Duplex

stainless steel

Adding stainless quality to life

COLUMBUS STAINLESS [Pty] Ltd

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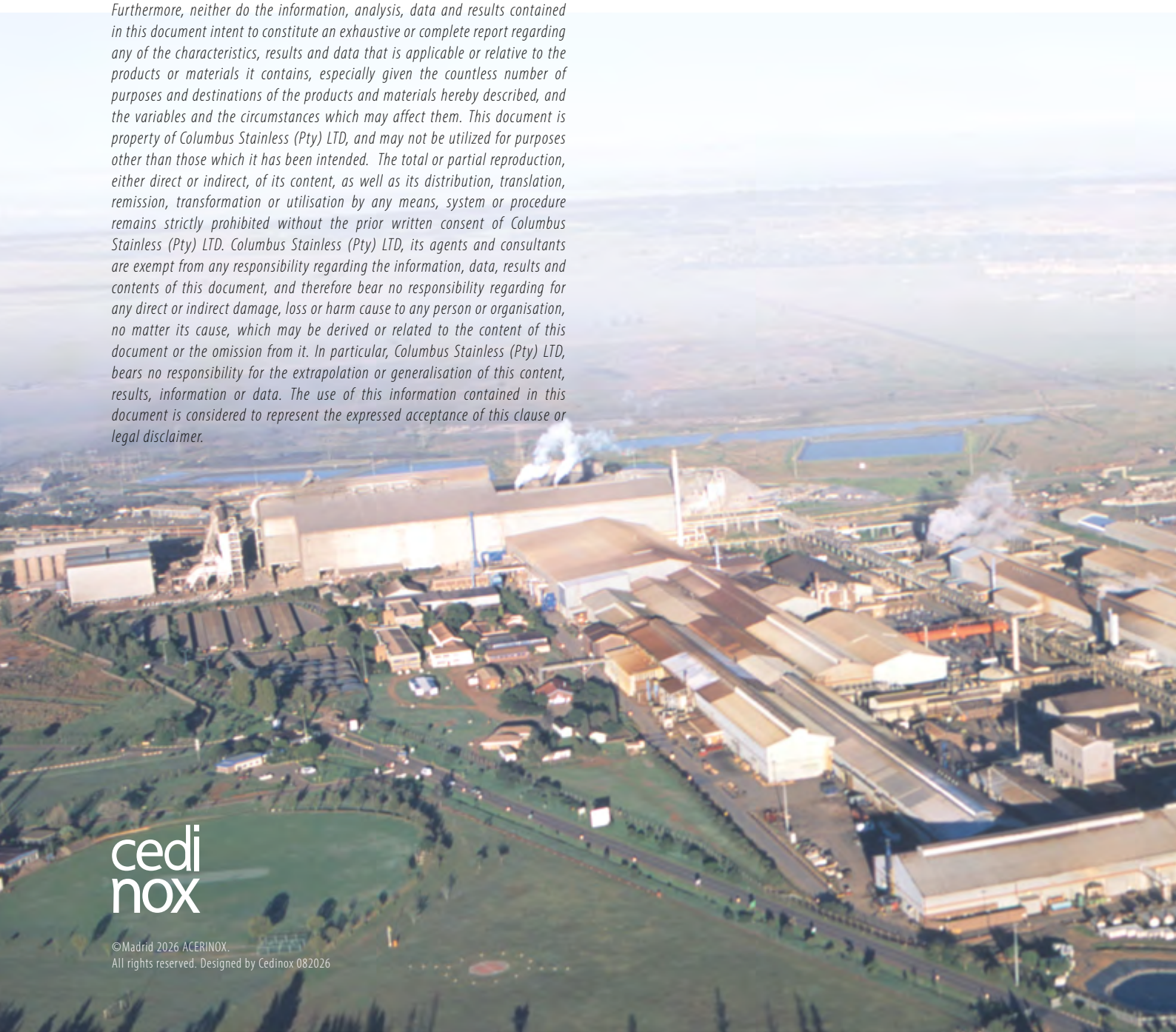


cedinox

Introduction

Duplex stainless steels have a microstructure of nearly equal proportions of austenite and ferrite. This microstructure ensures that they are much more resistant to stress corrosion cracking than conventional austenitic stainless steels such as 304L/1.4307 or 316L/1.4404.

Duplex stainless steels are also tough in gauges up to 40 mm and can be successfully welded in these thick gauges. This is in contrast to common ferritic stainless steels, which tend to be brittle in thick gauges, particularly if welded, which limits their use to applications requiring gauges up to 3 mm. Duplex stainless steels remain tough between -20ºC or lower, depending on the gauge, and 300ºC .

S32001 / 1.4482

has good strength, toughness, corrosion resistance and resistance to stress corrosion cracking. Applications include process and storage tanks, ducting and structural applications. S32001/1.4482 is also suitable for pipe supports, walkways, cable racking, strapping, clamps, etc. in aggressive environments.

S32304 / 1.4362

has higher chromium and nitrogen content than S32001/1.4482. The resultant composition gives the steel much improved corrosion resistance in many aggressive environments. The higher chromium and nitrogen contents ensure more resistance to pitting and crevice corrosion in chloride containing media and chemical environments such as sulphuric acid compounds as well as phosphoric and acetic acids. The lower rate of general corrosion in mildly corrosive environments gives the steel good atmospheric corrosion resistance in polluted marine atmospheres.

S32205 / 1.4462

is a highly suitable material for service in environments containing chlorides and hydrogen sulphide such as marine environments and the oil and gas extraction and processing industries. Typical applications also include the chemical industry (processing, transport and storage, e.g. pressure vessels, tanks and piping), the pulp and paper industry (digesters and liquor tanks) and the mining industry. S32205/1.4462 has thus found widespread use in production tubing and flowlines for the extraction of oil and gas from sour wells, in refineries and in process solutions contaminated with chlorides. S32205/1.4462 is also particularly suitable for heat exchangers where chloride bearing water or brackish water is used as the cooling medium.

Product range

The latest revision of the Product Catalogue should be consulted, as the product range is subject to change without notice.

The Product Catalogue is available from the Technical Department or can be found at www.columbus.co.za

Specifications and tolerances

Columbus Stainless (Pty) Ltd supplies the duplex stainless steel to ASTM A240 and EN 10088-2.

Columbus Stainless (Pty) Ltd normally supplies material to the following tolerances:

HOT ROLLED

ISO 9444 - material processed as coil		ISO 9444-2	
ISO 18286 - material processed as plate		ISO 18286	
ASTM A480	ASTM A480M	EN 10051	EN 10029
ASME SA480	ASME SA480M	IS 6911	

COLD ROLLED

ISO 9445	ISO 9445-2
ASTM A480	ASTM A480M
ASME SA480	ASME SA480M
IS 6911	

Other specifications and tolerances may be available on request.

Further information is available in the Product Catalogue, which can be obtained from the Technical Department or can be found at www.columbus.co.za

Further information:

TECHNICAL

Columbus Stainless (Pty) Ltd
PO Box 133 • Middelburg • 1050 • South Africa
Tel: +27 (13) 247 3343
Fax: +27 (13) 247 2289
E-mail: technical-help@columbus.co.za

COMMERCIAL

Columbus Stainless (Pty) Ltd
PO Box 133 • Middelburg • 1050 • South Africa
Tel: +27 (13) 247 2020
Fax: +27 (13) 247 2771
E-mail: commercial-help@columbus.co.za

Chemical composition

In accordance with the Columbus Stainless mill specification, ASTM A240 and EN 10088-2.

Compositions are ranges or maximum values unless stated.

UNS	AISI	EN	C	Mn	P	S	Si	Cr	Ni	Mo	Cu	N	PRE (Min)
S32001	-	1.4482	0.030	4.00 6.00	0.03	0.030	1.00	19.5 21.5	1.50 3.00	0.60	1.00	0.05 0.17	22
S32304	2304	1.4362	0.030	2.00	0.03	0.015	1.00	22.0 24.0	3.5 5.5	0.10 0.60	0.10 0.60	0.05 0.20	24
S32205	2205	1.4462	0.030	2.00	0.03	0.015	1.00	22.0 23.0	4.5 6.5	3.0 3.5	-	0.14 0.20	35

Mechanical properties

In accordance with ASTM A240 and EN 10088-2.

UNS	AISI	EN	Product	Max Thickness (mm)	$Rp_{0.2}$ (MPa)	Rm (MPa)	A[a] <3 mm thick % min	A[b] ≥3 mm thick % min
S32001	-	1.4482	C	≤6	500	700-900	25	30
			H	≤8	480	660-900	30	
			P	≤65	450	650-850		
S32304	2304	1.4362	C	≤6	450	650-850	25	25
			H	≤8	400			
			P	≤65		630-800		
S32205	2205	1.4462	C	≤6	500	700-950	25	25
			H	≤8	460			
			P	≤65		640-840		

a) 80 mm gauge length for EN 10088-2, 50 mm gauge length for ASTM A240

b) Proportional gauge length (5.65x√cross-sectional area) for EN 10088-2, 50 mm (2 in) gauge length

C: Cold rolled

H: Hot rolled

P: Plate

STRENGTH

The specification 0.2% Proof Stress of duplex stainless steels is about double that of conventional austenitic stainless steels. This often allows down gauging in the design (dependant on buckling and Young's Modulus limitations), with associated cost benefits.

Cost effective solutions

Duplex stainless steels can provide a cost effective alternative to austenitic stainless steels in many instances. The table below shows the relative price range, based on historical data, as a percentage based on the cost per tonne of the substituted conventional austenitic. The increased strength of duplex stainless steels often allows down gauging, which, depending on Young's Modulus and buckling limitations, is typically between 15 and 40%. This weight (and thus cost) saving, together with the price per tonne difference are presented in the table below.

	Relative price to substitute austenitic	Relative price plus 15% weight reduction (overall saving)	Relative price plus 40% weight reduction (overall saving)
S32001 | 1.4482 substituting 304L | 1.4307	5 - 20% more	0 - 10% saving	30 - 40% saving
S32304 | 1.4362 substituting 316L | 14404	10 - 30% more	25 - 40% saving	45 - 60% saving
S32205 | 1.4462 superior alternative to 316L | 1.4404	10 - 40% more	5% saving to 20% premium	15 - 30% saving

Duplex stainless steel

Backed by sound technical support, we are also able to make recommendations on correct material selection as part of our customer support process. As the only producer of stainless steel in Africa, Columbus strives for excellence and to deliver the highest quality of stainless steel products and related services.

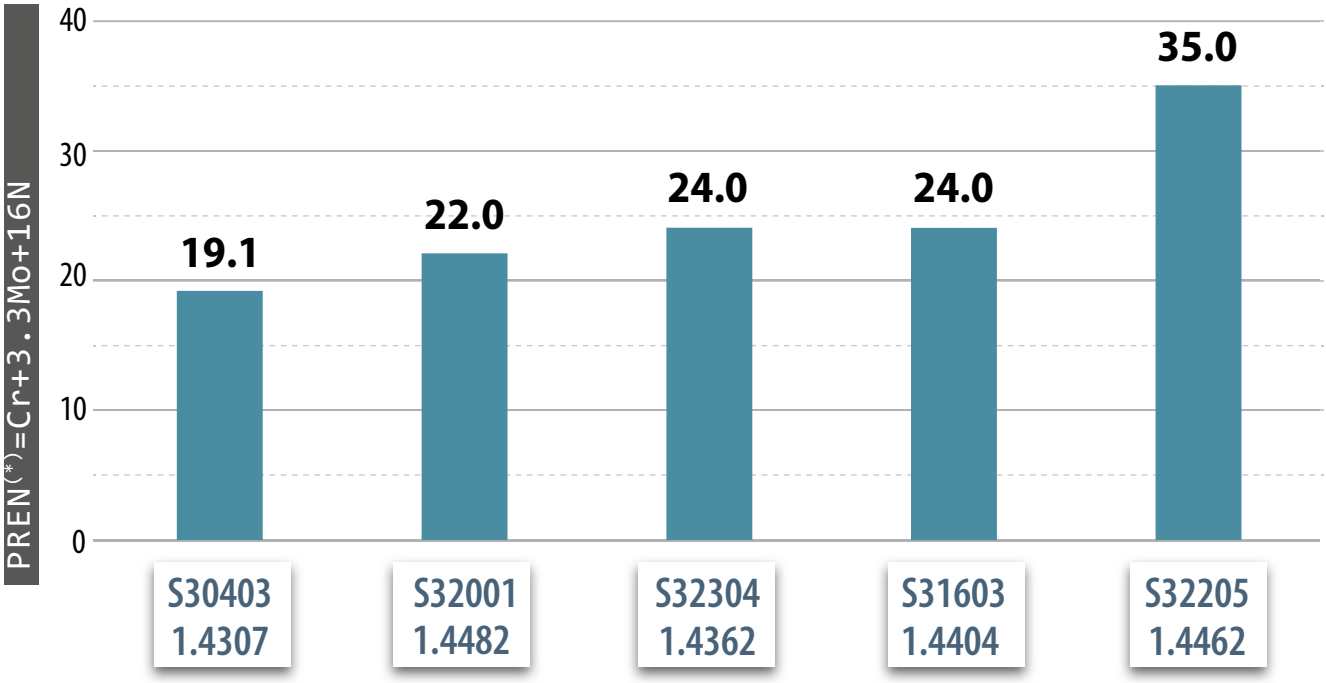
Resistance to corrosion

The adjacent figure shows the Pitting Resistance Equivalent (PRE) of the duplex stainless steels compared to the conventional austenitic stainless steels. The PRE is a measure of the pitting resistance in chloride environments.

In most environments, S32001/1.4482 has a similar corrosion resistance to 304L/1.4307, while S32304/1.4362 has a similar corrosion resistance to 316L/1.4404.

S32205/1.4462 has significantly better corrosion resistance than 316L/1.4404 in most environments.

It thus stands to reason that S32001/1.4482 can be seen as a 304L/1.4307 substitute, while S32304/1.4362 can be seen as a 316L/1.4404 substitute.



**Pitting Resistance Equivalent Number*

It can be seen that duplex stainless steels can offer a cost effective alternative to conventional austenitic stainless steels, without the gauge limitations of common ferritic stainless steels and the stress corrosion cracking susceptibility of austenitic stainless steels.

Some recommendations

Handling and transport

Before shipping, make sure every chain and steel element is not in contact with stainless steel. Raffia or wooden elements must be used at possible contact places.

When outside storage is required, material should be covered by a waterproof canvas.

Avoid contact with the ground using wooden blocks and store stainless steel and carbon steel separately. This way we avoid problems with contamination by oils, dirt or by contact among different materials.

When stainless steel has to be moved with lift trucks, the forks should be protected with nylon.

Avoid carbon steel slings, use nylon or polypropylene ones wherever possible.

Fabrication and installation

Make sure stainless steel is contamination free before starting to work. If there is any, it will be removed by pickling or mechanical means (*).

If cleaning is required, do it with pressurized water. Do not use sea or brackish water.

All tools employed in the installation must be made of stainless steel and these should have been never used with carbon steel. If this is not possible, tools must be carefully cleaned before use.

Stainless steel should be processed in machines exclusively dedicated to this material, in order to avoid contamination by projections or oxide traces from other materials.

Excessive temperature oxidation or *blueing* due to abrasive cutting, should be removed with pickling paste. Good refrigerated cutting tools help to avoid the problem.

If coating may be considered for aesthetic reasons, surface preparation is extremely important and may be performed either by acid pickling or mechanical means such as blasting.

(*) It is always advisable to contact the supplier

Some applications

Storage tanks

Ducting

Structural applications

Walkways

Cable racking

Oil and gas extraction and processing industries

Chemical industry

Pulp and paper industry

Mining industry

Heat exchangers

Certificates

Columbus Stainless' product meets the following international standards:

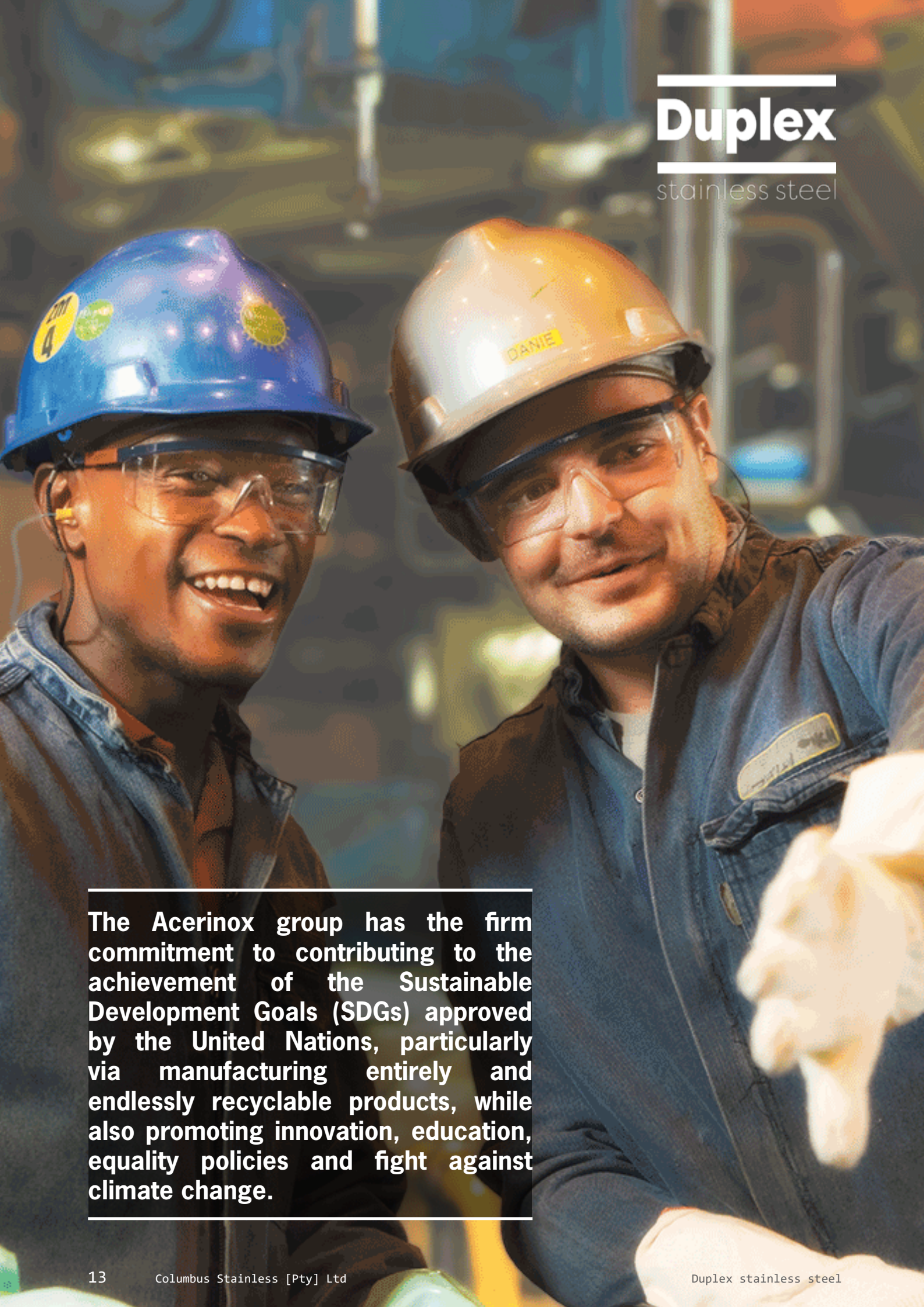
PED 2014/68/EU Certificate	BIS Certification Mark License
CPR 305/2011/EU Certificate	PESR Certificate
CPR Declaration of Performance + CPR Amend	

Available at www.columbus.co.za/quality/product-certifications or scan the code:

Committed to sustainable growth

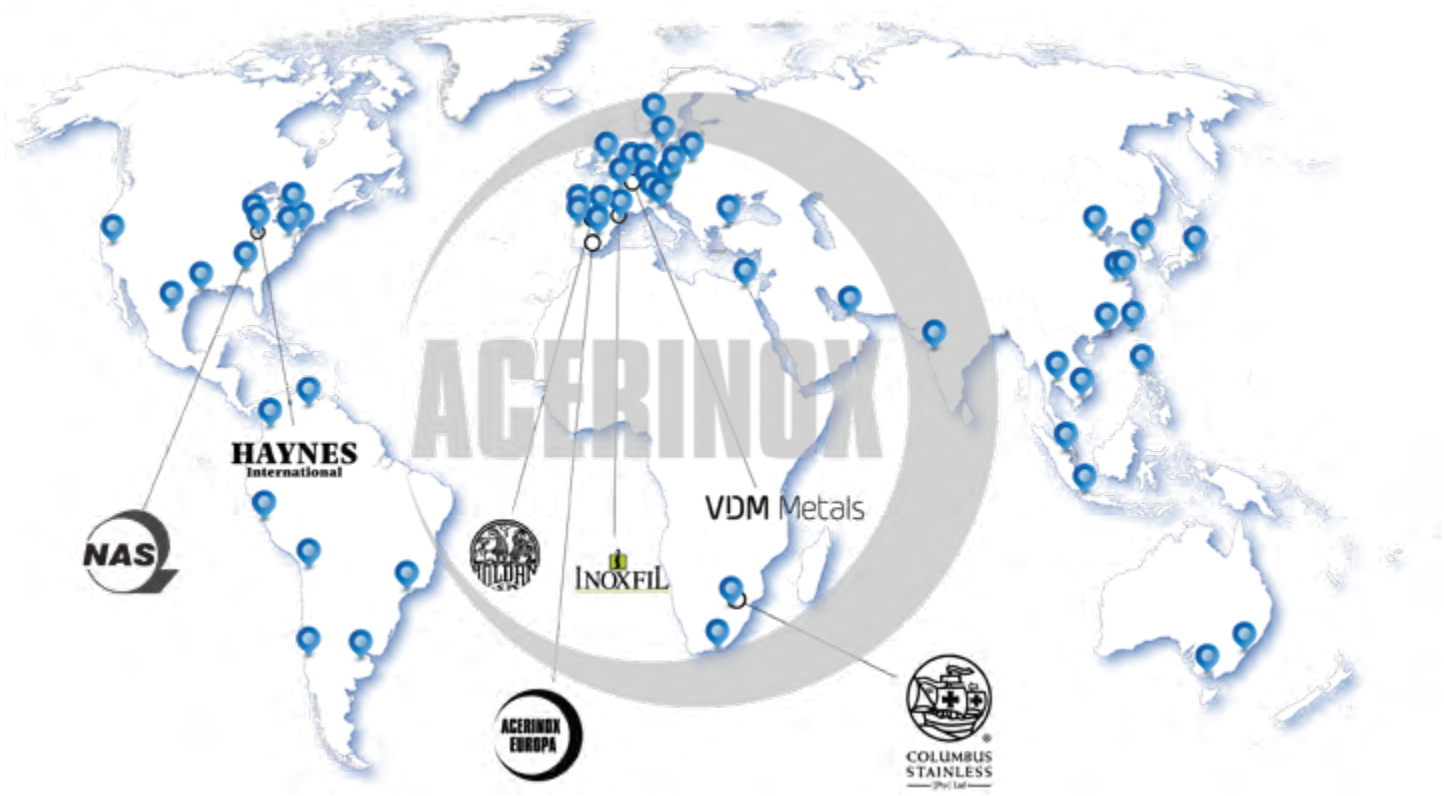
Acerinox is one of the major scrap recyclers wherever it is located. The production in the factories of Acerinox is transformed into final products which return to the factories as scrap to be melted again. This is a cycle that could be infinite due to the material properties.

Columbus Stainless also ensures optimum utilisation of raw materials and energy sources by focusing on the reduction of waste in both power, water and raw materials. Not only do these reduce the impact on the environment but also reduce the costs of producing quality products.



The Acerinox group has the firm commitment to contributing to the achievement of the Sustainable Development Goals (SDGs) approved by the United Nations, particularly via manufacturing entirely and endlessly recyclable products, while also promoting innovation, education, equality policies and fight against climate change.

Acerinox: the confidence of a strong group



Acerinox is the Spanish multinational global leader in stainless steel manufacturing. With a total production capability of 3.5 million tonnes per year. Acerinox owns factories worldwide confirming its global presence, stainless steel flat products manufacturing at Acerinox Europa, North American Stainless and Columbus Stainless; and Roldan, Inoxfil and North American Stainless for long products manufacture. In March 2020, VDM Metals, worldwide leader in high performance alloys manufacture and design, has also become part of the group. In November 2024, Acerinox completes the acquisition of Haynes International, U.S. leading manufacturer and marketer of technologically advanced high-performance alloys.

Every Acerinox facility satisfies the quality and environmental controls required by each country legislation, apart from the application of the Environmental Management System according to ISO 14001. Furthermore, subsidiaries assume higher standards than legal requirements in areas such as quality, safety and sustainability.

Scrap plays a key role in all Acerinox fabrication processes. Thus, a great value is added bringing it back to the material life cycle, reducing the environmental impact with the use of the same material for centuries.

Columbus Stainless was founded in 1966 in South Africa. It is the only integrated stainless steel factory on the African continent and today is the main supplier of stainless steel solutions for both the domestic and the continent market.

The factory is equipped with the most efficient and technologically advanced machinery in the sector, has seen the most significant technological advances in the sector, and has a considerable competitive advantage due to its location, not only for distributing its finished products, but also thanks to its proximity to the raw material extraction sources, especially chrome. It also supplies semi-finished flat products to other Acerinox Group factories.

Duplex
stainless steel

Columbus Stainless is the premier Stainless Steel Manufacturer and Provider in Africa. Our plant is technologically advanced, fully integrated and a single-site operation. This gives us flexibility to adjust quickly to changes in the market. We supply high-quality flat-rolled stainless and carbon steel products.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