Industeel

ArcelorMittal

Steel Solutions for nuclear applications

Our corporate values

The ArcelorMittal group is committed to «transforming tomorrow». At Industeel, we uphold four fundamental values that will help us meet this far-reaching challenge.

Boldness

We are there to help you succeed in your boldest projects. Let our innovation materialise your boundless imagination.

Sustainability

Our solutions are built to last, optimizing the reliability and life cycle costs of your critical applications and structures. We can deliver steel plates with optimised resistance to challenging service conditions to make your projects even more reliable. At the same time, we are developing cleaner processes and greener products for a more sustainable environment.

Quality

Industeel has a longstanding reputation for quality. We supply plates for a wide range of critical applications in which the quality of the steel is crucial to the safety of equipment. For this reason, the performance levels of Industeel products often go beyond the requirements of applicable standards.

Leadership

Industeel is a leader in the field of special steel plates. Much more than a mere material supplier, we work hand in hand with customers, experts and international organizations to drive progress and deliver innovative solutions to the challenges faced by industry.

Our business

Leading supplier of high quality steels

As the leading supplier of high quality steels, INDUSTEEL constantly innovates to provide customers with the best products and services. Industeel is a subsidiary of Arcelormittal producing special steel plates, ingots and formed pieces.

High quality materials designed to meet the strictest specifications

Tailor-made steel solutions **adapted to your project**

The widest dimensional range to meet all customer requirements thanks to our 3 integrated mills

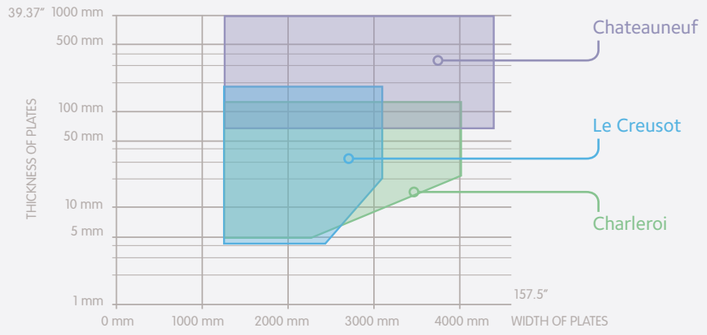
A high level of technical support provided by **a dedicated research & development centre**

Electric arc furnace

Rolling mill

On-line forging press

The widest dimensional range of plates



For all other dimensions, please consult

Our added value

Steel Solutions for a competitive future

Our R&D Center (CRMC) is a world class facility with 50 researchers dedicated to our customers.

Innovation

We design new solutions to respond to specific market requirements with innovative and added-value products. Our Research & Development center has developed a range of steel grades intended for the most severe specifications of the nuclear applications.

Technical Assistance

Our team can give you technical assistance to help you take full advantage of Industeel grades.

Providing on-field technical assistance to help our customers in the use of our steel solutions

An integrated welding workshop with an expertise in welding metallurgy and welding processes

Cooperation with research institutes and organizations on processing operations

R&D department fully dedicated to the development and optimization of hot workability and heat treatment processes

Microscopy device

Corrosion lab

Compression test specimen

Welding

Our expertise

First-class producer of steel solutions for the nuclear industry

Careful selection of raw materials to produce high purity steel melt by electric arc furnace

Fine tuned secondary metallurgy, vacuum and special degassing process for high cleanliness steels (AOD, VOD)

Bottom poured ingots forged based on monitored forging program and latest know-how techniques

Automatic quenching devices and high precision tempering furnaces to create homogeneous hardness and microstructure through the cross section

100% inspection of internal soundness by ultrasonic testing examination and surface control

Control of chemical composition

Rolling mill

UT inspection

Quality System Certificate

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

- RCCM
- ASME III
- ISO
- Manufacture License of Special Equipment of the People's Republic of China

Industeel works to the most demanding Quality Assurance (QA) Requirements.

Our **high quality steel solutions** for nuclear applications

INGOTS FOR FORGED PIECES

Ingots in a wide range of steel grades from 100% iron content to high alloyed steel grades including stainless steel and nickel based alloys, adapted to customer requirements.

- Traditional ingots (round, polygonal, corrugated and square) up to 240 tons
- Hollow ingots up to 240 tons
- Vacuum cast ingots from 76 to over 250 tons
- Casting moulds from 15 to 250 tons

Reproducibility of chemical analysis,
Inclusion control,
Ultra-low hydrogen content

Hollow ingot for steam generator

SPECIAL STEEL PLATES

Industeel's plates are produced under QA requirements with an excellent metallurgy assuring:

- **homogeneity of structure and properties,**
- **cleanliness and low inclusion content,**
- **low cobalt and residual content.**

Full range of high quality steel grades satisfying the severe criteria for the nuclear industry:

- Carbon steel grades: SA516-70, P265GH
- Low alloy steel grades: SA533-B-Cl.1 or Cl.2, SA508Cl.3, SA387gr.22, SA387gr.91
- Stainless steels: UR™ 304L, UR™ 321, UR™ 347, UR™ 316L, UR™ 316Ti, UR™ 316LN
- Superaustenitic grades UR™ 367
- Duplex UR™ 2202 and superduplex UR™ 2507Cu

Specially adapted **nuclear grades** combining strength, intergranular corrosion resistance and weldability...

- NUCL™ 304L
- NUCL™ 347
- NUCL™ 316L
- NUCL™ 304B4 for neutronic shields
- 405mod. / 410S mod. with improved machinability and broachability

Stainless steel plates

Your project is unique we offer you tailor made solutions...

CLAD PLATES

A clad plate is a composite material combining the good mechanical properties of the low alloy backer steel and the corrosion resistance properties of the cladding.

Backer material: Carbon steels, low alloy steels...

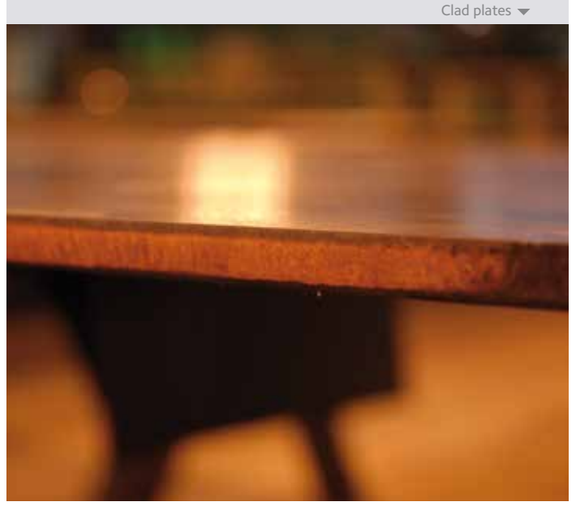
Cladding material: Stainless steels, Ni based alloys

Dimension range:
Thickness : from 6 to 120 mm
Unit weight : up to 17 tons
Max width : up to 3200 mm

Reliable quality of the roll bonding process

- Excellent control of cladding thickness
- Outstanding shear bond strength

Clad plates



FORMED AND FLAME-CUT PIECES

Full range of formed pieces, flame cut pieces, certified forged plates:

- Pressed heads up to 350 mm thickness tailor-made to customer's specifications
- Hot or cold formed pieces up to 70 tons unit weight
- Large cones and half-shells
- Pressed pieces in complex forms, with variable thickness...

The combination of both forging and rolling leads to:

- Soundness & compactness controlled by ultrasonic testing
- Homogeneity
- Good isotropy
- Uniformity

12000t Press

Our **steel solutions** for all types of nuclear applications

- Heavy plates, forged plates, formed or flame cut up to 80t unit weight
- Stainless steel up to 30t and 400mm thick
- Ingots, up to 250t

PRESSURISER / BORON INJECTION TANK

SA 508 cl.3, SA 533 B, SA 516 gr70, 16/18MND5, SA 387 gr22, SA 387 gr91

- Plates for shells
- Half shells
- Formed heads
- Clad plates

COMPONENTS FOR REACTOR PRESSURE VESSELS

SA 508 cl.3, SA 533 B, 16 MND5, SA 387 gr22, SA 387 gr91

- Shells
- Flanges
- Heads

UR™ 304L, UR™ 347, UR™ 321, UR™ 316L stainless steels

- Plates for reactor internals, accumulators

Ingots for forged pieces

SAFETY WATER TANKS

2202 Lean Duplex
304 or 321 stainless steel

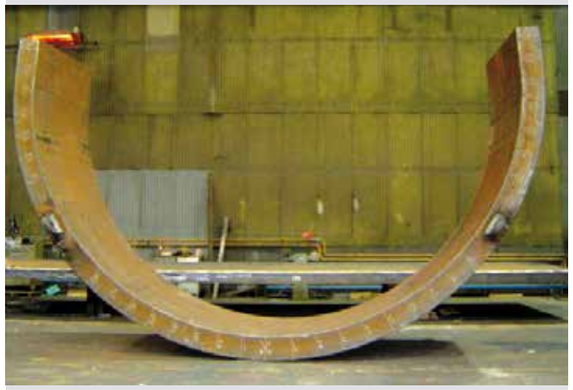
CONTAINMENT VESSELS

Quenched and Tempered steels with low temperature toughness properties (SA 738 B)

STEAM GENERATOR COMPONENTS

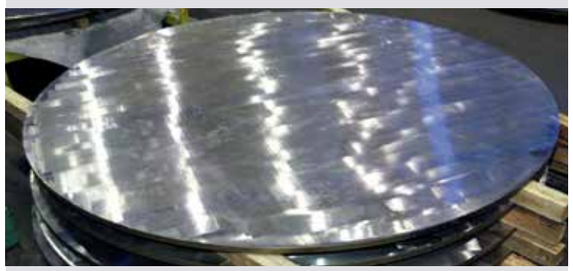
SA 508 cl.3, SA 533 B, SA 516 gr70, SA 387 gr22, SA 387 gr91

- Formed heads
- Tube sheets
- Plates for half shells



405 mod. /410 S mod. stainless steels

- Tube support plates



Ingots for forged pieces

PRIMARY PUMPS AND STEAM WATER LINES

20NCD14, 16/18MND5

- Disc for flywheel

UR™ 304 L, Duplex, Superduplex, Super austenitic stainless steels

- Plates for tubes
- Casted products

Other nuclear applications

Spent Fuel Reprocessing

Nuclear reprocessing technology was developed to chemically separate and recover fissionable plutonium from irradiated nuclear fuel.
Nitric acid solutions are often used to chemically attack spent fuel cells and separate the fission products.

INDUSTEEL SOLUTION

In some nitric acid solutions, special stainless steels developed by our R&D center have outstanding resistance.

	NITRIC ACID GRADES (NAG)		
	< 50%	50 – 70%	> 70%
Pure Nitric Acid T			
60 °C	UR™ 304L	UR™ 16 (304L NAG) UR™ 65 (310L NAG)	UR™ S1 (S30600)
Boiling	UR™ 16 (304L NAG)	UR™ 65 (310L NAG)	UR™ S1 (S30600)
Nitric Acid + Oxidizing impurities			
UR™ S1 (up to 30% Boiling)	UR™ 65 (310L NAG)	UR™ S1 (S30600) depending on Redox	
Nitric Acid + Fluorides			
UR™ 65 (310L NAG)	UR™ 65 (310L NAG)		

EXAMPLES OF APPLICATIONS

Crystallizer in UR™ 65,
a special 310 (310L NAG) used for its resistance in boiling 65% nitric acid and fluorides.

UR™ S1 evaporator
This high silicon grade is used in 98% concentration.

Nuclear Spent Fuel Transport & Storage

Containers for high-level spent fuel are robust and very secure casks which must allow for foreseeable accidents. They range from drum-size to truck-size and maintain shielding from gamma and neutron radiation, even under extreme accident conditions. Designs are certified by national authorities.

INDUSTEEL SOLUTION

304L type stainless steel or low alloy carbon steels (SA350 LF5) with excellent toughness and crack arrest properties used for closures or heads made from heavy plates

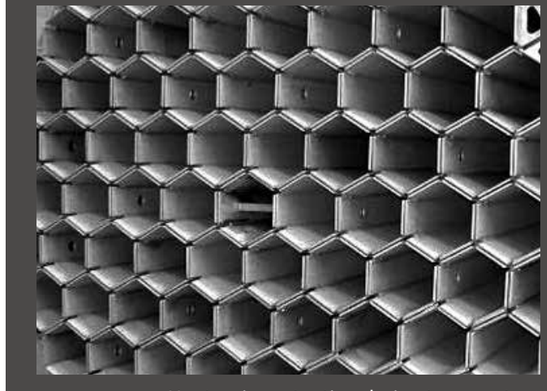
High strength stainless steels used for shock absorbers & internals in different grades:

- Duplex UR™ 2205,
- Superduplex UR™ 2507Cu,
- Precipitation hardening steels (Virgo™ 17.4 PH)
- High nitrogen chromium nickel manganese steels (UR™ XM19)

Borated stainless steels for neutronic radiation shielding

EXAMPLES OF APPLICATIONS

Special forged steel plates with excellent toughness properties and crack arrest properties (SA350 LF5...)
For removable Top shock absorber



Neutronic protection during transport
Grade NUCL™ 304B4 (1.2% boron)

Other nuclear applications

Nuclear Physics

Nuclear physics is the field of physics that studies the constituents and interactions of atomic nuclei. The most commonly known applications of nuclear physics are for particle accelerators, experimental fusion reactors (ITER), medical science...

INDUSTEEL SOLUTION

Special grades and non magnetic plates for many types of equipment used in high energy physics

- Accelerators
- Colliders
- Detectors

ITER References

Industeel supplied more than 10 000 tons of hot-rolled plates from 5 to 140 mm for different parts:

- Cryostat in 304L ITER
- Toroidal Field Coil in 316LNH
- Vacuum vessel in wall shielding ports and component in 316L(N)-IG, 304L, 304B4 and 430
- Thermal Shield in 304LN
- Divertor in 316L(N)-IG

Your partner for all your projects

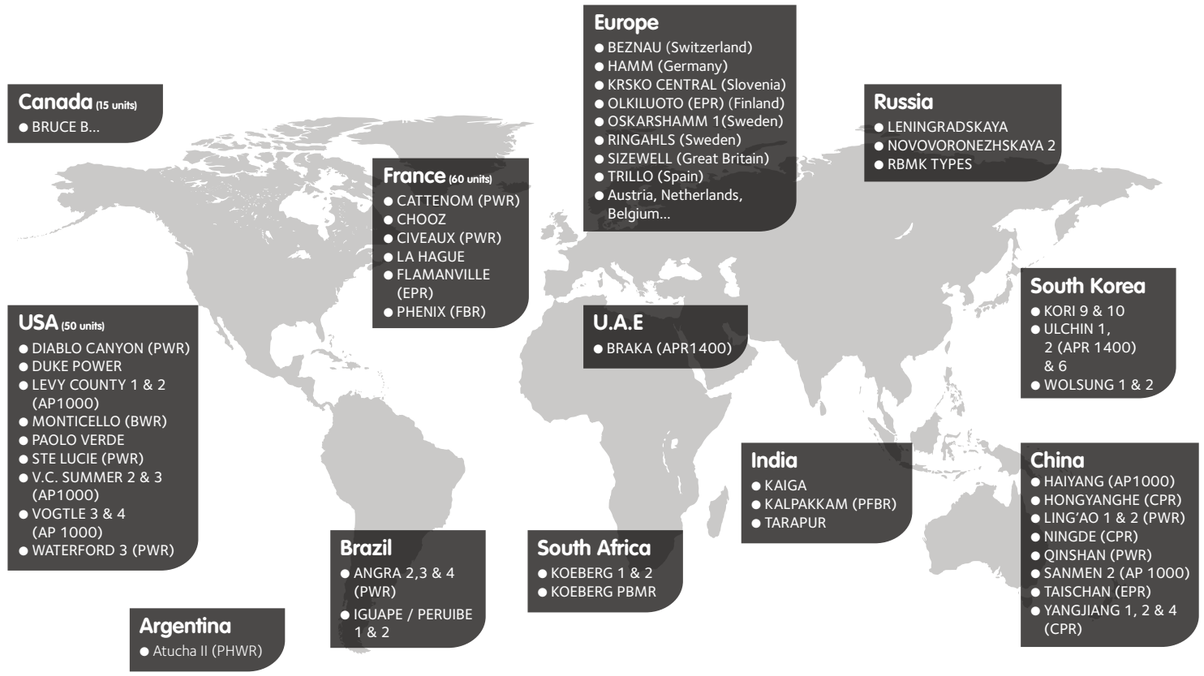
EXAMPLES OF APPLICATIONS

Special steels (XC06) for particle accelerator magnets in thickness 200mm, 15t unit weight

1.4429 Low ferrite content & magnetic permeability plates delivered for the super-conducting magnet half-shells (3000t, 41 km of half shells diameter 550 mm in 10.1 mm thickness)

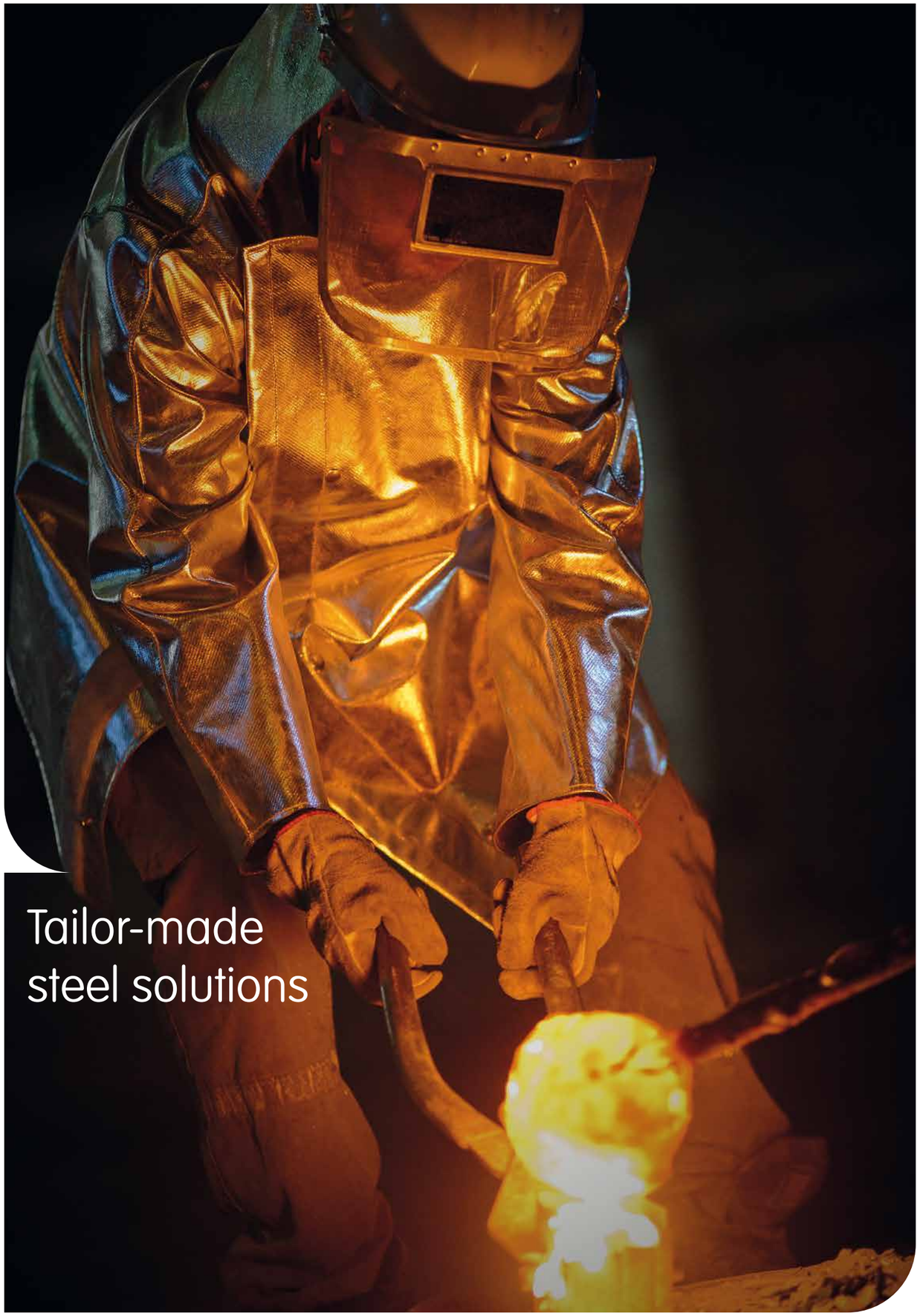
Industeel has nuclear references **all around the world...**

Some examples



Limited selection of references, this list is not exhaustive

Industeel, referenced supplier for all type of nuclear reactors (PWR, BWR, CANDU, FBR...).



Tailor-made steel solutions

Our sales network

More than 40 sales offices worldwide dedicated to Industeel products

Montréal, Philadelphia, Houston, Mexico, Caracas, Sao Paulo, Buenos Aires, Pretoria, Casablanca, Istanbul, Dubaï, Dehli, Mumbai, Moscow, Prague, Stockholm, Dusseldorf, London, Paris, Brussels, Barcelona, Lisbon, Milan, Singapore, Kuala Lumpur, Shanghaï, Busan, Seoul, Beijing, Tokyo, Sydney

ArcelorMittal

For any information

Industeel France
Châteauneuf plant
BP 368 Châteauneuf
F - 42803 RIVE-DE-GIER Cedex
FRANCE
Tel : + 33 4 77 75 21 41
Fax : + 33 4 77 75 20 01

Industeel France
Le Creusot plant
56, rue Clemenceau - BP 19
F - 71201 LE CREUSOT Cedex
FRANCE
Tel : + 33 3 85 80 53 02
Fax : + 33 3 85 80 55 00

Industeel Belgium
Charleroi plant
266, rue de Châtelet
B - 6030 CHARLEROI
BELGIUM
Tel : + 32 71 44 16 99
Fax : + 32 71 44 19 56

http://industeel.arcelormittal.com

Makheia – 04 78 33 99 00 – Janvier 2015

transforming
tomorrow