FMH Stainless

Stainless Steel, Architecture and Environmental Impact

RIMEX METALS (UK)







Specialists in Metal Finishes

Dynamic metal finishes suitable for:

Architecture • Elevators • Engineering
Machinery • Refrigeration • Signage • Transport

Australia | China | France | Germany | Middle East | South Africa | Spain | UK | USA

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Appendix

Introduction and Aims

Stainless steel is generally understood to be an environmentally friendly product, and through it's widespread specification in areas such as hospitals, restaurants, etc, is also understood to be a hygienic choice.

In architectural and industrial applications, stainless steel represents a long-lived product, which when specified correctly will stand up to the specific rigours of a given environment, even the harshest offshore applications.

Stainless steel is a highly recyclable product, helping greatly with the sustainability of the primary resources required for its production.

It is the intention of this report is to pull together information from varied sources in support of these statements and to provide an overview of the green credentials of stainless steel as an architectural choice.

Properties of Stainless Steel

Corrosion Resistance

Stainless steels (containing a minimum of 10.5% chromium), show excellent levels of corrosion resistance across the board of applications. It is the presence of an inert, self forming and healing layer of chromium oxide which gives stainless steel its corrosion resisting properties in isolating the iron in the metal from the atmosphere. The corrosion resistance of the material can be further enhanced through additional or the manipulation of the content of specific alloy metals in the stainless steel.

Architecturally, Stainless steel is globally accepted as an excellent choice for specifiers. Global references such as the **Chrysler building** in New York, which has been in situ for more than 80 years having only been cleaned on 2 occasions, reinforce this fact and a vast array of other documented evidence exists in support of it. In summary, 316 (1.4401) is the grade of stainless steel most suitable for polluted, industrial or marine environments due to its higher corrosion resistance than other standard grades such as 304 (1.4301).

Therefore in urban façade type applications where pollution coupled with the likelihood that a regular cleaning regime will not exist or be adhered to, 316 would generally be the specification of choice.

Durability

The mechanical properties of stainless steel when considered alongside the corrosion resistance, make it a highly durable product. Stainless steel consequently has a very long lifecycle when compared to alternative architectural materials such as aluminium or other steels. Included in the appendix is a typical Mill Test Certificate for 316 (1.4401) grade stainless steel, showing chemical and mechanical properties as shown in the. (Appendix 1).

Recyclability

The recycling characteristics of stainless steel can be summarised as follows:

1. Stainless steel is 100% recyclable.
2. It can be continually recycled without any degradation of it's properties or performance.
3. The recovery rate of steel construction products from UK demolition sites is currently around 94% with 84% going for recycling and 10% being directly re-used. (**Source: 'Stainless Steel and Sustainable construction', BSSA 2004**).
4. Stainless steel has a very high recycled content. Globally it was concluded, following a case study by the **International Stainless Steel Forum (ISSF)**, that the recycled content of stainless steel is 60%. In Europe the **ISSF** calculates that the input of recycled steel stands at 70%.

These figures make stainless steel the most recycled material in the world!

Sustainability and Environmental Impact

Due to the very high levels of recyclability and recycling, stainless steel has an environmental impact significantly lower than what would exist if production was purely from primary material sources as can be demonstrated in the below section of this report:

Energy Consumption, Emissions and Waste through Manufacturing

Recycling aside, due to increased efficiencies and working practices, it was calculated that energy consumption used in the production of stainless steel by the Outokumpo mill in Sheffield has fallen by 70% over the 20 years to 2004 (**Source: BSSA**).

In conjunction with improvements in manufacturing practices, the increasingly high level of recycled content in stainless steel helps reduce the energy consumption, emissions and consequently the carbon footprint of the producing mills. The paper, **'how to quantify the environmental profile of stainless steel' (Hiroyuki Fujii et al 2005)** employing **Life Cycle Inventory (LCI)** and **Life cycle Assessment (LCA)** figures for stainless steel, enables the comparison of primary production (that uses **purely new raw material** components), with alternative production (based on **purely recycled material**).

Definitions (Source: ISSF)

Life Cycle Assessment (LCA) is a tool to assist with the quantification and evaluation of environmental burdens and impacts, associated with product systems and activities, from extraction of raw materials in the earth to end-of-life and waste disposal. It is being increasingly used to assist with decision making for environmental related strategies and materials selection.

Life Cycle Inventory (LCI) is one of the phases of a **Life Cycle Assessment (LCA)**.

LCI Data quantifies the material, energy and emissions associated with a given functional system (for example the manufacture of 1KG of stainless steel coil).

The paper demonstrates that as recycled content of stainless steel goes up, the primary energy used in the stainless-steel production falls.

This principle can be summarised by the listed data for 304 2B raw material showing the two extreme scenarios of; **100% primary material based production against a 100% recycled material production** case as demonstrated in the same paper.

This lists the energy required, co2 emitted and waste generated in the **'production of 1KG of stainless steel'**.

304 2B	100% Primary Materiral	100% Recycling Material
Energy (MJ/Kg)	73.00*	23.00
CO2 (Kg/Kg)	7.10	3.90
Waste (Kg/Kg)	2.80	0.60

Notes

* Because no direct data exists for the 100% primary situation, which doesn't exist in practice, it was therefore calculated using LCI and LCA methods which were used and adjusted to give hypothetical data for the two cases shown above.
- These figures do not allow for credits for recycling at the end of life, which would further widen the result.

Other Environmental Considerations

- There is little or no run-off or contamination from a stainless-steel product making it hygienic and consequently results in little or no pollution of our land and waterways.
- Lower requirement for regular cleaning on account of high corrosion resistance, results in reduced run off of detergents or other specialist cleaning products into our waterways. As discussed in an earlier section of this report, the Chrysler building has been cleaned twice in more than 80 years.
- Due to high levels of recycling, there is significant reduction in the impact on land fill disposal of stainless steel, reducing further it's environmental impact recycling of stainless steel is commercially driven, rather than through tax breaks for recyclers and is therefore self-sustaining.
- Again, on account of the recycled content of stainless, the pressure on mining of primary resources such as nickel or molybdenum ore is reduced again helping to minimise the physical damage and pollution associated with mining.

Industry Awareness - Looking Forward

The Steel Construction Sector, led by the Steel Construction Sector Sustainability Committee, launched a sustainability strategy in 2002. This body in conjunction with the rest of the sector reviews progress against four sustainable development objectives defined by UK government.

1. Social Progress which meets the need of everyone.
2. Effective protection of the environment.
3. Prudent use of natural resources.

Maintenance of high and stable levels of economic growth and employment.
The full version of the strategy, which addresses a number of other initiatives can be downloaded from the following source;

http://www.steelconstruction.org/steelconstruction/view?entity1D=99&jsp-source&sessionID--1225454882317 &entityName=document **(Link doesn't exist)**

In addition to the strategy detailed above, A continually self-imposed pressure by stainless steel mills to reduce their environmental impact will continue to build on stainless steel's strong reputation as a building material to meet modern demands. New techniques and ideas continue to push back the boundaries of what can be achieved.

For example, one of the major environmental issues connected with stainless steel production is dust emissions and soil contamination resulting from metals settling out of these emissions.

The stainless steel manufacturing process generates large amounts of dust. To minimise emissions to the environment these are collected using filters. In 2007, 60,000 tonnes of

dust and scales were collected in filters by **Outokumpo** and from these, 21,000 tonnes of metal were recovered and re-used in the steel production process thereby reducing emissions, and reducing the burden on primary materials for the manufacturing process.

Outokumpo positions itself at the forefront of environmentally conscious steel production, reducing where possible their environmental and ecological burden. In their own report, **'Outokumpo and the environment 2007'**, The group describes a project initiated to assign an environmental cost to the raw material value, with the aim of employing resources in the most efficient way, maximising value, whilst using as little resource as possible and thereby further minimising their ecological burden.

BREEAM, The Green Guide and Environmentally Aware Construction

BREEAM (Building Research Establishment Environmental Assessment Method) is the longest established assessment method for buildings and is used to describe a buildings performance in enviro nmental terms. Developers and designers are encouraged to consider a range of issues at the earliest opportunity during the development process to achieve the optimal score for the design planned. The issued certificate, in the range; Pass, Good, Very Good or Excellent can then be used for promotional purposes in a climate ever more conscious of collective environmental responsibility.

The types of areas assessed are:

- Management.
- Health and well being.
- Energy.
- Transport.
- Water.
- Materials.
- Land use and ecology.
- Pollution.

Category scores are issued and environmental weightings applied to give a single score from which the rating is derived. (**Source: BRE website**)

The **BRE Green Guide to Specification** is a publication which provides guidance on the environmental impact of elemental specifications for roofs, walls, floors, etc for specifiers, designers and their clients. This thereby enables them to make informed choices in the design of the building. **LCA Data** for different materials is used to assess various elemental construction systems and assign them ratings against various categories such as their effect on:

- Climate change.
- Fossil fuel depletion.
- Ozone depletion.
- Human toxicity to air and water amongst other things and then assign that particular element a summary rating in the range A-C.

The section of **The Green Guide** associated with external wall cladding systems, observes in the words of the authors that, **'Stainless steel cladding profiles extremely well; combining the benefits of lightweight cladding together with good recycling attributes, and consequently gives relatively low embodied energy and pollutant emissions'.**

The system rated in the guide incorporating stainless steel cladding (stainless steel cladding and coated steel lining panel, galvanized steel fixing rail, insulation, plasterboard internal wall on steel stud) an 'A' rating whereas of all the other wall cladding systems mentioned, mostly perform only on a 'B' rating.

Rimex Metals and the Environment

Rimex Metals are a manufacturer of specialist metal finishes, primarily in stainless steel.

For external facade cladding applications, Rimex would recommend **316 (1.4401) grade** stainless steel, identified earlier in this report **as the correct specification for harsh external environments**.

The principle products supplied for architecture by Rimex Metals (textured and coloured products) are manufactured via processes that contribute to the environmental strengths of stainless steel as an architectural product, rather than detract from them.

- The **patterning processes** helps to increase the visual aesthetics and performance lifespan of a product, pushing back the architectural need to replace it and again reducing the burden on stainless production. The rolling process increases the rigidity of the stainless steel leading to greater resistance to impact damage, improved optical flatness and the concealment of scratches and abrasions through the existence of the pattern and light interplay with it. For this reason they are often specified for wall/column claddings in transit terminals and public buildings such as hospitals and schools and lift car claddings.

The **colouring process** is a chemical process that thickens the naturally existing chromium oxide layer that naturally forms on stainless steel by between 0.02 and 0.36 microns. The presence of this thickened layer leads to light interference effects and the impression of colour. It is not achieved through a paint or dye application. A study conducted into the performance of the coloured finishes produced via the INCO process as employed by Rimex, found that stainless steel coloured via this route showed enhanced corrosion resistance over uncoloured sample pieces in both accelerated corrosion and accelerated pitting tests.
(Source: R.Blower and T.E Evans; INCO European Research and Development Centre). This enhanced corrosion resistance will also extend the lifespan of the product, potentially reducing pressure on raw material production with all that that entails.

Rimex Metals are committed to reducing the effects of their activities on the environment wherever possible and a copy of our **Environmental Statement** accompanies this report (Appendix 2).

Conclusions

Stainless steel is an inherently green material in that it is 100% recyclable without any degradation or deterioration of quality. The stainless steel we are producing now could and should be in use in centuries to come. It is the most recycled material in the world.

The stainless steel industry is increasingly committed to improve manufacturing techniques and practices, using raw materials as efficiently as possible and keeping to a minimum any environmental impact caused. Recycling is a crucial part of this and LCI and LCA Data, which is increasingly available, will assist in this ongoing process.

There are specific tools such as BREEAM and the Green Guide available to assist clients, designers and specifiers in the selection of materials and systems in the development of environmentally sensitive construction projects. Stainless steel performs very well as a cladding choice according to this methodology and publication.

Rimex Metals as a finisher of raw stainless steel do through certain production techniques such as texturing and colouring, etc, to enhance the operational life of the product. Rimex are committed to work with environmental bodies and within European guidelines, to minimise their environmental impact.

Appendix

1. Mill Test Certificate

Herstellerwerk / Manufacture's works / Usine productrice

outokumpu

Art der Prüfbescheinigung / Type of inspection document / Type du document

ABNAHMEPRUEFZEUGNIS
INSPECTION CERTIFICATE
CERTIFICAT DE RECEPTION
nach / according to / suivant
EN 10204-3.1

Bescheinigungsnr. 02.08.2017
Document number
Numéro de document
1000655142 /

Seite / Page / Page
1 / 1

Oberschlesienstrasse 16, 47807 Krefeld

Outokumpu Stainless Distribution
Coil Service Center,
SL2 Building, Door 51
SHEFFIELD
S9 1ZT
UNITED KINGDOM

Besteller/Empfänger / Customer/Consignee / Acheteur/Destinataire
Outokumpu Stainless Distributi,Sheffield

Kundenbestellnr. / Customer's order number / Numéro de la commande du client
149974

Werksauftragsnr / Manufacturer's works order no/ N° de la commande de l'usine productrice
900504913 / 002

Lieferanzeige Nr. / Delivery Note No. / Avis d' expédition N°.
87882033 / 020

Erzeugnis / Product / Produit
BAND/COIL/ROULEAU

Lieferbedingungen / Terms of delivery / Conditions de livraison
EN 10088-2
EN 10088-4
\STM A 240/A 240M
ASME SA 240/SA 240M Sec.II Part A Ed.2015

Stahlsorte und Gütegruppe / Steel grade and quality / Nuance de l'acier
NIROSTA 4016 / 1.4016
TYPE 430

Kundenmaterial-Nr. Customer's material number N° de matiere du client	Maße des Erzeugnisses (Dicke / Breite / Länge) Product dimensions (Thickness / Width / Length) Dimensions du produit (Epaisseur / Largeur / longeur)	Herstellart Steelmaking proc. Mode d' elabor.	Ausführung Finish Fini
	1,5 mm x 1000,0 mm	AOD	IIId / 2R

Paket-Nr. Packing-No. N° Palette	Stückzahl No of pieces N° de pièces	Ist-Gewicht Actual weight Masse effective	Ident.-Nr. Erzeugnis Ident.-No of product Ident.-N° du produit	Schmelzennr. Cast number Id. de la coulée	Proben-Id. Sample Id. Empl.du prélèvement	Proben-Id. Sample Id. Empl.du prélèvement
9070577	1	5275 KG	231810	319610	1003362013	1003362014
9070581	1	5590 KG	231810	319610	1003362013	1003362014
9070582	1	5255 KG	231810	319610	1003362013	1003362014
	3	16120 KG				

Schmelze / Cast-No./ Coulée N°	Erschmelzungsland Country of heat / Origine du coulée	Chemische Zusammensetzung / Chemical composition/ Composition chimique									
		% C	% Si	% Mn	% P	% S	% Cr	% Ni	% N		
319610	FIN	0,040	0,36	0,50	0,029	0,0010	16,10	0,20	0,026		

Prüflos/Inspection lot Lot de contrôle Proben-Id./-Lage Sample Id./-Position Ident./empl.du prélèvement	QUER										
	Rp0,2% MPa	Rp1% MPa	Rm MPa	A80 %	A2" %	HV HV	HRB HRB				
1003362013	396	414	499	30,0	30,0	152	78,0				
1003362014	402	418	490	29,1	29,1	150	77,0				

Beständig gegen interkrist. Korros./Resistant to intercryst. corros./Resistant à la corros. Intercrist.: EN ISO 3651-2 I.O.
Maße-Oberfläche/Dimensions-Surface/Dimensions-Surface: I.O.
Verwechslungsprüfung (Spektralanalyse)/Test of identity(spectrum analysis)/Contrôle d'identification (analyse spectrale): I.O.

WAERMEBEHANDLUNG : 820 GRAD C / LUFT
TRAITEMENT THERMIQUE : 820 GRADE C / AIR
HEAT - TREATMENT : 820 DEGREE C / AIR

Aussteller der Bescheinigung / Originator of the document / Auteur du document
Outokumpu Nirosta GmbH
Dieses Zeugnis wurde maschinell erstellt
Werk Krefeld

Die Lieferung entspricht der Bestellung
The delivery meets the order agreement
La livraison correspond à la commande

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Stempel des (der) Abnahmebeauftragten
Receiving agent's stamp
Poincon de l'agent réceptionnaire
QA

Datum der Ausstellung und Bestätigung
Date of issue and validation
date d'emission et validation
02.08.2017

CE
0432-CPR-00052-1

2. Environmental Statement

Customer Information Document

Environmental Policy Statement

Since 1959, Rimex Metals (UK) Ltd ('Rimex' or 'Company') has manufactured a range of metal finishes which enhance the performance, functionality and/or appearance of its customer's products.

Like any industrial concern, Rimex's manufacturing processes can have a potential impact on the environment and consequently the Company is committed to minimising any such effect. In particular, the Company is committed to:

- Complying with all relevant environmental legislation and regulations and where appropriate, the environmental compliance obligations of our customers and suppliers.
- Protecting the environment by reducing environmental risks on our premises so that the likelihood of a pollution incident is reduced.
- Continually improving the Company's resource efficiencies by using fewer materials and energy, and producing less waste.

The Company's environmental objectives and targets are continually monitored on a quarterly and annual basis to best manage and reduce any potential impact to the environment. The Company's management is currently focused upon:

- The improvement of overall operating efficiencies at Aden Road.
- Minimising the release of wastewater to sewer.
- A reduction of water usage where practical.
- Minimising waste generation and reducing the volume of waste that goes to landfill.
- Ensuring the efficient planning of transport to and from our site.
- Minimising the use and disposal of packaging consistent with protecting our products.
- Ensuring that we consider the ethical and environmental impacts of our supply chain.
- Maintaining ISO14001 certification for our environmental management system.
- Maintaining the practice of best available technique with respect to emissions from the Company's manufacturing processes.
- Improving energy efficiencies within the company and reducing CO^2 emissions.

The commitments in this published policy are managed and delivered through the Company's ISO 14001 - certified Environmental Management System. It is reviewed by the relevant management on a quarterly and annual timetable that is monitored by the Environment Agency and our external auditors. Our overall intention is to continually improve our environmental management system in order to enhance our environmental performance.

Tim Childs
Managing Director

August 2017 | Review Date: September 2018 RMD02 Rev 6

Specialists in Metal Finishes

ISO 9001:2016 | Cert Nº 11504
ISO 14001:2016 | Cert Nº 2751

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References

BRE environmental profiles http://www.bre.co.uk/page.jsp?id=53

How to quantify the environmental profile of stainless steel
(Hiroyuki Fujii and Toshiyuki Nagaiwa, ISSF Fellows (Nippon Yakin Kogyo Co.Ltd, Tokyo, Japan), Haruhiko Kusuno, (ISSF)

Staffan Malm, (ISSF Brussels, Belgium) November 2005
http://www.worlds tainless.orq/NR/rdonlyres/4AD88A29-6C1E-42F8-B235-B4176E901658/2432/Howtoquantifytheenvironmentalprofileofstainlessste.pdf

Introducing coloured stainless steel - a novel product and new process
R.Blower and T.E Evans; INCO European Research and Development Centre, Birmingham

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Stainless steel the green material, Designer Hand book; Specialty Steel Industry of North America (SSINA)

Stainless Steel and Sustainable construction - Special British Stainless Steel Association Report, Feb 2004.http://www.bssa.orq.uk/publications.php?id=63

The Green Guide to Specification, Jane Anderson and David Shiers (3rd edition)
http://www.steelconstruction.org/steelconstruction/view?e ntity1D=99&jsp=source&sessionID=-1225454882317&entityName=document

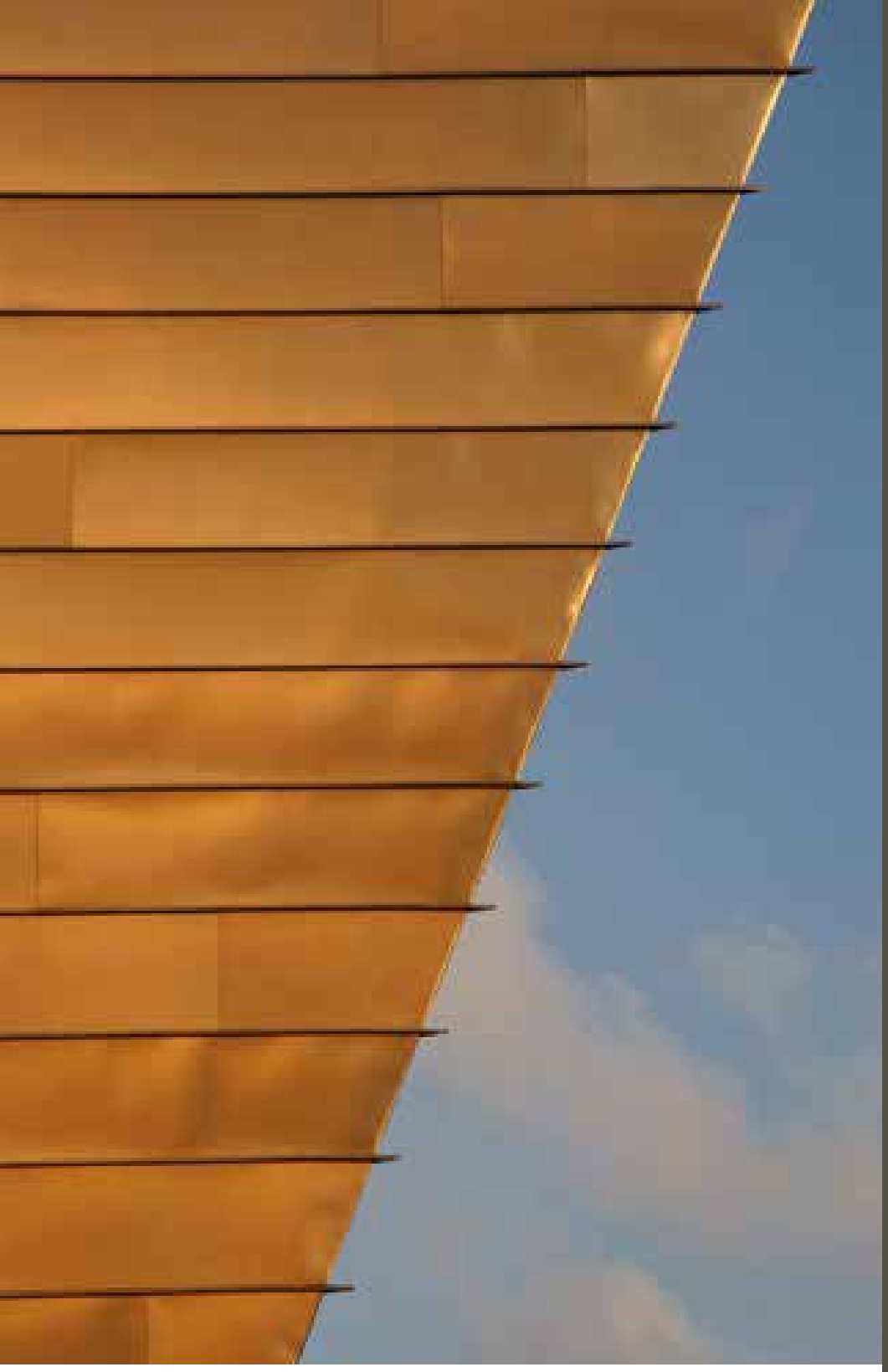
Organisations

www.bre.co.uk (BRE)

www.bssa.org.uk (British Stainless Steel Association)

www.nickelinstitute.org (Nickel Institute)

www.worldstainless.org (International Stainless steel Forum)



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