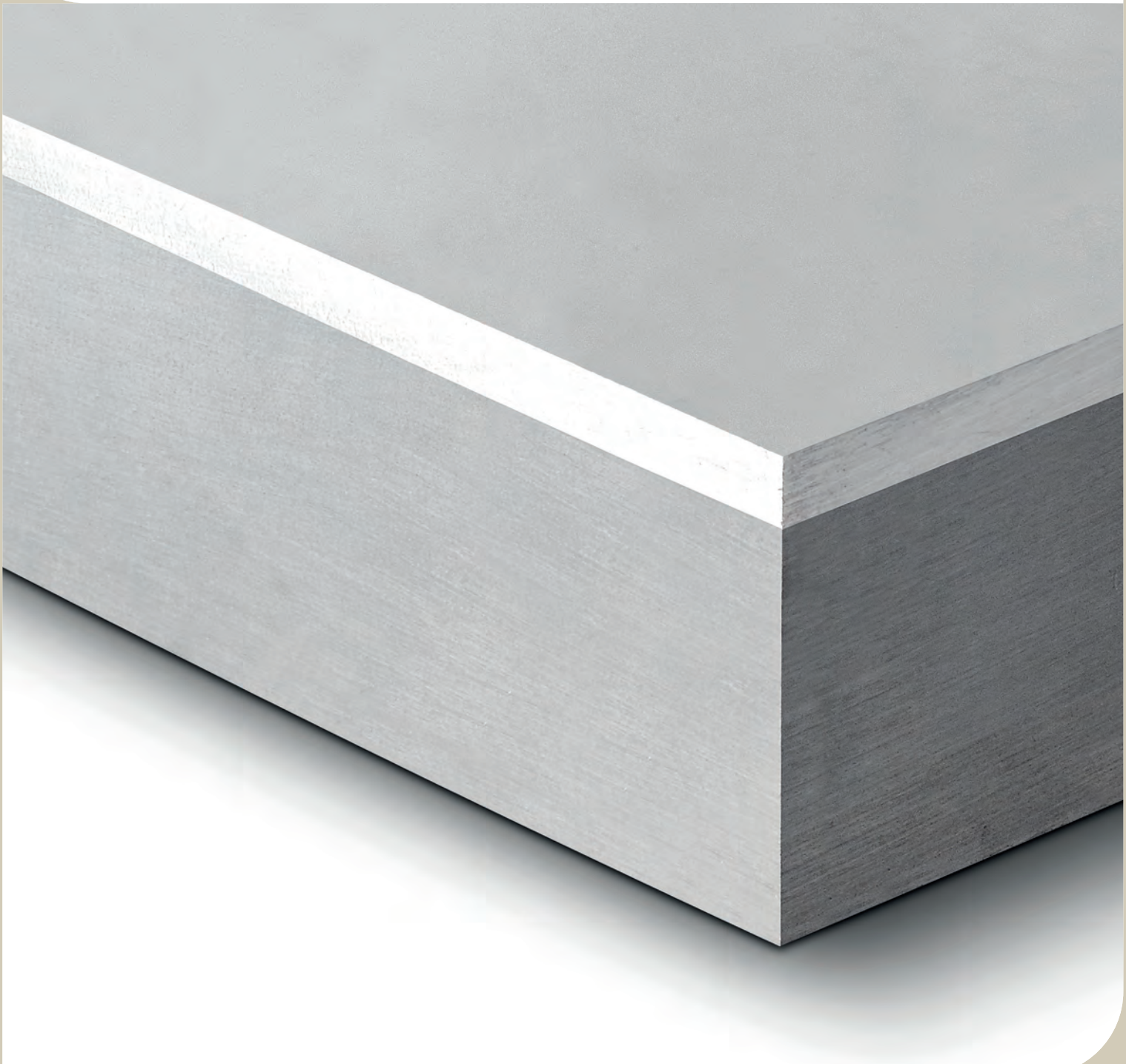
Industeel

ArcelorMittal

Clad plates



Our Business

Industeel
Leading special steels producer

Industeel is a subsidiary of ArcelorMittal producing special steel hot rolled plates, forged blocks, ingots and formed pieces in the world's widest dimensional range.

Specialized in carbon, low alloys, and Corrosion Resistant Alloys (stainless steels and nickel based alloys), Industeel offers a complete range of high quality steel grades designed to meet the most stringent specifications.

Thanks to 3 integrated mills located in Belgium and France, Industeel meets all customer requirements providing the widest dimensional range.

Tailor made solutions adapted to your projects thanks to a rich metallurgical know-how.

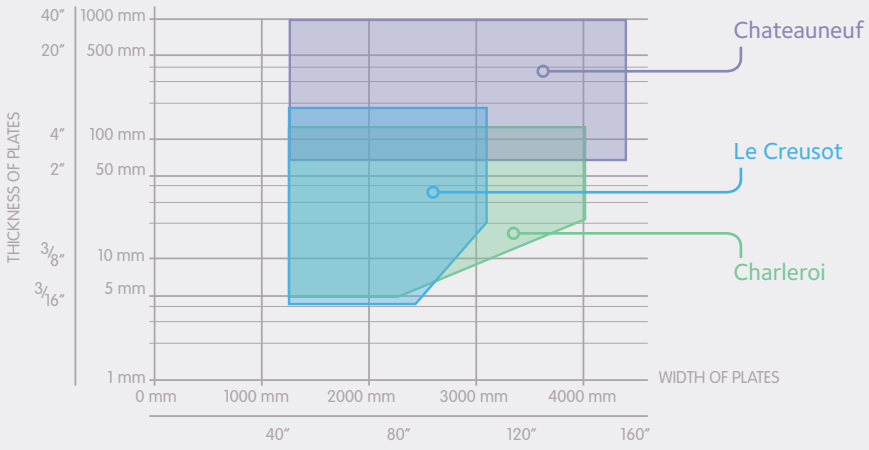
VOD Electric arc furnace

Heat treatment

Clad plate welding

Hot formed head

The largest dimensional range of plates



For all other dimensions, please consult

Clad plate solutions for a competitive future

Our Research & Development Centre (CRMC) is a world class facility with more than 50 customer-oriented researchers.

Innovation

Thanks to our strong technical skills, our R&D centre continuously improves both low alloyed steels and corrosion resistant grades to fine-tune the clad plate properties.

Extensive market-oriented corrosion studies allow us to help customers with materials selection

Our Life Cycle Cost software provides technical recommendations calibrated to our customer's needs

Technical assistance

Our R&D teams provide technical assistance to allow you to take full advantage of selecting Industeel's grades at all stages of your project.

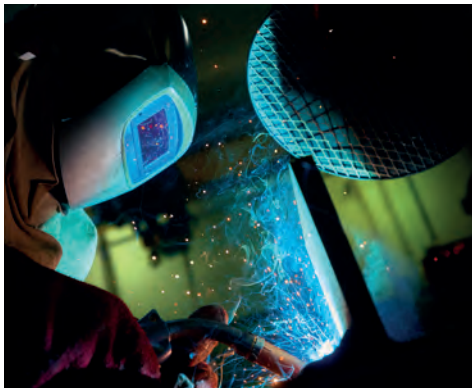
We assist our customers on welding, forming and heat treatment, to maintain optimal steel properties after fabrication

Our Research Centre is involved in many external and technical working groups led by industrial partners

Large panel of corrosion testing for material selection

Metallographic examination

High level of technical skills



Technical support for welding

Clad plate
A cost effective and reliable solution

Smart combination of properties

Clad plate is a multi-layer plate which combines a carbon or low alloy steel plate (backing or backer) with a thin layer of corrosion resistant grade (cladding or clad).

Cost effective solution

Selecting clad plate can reduce equipment weight, fabrication time and material cost.

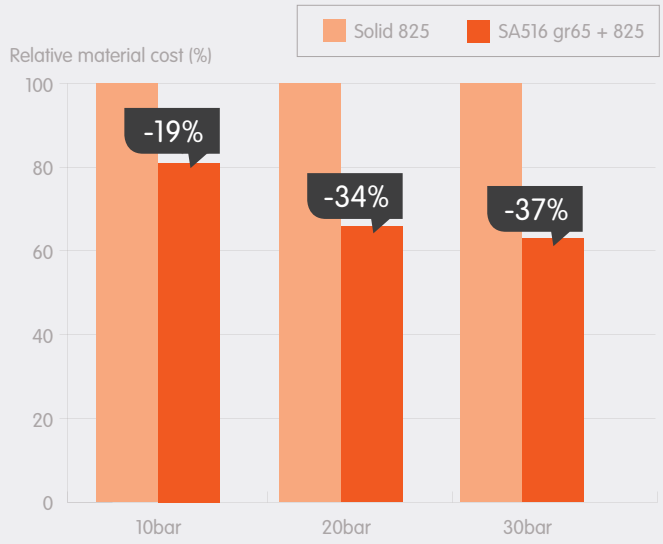
High Performance solution

Clad plate combines the high mechanical properties of the backing and the high corrosion resistance of the cladding.

Backing is supplied with Normalizing (N) or Quenching with Tempering (QT) heat treatment.

Reliable solution

Thanks to high temperature and high rolling force, the hot-rolled bond process guarantees the integral metallurgical bond between the cladding and the backing.



Cost benefit using 825 clad plate instead of solid 825 plate for a pressure vessel with different internal pressures

Example

For a pressure vessel, service conditions with requiring 825 nickel based alloy:
ASME VIII division 1 calculations have been made for different pressure levels with on one side SA516 Gr65 carbon steel cladded with 3mm of 825 compared to solid 825 plate.

Depending on the internal pressure of the vessel, the use of 825 clad plate can give materials cost savings of up to 37%.

Advantages of roll-bonded clad plates

Compared to **solid corrosion resistant plates**, roll-bonded clad plates are:

- Material cost saving
- Weight reduction
- Welding cost saving
- Better thermal conductivity
- Lower thermal expansion

Compared to **explosion clad plate**, roll-bonded clad plates have:

- Cost competitiveness
- Homogeneous bond
- Wider dimensional range
- Lower residual stresses
- Improved flatness tolerances

Compared to **mechanical cladding and wall papering**, roll-bonded clad plates present:

- Integral bonding between the backing and the cladding
- Continuous and high properties even in welds
- Resistance to pressure cycles
- Easier circular welds for pipes
- Easier maintenance
- Safer solution in case of corrosive product infiltration

Industeel
CLAD
PLATES
Advantages

Compared to **weld overlay**, roll-bonded clad plates exhibit:

- Higher corrosion resistance
- Greater choice of Corrosion Resistant grades
- Homogeneous chemical composition
- Higher internal soundness
- Homogeneous bond (neither wave, nor Heat Affected Zone)
- Better surface finishing

Compared to **coatings** (organic, plastic or tiles,...) , roll-bonded clad plates have:

- Higher reliability (wear, earthquake)
- Easier field erection
- Easier maintenance operation
- Sustain after service exposure

Our expertise for clad plates

Reliable partner

More than 70 years of clad plate production have made Industeel a key clad plate supplier with more than 300 000 tons delivered worldwide.
Industeel produces clad plates for renowned companies all over the world, especially for the Oil and Gas, chemical or nuclear industries.

Tailor made solutions

No restriction on order size.
Material chemistries and/or the manufacturing process can be adapted to the most stringent customer requirements.
Beyond 2-layer, Industeel can also produce 3-layer clad plates.

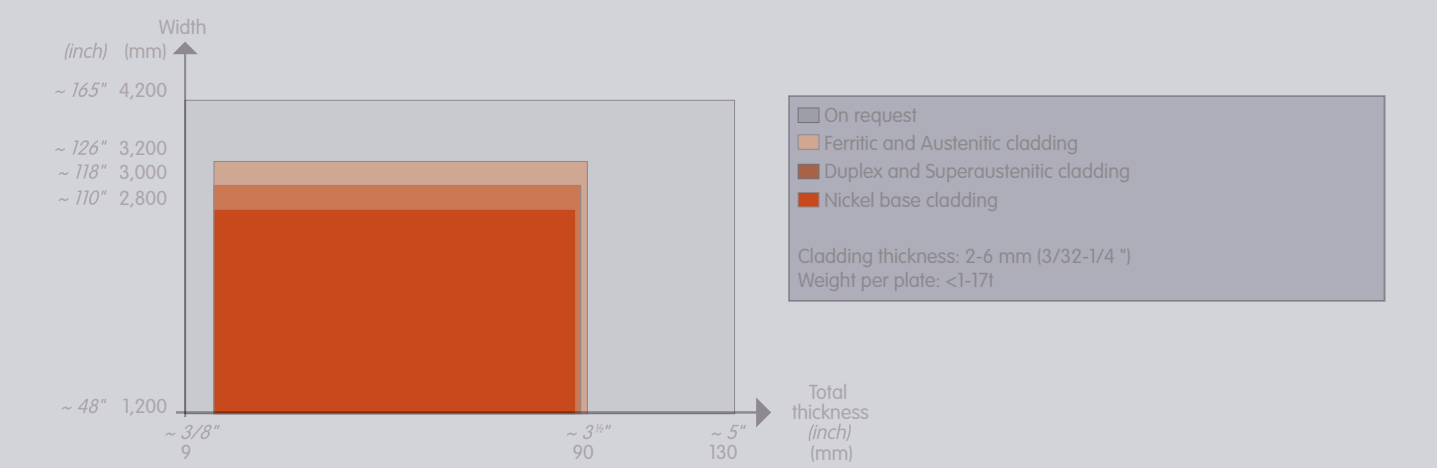
Gage of quality

As a producer of both low alloyed steels for the backing and corrosion resistant grades for the cladding, Industeel supplies ultra clean quality steel grades with:

- Excellent properties of the backing material.
- Corrosion resistance of the cladding adapted to the service conditions.
- Strong bonding of the backing and the cladding guaranteed by 100% ultrasonic testing (automatic and/or manual) and mechanical shear tests.

Hot-rolled bond process ensuring the cohesion of the two materials

General dimensions range of clad plates



Demanding Quality Assurance

Quality System Certificate
Industeel experience is recognized worldwide and has been qualified by several international organizations.

Deliveries according to ASME SA263, SA264, SA265, ASTM A263, A264 and A265, DNV OF 101, API SL / SLD, EN 13445-2 (C), and additional specific requirements.

Certifications: ISO 9001, ISO 14001 and OHSAS 18001, BV, Lloyd's, TÜV.

Heating | Hot rolling | Separation | Heat treatment | Ultrasonic inspection | Surface finish | Packaging & shipment

Clad plate solution for pressure vessels & structural applications

Our clad plates are used for pressure vessels and for structural applications where combining fabrication procedures and corrosion resistance is of prime importance. Industeel produces "Normalized" as well as "Quenched and Tempered" clad plates.

Our strengths

- All ASME pressure vessel grades are available
- Excellent in-service properties, in particular in sour service (Hydrogen Induced Cracking resistance)
- Sharpened chemistry to optimise the welding and forming behaviour
- Faculty of being fully heat treated after welding and forming
- Excellent toughness in Heat Affected Zone

Standards

- ASTM
- ASME
- VdTÜV

Wide range of steel grades for the backing

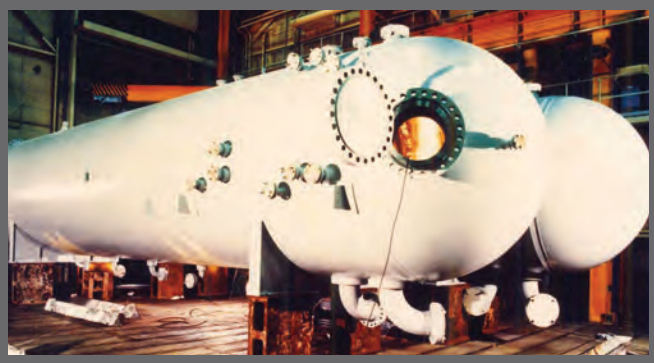
	Industeel trademark	ASTM/ASME	EN 10028
C-Mn Steel	CarElso™ 60/65/70 (HIC)	A/SA516 Gr 60-65-70 A/SA537 Cl 1-2	S/P275 and S/P355 types
C-Mn-Mo Steel	-	A/SA204 Gr A-B-C	16Mo3
Cr-Mo	CromElso™ 11, 12, 22	A/SA387 Gr 11-12-22 Cl 1-2	13CrMoSi5-5 / 13CrMo4-5 / 10CrMo9-10
Cr-Mo-V	CromElso™ 22V	A/SA542 Gr D	13CrMoV9-10
C-Mn-Mo-Ni	SuperElso® 500 HR / 533E	A/SA533 type B-C-E	P500QL2

Corrosion resistant cladding grades

	Industeel trademark	ASTM/ASME	EN 10028
Ferritic stainless steel	Soleil™ B2	410S	1.4000
Cr-Ni austenitics	UR™ 304L, 321, 347	304L, 321, 347	1.4306 and 1.4307, 1.4541, 1.4550
Cr-Ni-Mo austenitics	UR™ 316L, 316LMo UR™ 316Ti, 316Nb UR™ 317L	316L, 316LMo, 316Ti, 316Nb, 317L	1.4404, 1.4432, 1.4571, 1.4580, 1.4438
Nickel based alloys	UR™ 825 UR™ 625 UR™ 276 UR™ 22	“825” - N08825 “625” - N06625 “C276” - N10276 “C22” - N06022	2.4858 2.4856 2.4819 2.4602

These lists are non exhaustive. Please consult for more information.

PRESSURE VESSELS FOR OIL AND GAS



Separator for offshore UR™ 904L cladding with SuperElso® 500

A scrubber in Flue Gas Desulfurization system made of 625 cladding

CLAD PLATES FOR STRUCTURAL APPLICATION

CLAD PLATES FOR COKE DRUMS AND AUXILIARIES

SA387Gr11 backing with 410S cladding

Clad plates for process industry

CLAD PLATES FOR PROCESS INDUSTRY (PULP AND PAPER, CHEMICAL PLANTS...)

Clad plate solution for clad pipe applications

Oil and Gas pipelines are exposed to increasingly aggressive environments, in terms of corrosivity, temperature and pressure.

Clad pipes made from our metallurgical roll bonded clad plate offer the best material solution for these most demanding applications.

Our strengths

- Resisting in the most severe environment (High Pressure, High Temperature, H_2S, CO_2, elementary sulphur, chloride...)
- Exhibiting high fatigue resistance
- Wide range of thickness with both high corrosion resistance (HIC, pitting and intergranular corrosion resistance, ...) and toughness (Charpy, Battelle)
- Excellent toughness in Heat Affected Zone and at mid thickness
- Having limited scattering properties to ease the pipe forming
- Whole process in our hand, including internal casting of CRA and backing

Standards

- ASTM / ASME
- API 5LD
- DNV OS-F101

Dedicated carbon manganese backing steels

	ASTM	API	DNV
Normalized grades	A516 Gr 60-65-70	API5L GrB	-
Quenched and Tempered grades	A516 Gr 60-65-70	API5L GrB X60Q(S) X65Q(S)	DNV415 DNV450

Dedicated corrosion resistant cladding with various corrosion behaviours

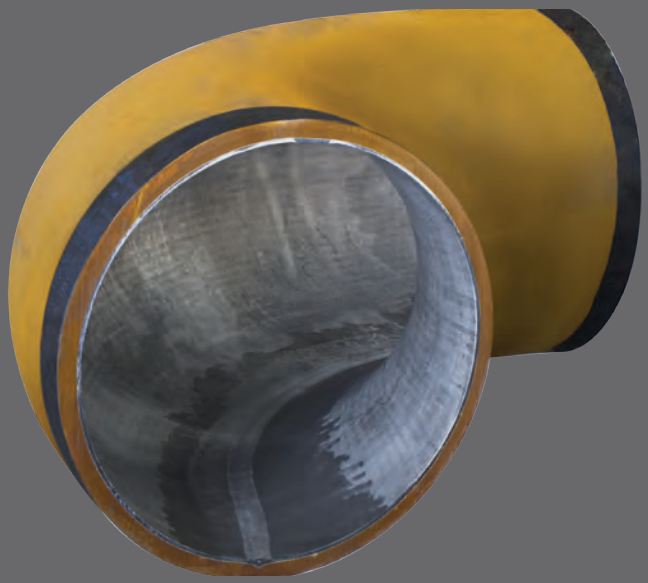
	Industeel trademark	ASTM
Cr-Ni-Mo austenitics	UR™ 316L, UR™ 316LMo	316L, 316LMo
Nickel based alloys	UR™ 825 UR™ 625	"825" - N08825 "625" - N06625

These lists are non exhaustive. Please consult for more information.

Riser pipes are exposed to very large dynamic stresses from ocean currents with high internal and external pressures.

METALLURGICALLY ROLL BONDED CLAD PLATES HAVE DEMONSTRATED HIGH RESISTANCE.

Pipes



Fitting

For Upper Zakkum Oil and Gas project, Industeel produced more than 6,500 tons of clad plates made from 825 nickel alloy for the cladding and X60 and API5L grBNS for the backing to produce pipes and fittings.

AFTER COLD FORMING OPERATIONS, PIPES AND FITTINGS KEEP THE GOOD PROPERTIES OF THE BOND.

3-layer clad plate after bending

Beyond possible
Tailor made clad solutions

Our excellent knowledge of the clad plate process and specialty plate metallurgy, open up the possibilities for a wide range of multiple materials combinations.

Our strengths

- Melting Carbon steels as well as Corrosion Resistant Alloys
- Providing dedicated technical support

Full range of steel grades

- Carbon manganese steels
- Low alloyed steels
- High Strength Steels
- Armor steel

Unlimited range of corrosion resistant cladding

- Martensitic stainless steels
- Austenitic, Superaustenitic stainless steels
- Duplex stainless steels
- Nickel based alloys

Complex composite materials

- up to 3 layers

Possible combinations

BACKING MATERIAL			
	Industeel trademark	ASTM/ASME	EN
C-Mn steel	CarElso™ 60 / 65 (HIC) CarElso™ 70 (HIC or SOHIC)	A/SA516 Gr 60 – 65 – 70	P275 and P355 types
C-Mn-Mo steel	-	A/SA204 Gr A – B – C	-
Quenched and Tempered grades	SuperElso® 500	A/SA533 type B-C-E	P500 types
Cr-Mo Cr-Mo-V	CromElso™ 11,12,22 CromElso™ 22V	A/SA387 Gr 11 – 12 – 22 A/SA542 Gr D	13CrMoSi5-5 / 13CrMo4-5 / 10CrMo9-10 13CrMoV9-10
Armor steel	Mars® 190 (MIL12560 C/1)	-	-

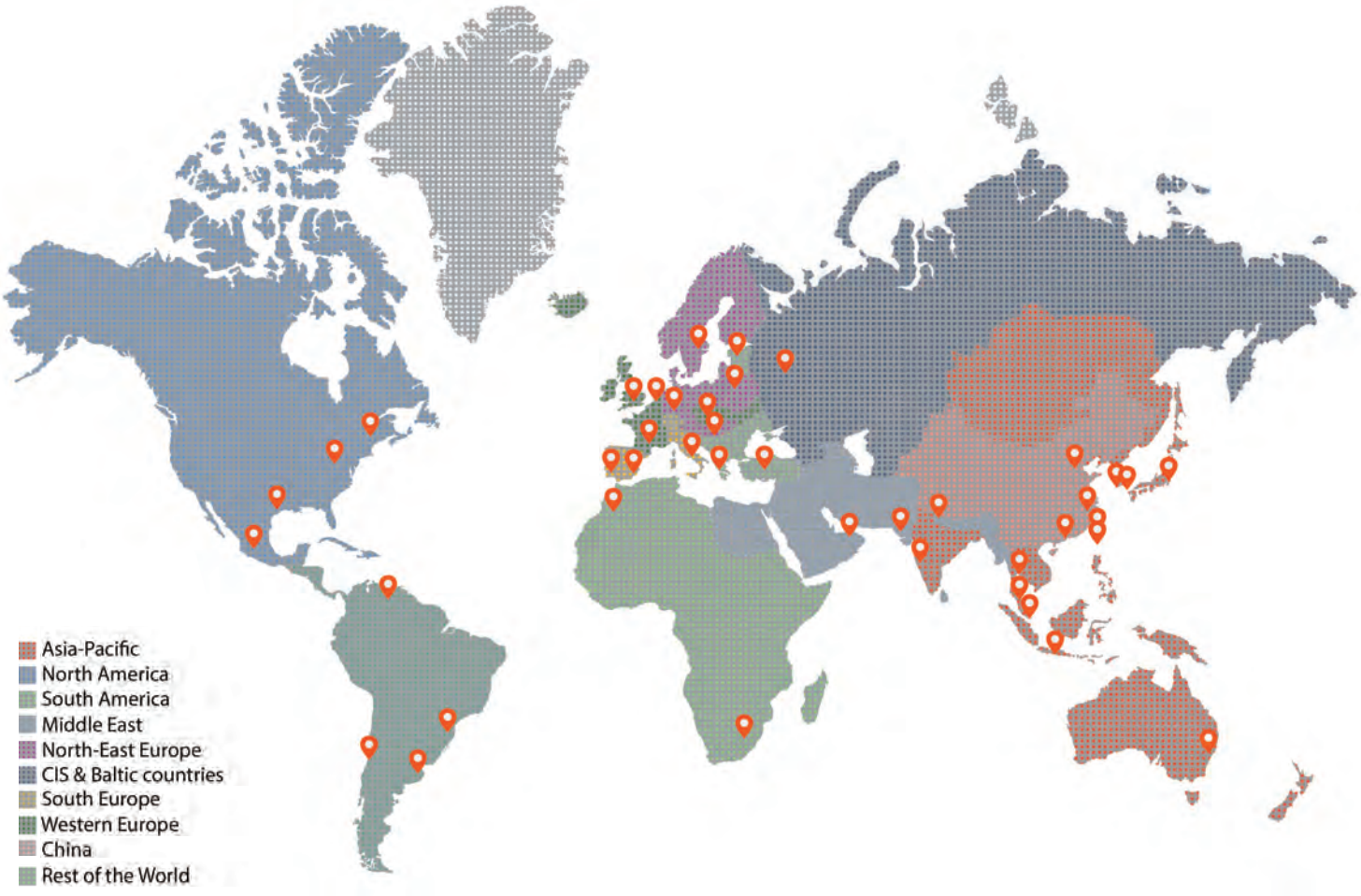
CORROSION RESISTANT CLADDING			
	Industeel trademark	ASTM/ASME	EN
Superaustenitic grades	UR™ 904 UR™ 254 UR™ 926	"904L" – N08904 "254" - S31254 N08926	1.4539 1.4547 1.4529
Duplex grades	UR™ 2304 UR™ 2205 UR™ 2507	"2304" – S32304 "2205" – S31803/S32205 "2507" – S32750	1.4362 1.4462 1.4410
Nickel based alloys	UR™ 825 UR™ 625 UR™ C276 UR™ C22	"825" - N08825 "625" - N06625 "C276" - N10276 "C22" - N06022	2.4858 2.4856 2.4819 2.4602

These lists are non exhaustive. Please consult for more information.

Clad plates

Our presence

Our sales network



With 40 sales offices in 40 different countries around the world, Industeel stands as one of the foremost international steel makers, with an unmatched capacity of support everywhere around the world.

ArcelorMittal

Industeel France
Le Creusot plant
56, rue Clemenceau - BP 19
F - 71201 LE CREUSOT Cedex
FRANCE
Tel : + 33 3 85 80 51 36
Fax : + 33 3 85 80 55 00

http://industeel.arcelormittal.com

Makheia – 04 78 33 99 00 – Mars 2016

transforming
tomorrow