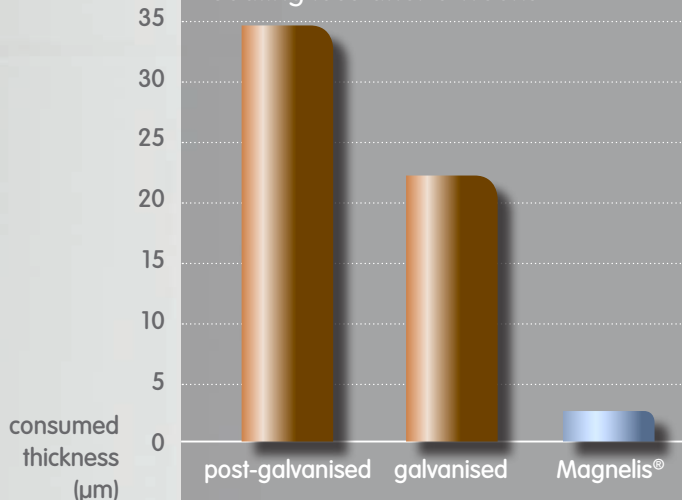


Post-galvanised 85 µm
after 12 weeks



Magnelis® 20 µm
after 12 weeks

Coating loss after 6 weeks



These are results from a 3CT (VDA 621-415) cyclic corrosion test. Source: ArcelorMittal R&D

Salt spray and cyclic corrosion test results highlighted the superior performance of Magnelis® compared to other metallic coatings.

No red rust was observed on steel with a 20 µm coating of Magnelis® after 34 weeks of salt spray testing. Magnelis® offers a real advantage over post-galvanised steel.

Magnelis® outperforms
galvanised steel in all
types of environments

*Magnelis® samples
at the French Corrosion
Institute in Brest.*

Corrosion resistance, proven outdoors

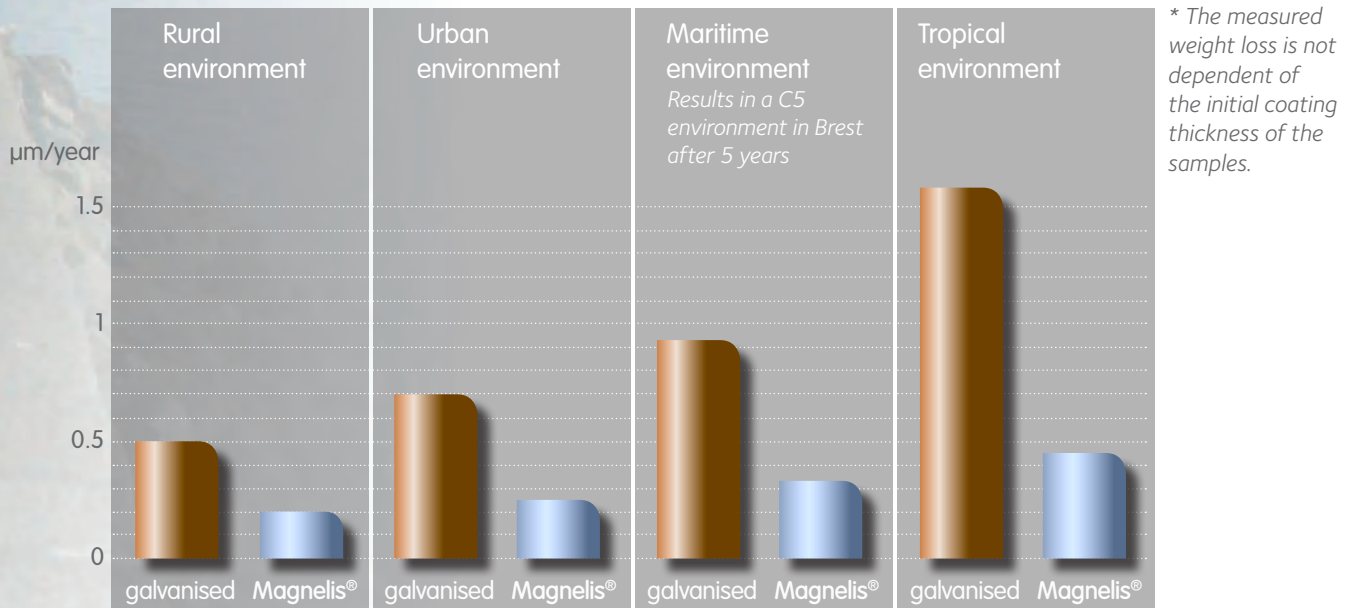
More than thousand Magnelis® samples have been exposed to a variety of different environments around the world in outdoor tests. The samples included shapes such as flat sheets, tubes, and profiles, and a range of different dimensions.

Every test has confirmed the optimal protection provided by Magnelis® against long-term corrosion.

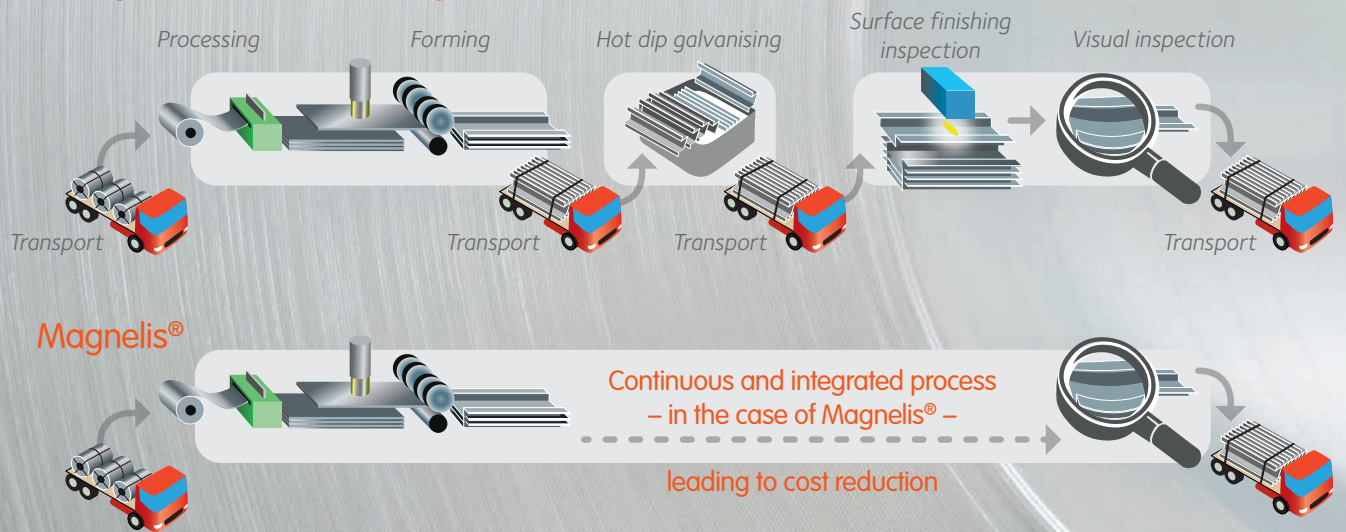
Magnelis® shows three times better protection than galvanised steel in all types of environments, and even more in very aggressive environments.

Mean yearly consumed thickness* in different environments in microns/year (after 2 years)

Source: ArcelorMittal R&D



Post-galvanised versus Magnelis®



Cost advantages over competing solutions

Advantages over post-galvanised steels

- Freedom to optimise designs thanks to the ability of Magnelis® to protect deformed shapes
- Lower weight of Magnelis® coating (depending on environment) to obtain the same level of corrosion resistance
- Protects flat and deformed surfaces as well as cut edges
- Shortens the logistics chain thanks to simpler fabrication processes.

Cost effective compared to stainless steel and aluminium

- Magnelis® provides the high level corrosion resistance of stainless and aluminium at a significantly lower cost.

Reduces maintenance costs compared to post-painting:

- The use of Magnelis® can avoid the need for post-painting. This leads to cost savings and productivity improvement
- The extended durability of Magnelis® results in reduced maintenance.

Magnelis®
Think strategy

Technical specifications

Magnelis® is applied to the steel on a continuous hot dip galvanising line.

The steel strip is dipped into a molten bath of Magnelis® which includes zinc, 3.5% aluminium, and 3% magnesium.

By closely controlling the process conditions, ArcelorMittal is able to ensure the optimal properties of the final product.

Magnelis® can be applied to a very wide range of steel grades. These include steels for cold forming and deep drawing applications, as well as structural and high strength, low alloy steels.

Steel thickness can range from 0.45 to 6 mm, while the coating can be from 5 to 35 µm/per side (ZM430).

Coating Designation		ZM70	ZM90	ZM120	ZM175	ZM200	ZM250	ZM310	ZM430	ZM620
Coating Mass (total both sides)	g/m ²	70	90	120	175	200	250	310	430	620
Coating Thickness	(µm/per side)	5	7	10	14	16	20	25	35	50
Aspect	MA and MB aspect*									
Surface Treatment	C (E-Passivation® CrVI-free), O (oiled)									
Thickness	0.45 to 6.00 mm								1 to 4 mm**	
Width	Up to 1680 mm									

Steel grades*

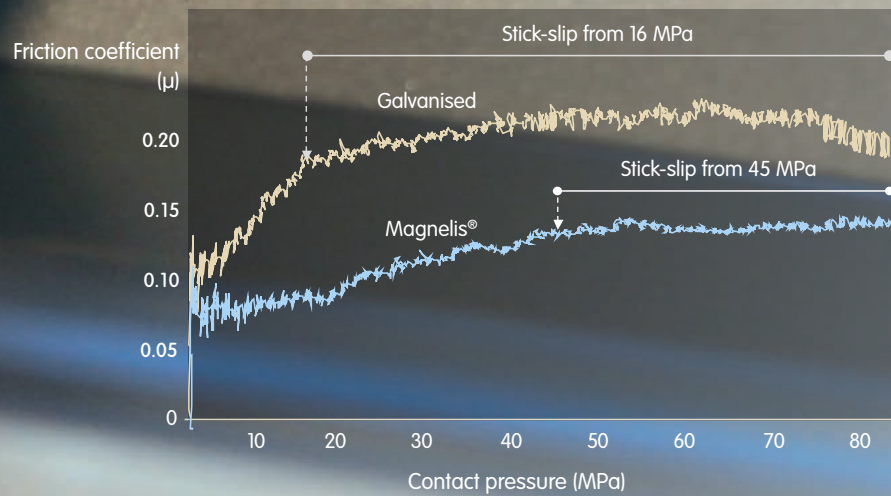
DX51 to DX57 + ZM
 S220 GD to S550 GD + ZM
 S420GD-HyPer® + ZM, S450GD-HyPer® + ZM and S550GD-HyPer® + ZM
 HX260 LAD up to HX700 LAD + ZM

* Contact us for detailed feasibility

** Higher thicknesses available on request

Friction test

Magnelis® offers improved friction behaviour.



Lubrication Oil Fuchs 41075 in excess
Source: ArcelorMittal R&D

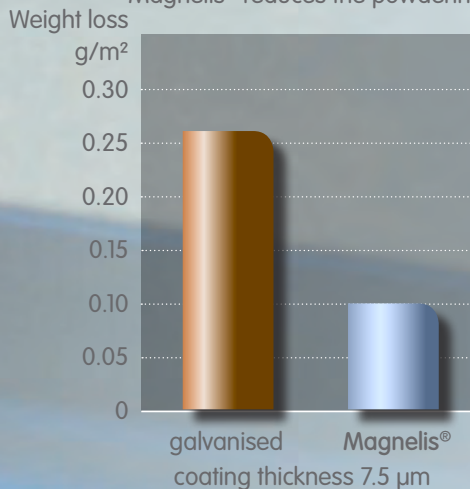
Easy to process

Thanks to its highly resistant, adherent metallic layer, Magnelis® can be processed using a variety of methods. These include bending, drawing, and profiling. Magnelis® maintains a high level of corrosion protection, even in the deformed zones.

Outdoor exposure tests have confirmed the exceptional corrosion resistance of Magnelis® on deformed parts compared to galvanised steel. The Magnelis® barrier protects the entire surface including cut edges and perforations.

Powder behaviour comparison

Magnelis® reduces the powdering behaviour.



Lubrication Oil Fuchs 41075 in excess
Source: ArcelorMittal R&D

Formability

Magnelis® proves better results on workability of the product and protection of the processing tools.

Friction tests show that Magnelis® performs better than hot dip galvanised steel.

Steels coated with Magnelis® are easy to process and do not harm processing tools. Magnelis® also enables manufacturers to deform the steel without the need for a lubricant, something that is not possible with galvanised steels.

Weldability

Magnelis® offers improved weldability due to its thinner coating. The process to weld Magnelis® is the same as that used for zinc-coated parts. The same welding consumables, procedures, and guidelines can be used. Arc, spot, and high frequency induction (HFI) welding techniques are all compatible with Magnelis®.

In cases where welded areas need to be re-protected, Magnelis® demonstrates even better corrosion resistance than a post-galvanised coating.

Paintability

Magnelis® can be post-painted and offers superior corrosion resistance compared to other metallic coated steels.

Standards and certification

Magnelis® has been included in the European standard for hot dip galvanised steel (EN 10346) since July 2015. The composition of Magnelis® is classified as Type 2 in the ASTM A1046/A1046M-19 standard.

The excellent corrosion resistance of Magnelis® has seen it certified for use by independent authorities including: CSTB (France), DIBt (Germany), RISE (Sweden).

DIBt Z-30.11-51 allows the use of Magnelis® ZM310 in C4, Magnelis® ZM250 in C3 and Magnelis® ZM120 in C2 with durability H – high (>15 years) in accordance with DIN 55634-1:2018 and EN ISO 12944-1 and -2 of 2017.

Magnelis® is the only metallic coating product certified for use in a C5 environment by the RISE certification body in Sweden.

Magnelis® is suitable for food contact applications in accordance with European regulation EC 1935/2004.

Magnelis® complies with the European directives covering:

- Restriction of Hazardous Substances (RoHS)
- Registration, evaluation, authorisation and restriction of chemicals (REACH)
- Waste Electrical and Electronic Equipment (WEEE)

CSTB / Direction Enveloppe, Isolation et Sols
Division Façades, Couvertures et Toitures

**EVALUATION TECHNIQUE DE PRODUITS ET MATERIAUX
N° 20/0067 du 3 février 2020**

concernant le produit de revêtement métallique sur tôle
d'acier
« MAGNELIS® »

Destinataire : ArcelorMittal Europe (Flat Products)
24-26 Boulevard d'Anschitz
1160 LUXEMBOURG
Luxembourg
E-mail : frs@arcormittal.com / frs@arcormittal.lu
Téléphone : +352 422 21 43

Destinataire : ArcelorMittal Euro Carbon
24-26 Boulevard d'Anschitz
1160 LUXEMBOURG
Luxembourg

Projet : ArcelorMittal Europe
22 Chaussée de Namur
69100 ANGERS
France

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DIBt
Deutscher Institut für Bautechnik

**National technical approval /
General construction
technique permit**

Number: Z-30.11-51

Validity: from 17 September 2019 to 17 September 2024

Applicant: ARCELMITTAL FLAT CARBON EUROPE
24-26 Boulevard d'Anschitz
1160 LUXEMBOURG
LUXEMBOURG

Subject of decision: Steel strips protected against corrosion by "Magnelis®", a metallic coating, to be used for the production of this-walled, cold formed members

The subject named above is hereby granted a national technical approval (allgemeine bauaufsichtliche Zulassung) / general construction technique permit (allgemeines Baugenehmigung). This decision contains eight pages. The subject concerned was granted the first national technical approval on 23 July 2013.

Translation authorised by DIBt

DIBt
Deutscher Institut für Bautechnik

RISE

Type Approval and decision on production control
SI 0579 15

Magnelis ZM310, Corrosion protection

Marking/Label: ArcelorMittal Europe - Flat Products, Rue Vert-Moulin, 49, BE-4430 Seneffe, Belgium, Tel: +32 4 224 21 43, E-mail: arcormittal@arcormittal.com

Information supplied by: ArcelorMittal Europe - Flat Products, Rue Vert-Moulin, 49, BE-4430 Seneffe, Belgium, Tel: +32 4 224 21 43, E-mail: arcormittal@arcormittal.com

Product owner/producer: Corrosion protection coating, Magnelis ZM310 is a special coating imposed by a variety of zinc-plummet and phosphorus.

INTENDING USER: Intended as corrosion protection of steel sheets for indoor and outdoor applications. The corrosion protection is suitable for an expected service life, according to EN ISO 12944-2 described in this report, in an expected service life of 20 years.

Inspector: Magnelis ZM310

Approval: The product fulfils the requirements on EN ISO 12944-2 S. 3.1.5 P.10, in respect of steel under conditions listed in the certificate, and is therefore permitted to conform with the provisions of the following national technical approval provisions in application of the European construction standards (Eurocodes) (EN).

EN 12944-2 (S. 3.1.5 P.10) Section A.2.1.1
EN 12944-2 (S. 3.1.5 P.10) Section A.2.1.2

Responsible signatories:

Checked: The factory production control (FPC) is recognised by an independent inspection body. Control agreement: Approval dated 23-04-2019, inspection body: Kurtermittel Institut für Technologie- und Normenwesen, ZIS-54-0213, inspection body: RISE Research Institute of Sweden AB.