PRODUCT CATALOGUE

ABRASION RESISTANT & HIGH YIELD STRENGTH STEEL

QUARD® ABRASION RESISTANT STEEL

QUEND® HIGH YIELD STRENGTH STEEL

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NLMK GROUP

QUARD® ABRASION RESISTANT STEEL

QUEND® HIGH YIELD STRENGTH STEEL

ABOUT NLMK GROUP

NLMK Group is a vertically-integrated company, Russia's largest steelmaker and a leading global supplier of high-quality steel products.

NLMK Group produces hot-rolled, cold-rolled, galvanized and pre-painted rolled products, electrical steel (grain oriented and non-grain oriented), a wide range of plates, long products, and metalware. NLMK Group's steel products are used by various industries, from construction and engineering to the manufacture of power-generating equipment and offshore wind turbines.

In 2014, NLMK Group supplied its products to 70 countries around the world, selling a total of 15.1 million tonnes of steel products, a third of which was value-added products.

NLMK Group's key production assets are located in Russia, Europe, and the United States. Its liquid steel capacity is over 17 million tonnes per year. NLMK Group has the most competitive cost among global steel manufacturers.

NLMK Group companies are committed to globally accepted social responsibility standards and are constantly improving their production processes to reduce their environmental impact and ensure occupational safety. In 2015, investment in environment alinitiatives and projects to talled 107 mln USD.

To improve customer service, we have set up a unified sales service call centre: +32 (2) 391 91 00 (NLMK Clabecq)

To provide feedback on the quality of products and our sales service performance, please write to sales@nlmk.com.

CUSTOMER SERVICE

To improve customer service, we have created departments focusing on direct sales to customers and distributors, product marketing, technical support, sales planning and support.

Our sales and technical support experts are always available to provide consulting services both long distance and on site.

NLMK's sales policy is aimed at ensuring consistently high product quality, on-time delivery, competitive pricing and excellent service.

We value customer loyalty and are committed to building long-term mutually beneficial relations, focussing on the individual needs of our partners.

+32 (2) 391 91 00 (NLMK Clabecq)

sales@nlmk.com

According to Rosgidromet (Russian Federal Service for Hydrometeorology and Environmental Monitoring), air pollution in Lipetsk, home to 80% of NLMK Group's production facilities, is five times lower than 10 years ago, bringing it in line with cities with no industrial operations. In 2014 Lipetsk was recognized as the cleanest regional center in the Central Federal District and the cleanest steelmaking city in Russia.

EFFICIENT PRODUCTION WITH MINIMUM ENVIRONMENTAL EFFECT

NLMK Group has invested over $1 billion into environmental projects over the last decade. Over this period, NLMK's output almost doubled, and the company became the largest steel producer in Russia. Today, NLMK accounts for 22% of all Russian steel.

In the context of a doubling of production volumes, NLMK Group's confident strides towards reducing its environmental footprint and implementing the most advanced technologies allowed the company to more than halve its air emissions, approaching best available technologies (BAT). NLMK completely discontinued waste water discharge and industrial waste accumulation.

In May 2014, NLMK Group announced the new stage of its Environmental Programme leading up to 2020. It is aimed at further minimizing NLMK's environmental footprint and achieving the best possible environmental standards in global steel production.

of Russian steel is produced by NLMK Group

invested in environmental projects and initiatives

reduction of emissions against output growth

ABOUT THE OPERATIONS

NLMK Europe – Plate includes three companies: NLMK Clabecq, NLMK Verona and NLMK Dansteel. The synergies between these three facilities allow NLMK to offer its clients full scope of products ranging from thin & narrow to heavy & wide plates.

NLMK's industrial model is unique for Europe and is based on the efficient supply of semi-finished products from Russia to flexible high quality European processing facilities, close to key customers. A wide range of Quard and Quend plates is produced from slabs supplied by the NLMK's Lipetsk production site, using a unique quenching and tempering technique at NLMK's Belgian Clabecq plant.

NLMK Europe Plate Structure

NLMK Clabecq Belgium	NLMK DanSteel A/S Denmark	NLMK Verona Italy
		
• Superior surface finish, flatness, and tight thickness tolerances • State-of-the-art Q&T line • Proximity to main European ports • Thickness: 3–120 mm • Width up to 2,750 mm / Q&T up to 3,100 mm • Thermomechanical rolling, normalization, Q&T • Production capacity: 650,000 t, including up to 250,000 t Q&T.	• Short lead time • Q4 2012: new mill commissioned • Excellent logistics • Thickness: 6–200 mm • Width up to 4,050 mm • Thermomechanical rolling, normalization • Production capacity: 550,000 t.	• In-house alloyed steel production • Unique combination of forging and rolling • Ingots up to 86 t • Heavy plates: — from ingots: 150–1,000 mm; — from slabs: 20–220 mm • Width up to 2,500 mm • Production capacity: 550,000 t

CERTIFICATION

NLMK Group, Russia's largest producer of steel and HVA products, has successfully passed certification audits confirming the compliance of its production of special dimension slabs from high strength and corrosion resistant steel grades.

Item №	Certifying authority	Regulatory document	Product name
1	AFNOR (France)	ISO 9001:2008	Quality management system
2	AFNOR (France)	ISO 14001:2004	Environmental management system


Certificat
Certificate


Certificat
Certificate

NLMK

QUARD® ABRASION RESISTANT STEEL

Quard plates are produced at the NLMK's Belgian mill 'Clabecq', where they are treated in a state-of-the-art Quenching and Tempering unit. The slabs used are supplied by the NLMK's Lipetsk production site.

The Quard abrasion resistant plates are delivered with hardness of 400 HB (Quard 400), 450 HB (Quard 450) and 500 HB (Quard 500), with thicknesses ranging from 3.2 mm to 64 mm and widths from 1,500 to 3,100 mm.

They are designed for construction and mining equipments (excavators, dump trucks, bulldozers, hoppers, mixers, etc.), as well as for machinery in very demand industries (recycling, agriculture, etc). The use of Quard may result in product lifetime being more than tripled when compared to products made from standard grades of steel.

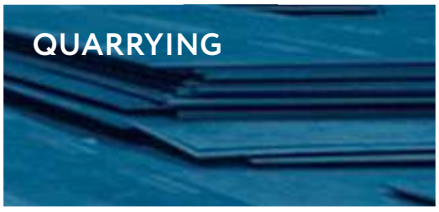




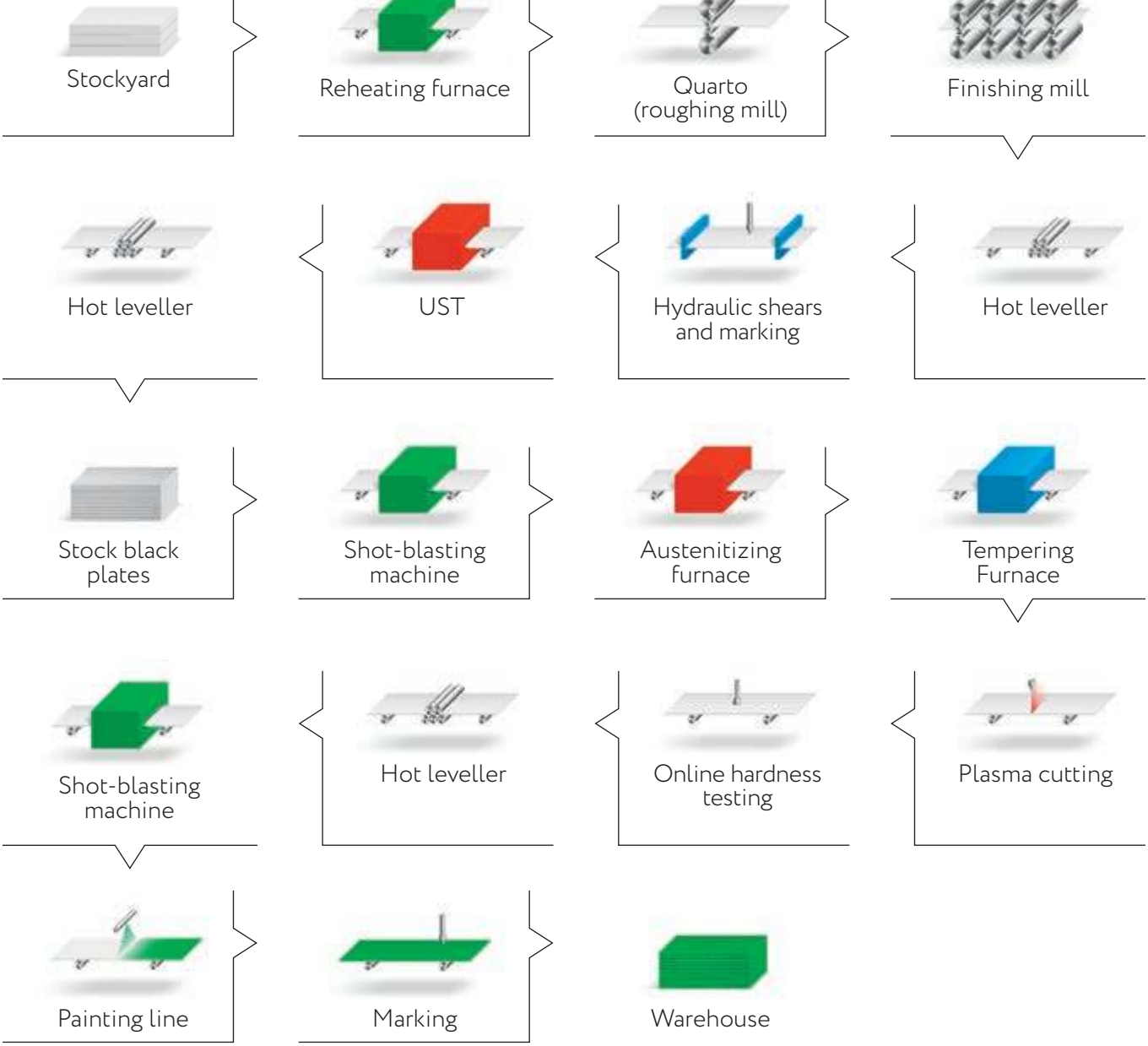








QUARD®
PRODUCTION PROCESS



NLMK EUROPE QUARD PRODUCTION FACILITIES

Facility	Description
Hot-rolling	
Reheating furnace	Slab heating before hot-rolling
Quarto (roughing mill)	Finished plate or semis for finishing mill
Finishing mill	Thin plate rolling
Hot leveller	Plate levelling
Hydraulic shears	Finishing cutting
Ultrasonic testing machine	Plate testing for discontinuities
Quenching & Tempering (Q&T)	
Shot-blasting machine	Scale removal from plate surface
Austenitizing furnace	Plate heating to austenitizing temperature
Quenching	Accelerated cooling of plates
Tempering furnace	Plate heating to tempering temperature
Leveller	Cold-levelling of plates
Online hardness testing machine	Plate hardness testing online
Plasma cutting machine	Cutting to size
Hydraulic shears	Cutting to size
Painting line	Protective priming of plates

Description and applications

Quard is a martensitic abrasion resistant steel with an average hardness of 400, 450 and 500 HBW. Due to its versatility in terms of high toughness, good cold formability and excellent weldability, Quard combines outstanding workshop performance and long lasting wear resistance.

Quard is recommended for the following applications:
— mining and earthmoving machinery;
— dump truck and car bodies;
— cement mixer drum bodies;
— waste bins, trash containers;
— buckets, knives;
— feeders, trolleys, screw conveyors.

Dimensions

The following Quard product mix is currently available:

	Thickness	Width
Quard 400	4–50 mm	1,500–3,100 mm
Quard 450	4–64 mm	
Quard 500	4–40 mm	

Technical characteristics

Hardness guarantee

	Hardness
Quard 400	HBW = 370–430
Quard 450	HBW = 420–480
Quard 500	HBW = 470–530

Brinell hardness test, HBW according to EN ISO 6506-1, is performed 1–2 mm below the plate surface once per heat and 40 tonnes.

Other mechanical properties (typical values)

	V-notch impact test (longitudinal at –40°C)	Yield strength (MPa)	Tensile strength Transverse testing (MPa)	Elongation A5 (%)
Quard 400	40 J	1,160	1,300	10
Quard 450	35 J	1,250	1,400	10
Quard 500	30 J	1,500	1,700	8

KEY PARTNERSHIPS

BELAZ

Steel grade: Quard 450 .

BELAZ is the largest global producer of heavy lift dump trucks, and other heavy load handling equipment used in mining and construction.

Starting from 2013, NLMK Group has been supplying Quard 450 abrasion resistant steel to BELAZ. BELAZ experts tested the product. As a result, it was successfully certified and is used for the production of heavy lift dump truck bodies. For instance, Quard 450 is used for the production of the unique BELAZ-75710 dump truck with a lifting capacity of 450 tonnes.

NLMK Group supplied the required plates in 2014.

With slabs coming from the NLMK Group's production site of Lipetsk and with the whole process of rolling and Quenching & Tempering in NLMK Clabecq (Belgium), a complete product quality control can be done along the entire production chain.

This means that NLMK can control product quality along the entire production chain.

Developopping its cooperation with BELAZ, NLMK Group has arranged regular supplies of abrasion resistant plates with a special nesting pattern up to 3,200 mm wide with additional treatment : edge preparation for welding.

NLMK Group is currently one of the key suppliers of abrasion resistant steel for BELAZ. NLMK is planning to build on this partnership to develop the product and to introduce new high strength steel grades.

For more detailed information about the customer and the products, please visit:

http://www.quard.me/
http://quend.me/
http://www.belaz.by/

Chemical composition

Steel is grain refined

Quard 400

Plate thickness	Ladle analysis, % (max.)								
	C	Si	Mn	P	S	Cr	Ni	Mo	B
4–25.4 mm	0.16	0.60	1.40	0.025	0.010	0.50	0.10	0.25	0.005
25.41–40 mm	0.17	0.60	1.60	0.025	0.010	1.15	0.10	0.30	0.005
40.01–50 mm	0.17	0.60	1.60	0.025	0.010	1.30	0.50	0.50	0.005

Quard 450

Plate thickness	Ladle analysis, % (max.)								
	C	Si	Mn	P	S	Cr	Ni	Mo	B
3.2–20 mm	0.20	0.60	1.40	0.025	0.010	0.20	0.10	0.25	0.005
20.1–40 mm	0.21	0.60	1.60	0.025	0.010	0.75	0.10	0.30	0.005
40.01–64 mm	0.23	0.60	1.60	0.025	0.010	1.30	0.50	0.50	0.005

Quard 500

Plate thickness	Ladle analysis, % (max.)								
	C	Si	Mn	P	S	Cr	Ni	Mo	B
4–40 mm	0.30	0.80	1.60	0.025	0.010	1.00	1.00	0.50	0.005

Carbon equivalent

Carbon equivalent, typical values, %			
	Plate thickness	CEV(1)	CET(2)
Quard 400	4–8 mm	0.36	0.25
	8.01–20 mm	0.40	0.28
	20.01–25.4 mm	0.45	0.29
	25.41–40 mm	0.57	0.33
	40.01–50 mm	0.64	0.36
Quard 450	3.2–7.99 mm	0.41	0.30
	8–20 mm	0.41	0.32
	20.01–40 mm	0.56	0.37
	40.01–64 mm	0.64	0.40
Quard 500	4–20 mm	0.57	0.40
	20.01–40 mm	0.61	0.43

(1) CEV = C +Mn/6 + (Ni+Cu)/15 + (Cr+Mo+V)/5.
(2) CET = C + (Mn+Mo)/10 + Ni/40 + (Cr+Cu)/20.

KEY PARTNERSHIPS

Ural Mining & Metallurgical Company (Managing Company: UMMC-Holding)

Steel grade: Quard 400, Quard 450

Ural Mining & Metallurgical Company is a vertically-integrated holding, Russia's leading copper manufacturer.

UMMC-Holding unites mining, steelmaking, steel processing, machine building and construction companies located both in Russia and abroad into a single process chain.

NLMK has been working with UMMC since 2014. NLMK Group suggested the raw material companies of the holding companies use Quard for repairs including maintenance of excavator and loader buckets, mining dump trucks and loader-trammer body linings.

First supplies of NLMK's abrasion resistant steel to Uchalinsky GOK, Svyatogor, Sibir-Polymetally and Safyanovskaya Med began in 2015.

For more detailed information about the customer and the products, please visit:

http://www.ugmk.com/
http://www.quard.me/
http://www.quend.me/

Tolerances and surface properties

Quard offers a unique combination of excellent flatness, tight thickness tolerances and superior surface finish.

Feature	Grade		
	Quard 400	Quard 450	Quard 500
Flatness	EN 10029: class N (standard) and class S		
Thickness tolerance	Meet and exceed EN 10029 Tighter tolerances upon request		
Shape, length, width and thickness tolerances	Comply with EN 10029		
Surface properties	Exceed existing market standards EN 10163-2 Class B3		

Delivery terms

Quard 400, Quard 450 and Quard 500 plates are supplied in the shotblasted and primed condition. Plates can also be delivered unpainted. In order to maintain a good weldability and laser cutting performance, a low zinc silicate primer can be applied (upon request).

KEY PARTNERSHIPS

WEAR SERVICE

Steel grade: Quard 450, Quard 500.

Wear Service is a leader in the Russian market of wear resistant parts and services related to equipment wear protection.

The company specializes in manufacturing items from abrasion resistant steel and bimetallic plates, welding and spraying hard alloys, as well as repairing worn-out parts and units.

Wear Service took an interest in NLMK's products when the company introduced a new product in the Russian market: its low-alloy quenched abrasion resistant steel. This allowed Wear Service to diversify its supplier base and to propose its own services and products to NLMK Group.

Cooperation between NLMK and Wear Service began in 2015 with a series of tests and a trial lot of Quard. Having successfully completed the tests, the companies continued to develop their partnership that includes now the supply of NLMK's abrasion resistant steel to Wear Service; and organization of workshops and technical consults by Wear Service for NLMK Group companies: Novolipetsk, Stoilensky, Vtorchermet NLMK.

For more detailed information about the customer and the products, please visit:

http://www.wearservice.ru/
http://www.quard.me/
http://www. quend.me/

Heat treatment

Quard 400, Quard 450 and Quard 500 receive their properties through quenching and when applicable with subsequent tempering. For these properties to be retained, Quard plates should not be used in applications requiring heat treatment and service temperatures above 250°C. Quard 400, Quard 450 and Quard 500 is not intended for any additional heat treatment.

Ultrasonic testing

Ultrasonic testing (UT) is used to identify such discontinuities as inclusions, cracks and porosity. In thickness from 8 mm and higher, all plates are UT tested and controlled against class S2, E2 in accordance with EN10160.

General processing guidelines

To obtain optimal processing productivity for Quard 400, Quard 450 and Quard 500, it is essential to use the recommended procedures and tools given below.

Thermal cutting

Plasma and flame cutting can be performed without the need for preheating plates in thicknesses up to 20 mm, provided the ambient temperature is above 0°C.
After cutting, plates should be cooled down to room temperature. Slow cooling reduces the risk of cut edge cracking. Never use accelerated cooling.

NLMK GROUP'S ENVIRONMENTAL POLICY

Efficient production with minimum environmental impact.

Principles:

- environmentally responsible approach to operations, upgrading, revamping and capital construction of production facilities;
- compliance with Russian (international) statutory and regulatory environmental requirements;
- mitigation of environmental risks;
- transparency and availability of information on the Group companies' environmental activities and their environmental footprint.

Cold forming

Quard grades are well suited for cold forming. The minimum recommended R/t ratios for Quard bending are given in the table below:

	Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. width (W/t)	Long. width (W/t)
Quard 400	t < 8.0	2.5	3.0	8	10
	8 ⩽ t < 20	3.0	4.0	10	10
	t ⩾ 20.0	4.5	5.0	12	12
Quard 450	t < 8.0	3.5	4.0	10	10
	8 ⩽ t < 20	4.0	5.0	10	12
	t ⩾ 20.0	5.0	6.0	12	14
Quard 500	t < 8.0	3.5	4.5	10	12
	8 ⩽ t < 20	4.5	5	12	14
	t ⩾ 20.0	6	7	16	18

R — recommended punch radius (mm), t — plate thickness (mm),
W — die opening width (mm) (bending angle ⩽90°).

Due to the homogeneous properties and narrow thickness tolerances of Quard 400, 450 & 500 plates.
Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

Welding

Quard shows good weldability due to low carbon equivalent. It can be welded using any conventional welding method, both manual and automatic.

Quard welding is recommended at ambient temperatures not lower tan +5°C.

After welding, the welded parts should be left to cool down to room temperature. Never use accelerated cooling.
When welding plates in thicknesses up to 12 mm using a heat input of 1.7 kJ/mm, preheating is not required. Interpass temperatures used should not exceed 225°C.

Soft weld consumables, ensuring low hydrogen weld deposits (<= 5 ml/100g), are recommended to avoid hydrogen cracking. The consumable strength should be as soft as the design and wear mode allows..

In general, welding recommendations for Quard plates should comply with EN-1011.

Machining

Quard offers good machinability with HSS and HSS-Co alloyed drills. The feed rate and cutting speed have to be adjusted to the high hardness of the material. Face milling, counter boring and countersinking are best performed using tools with replaceable cemented carbide inserts.

KEY PARTNERSHIPS

VZMEO

Steel grade: Quard 450.

Volgodonsk Metallurgical & Power Equipment Plant (VZMEO) is a major budget revenue generating company manufacturing equipment and spares for steel plants, pulp-and-paper mills, construction companies, heat and nuclear plants and petrochemical facilities.

NLMK and VZMEO began cooperating as part of a project to supply products to Siemens VAI Metals technologies, VZMEO's long-time partner.

To manufacture yet another batch of equipment VZMEO needed an immediate supply of abrasion resistant steel with Brinell hardness of 450, so the company turned to NLMK. The order was met. As a result, this project opened up new opportunities for mutually profitable cooperation.

For more detailed information about the customer and the products, please visit:
http://www.quard.me/
http://www. quend.me/
http://www.vzmeo.ru/

NLMK

QUEND® HIGH YIELD STRENGTH STEEL

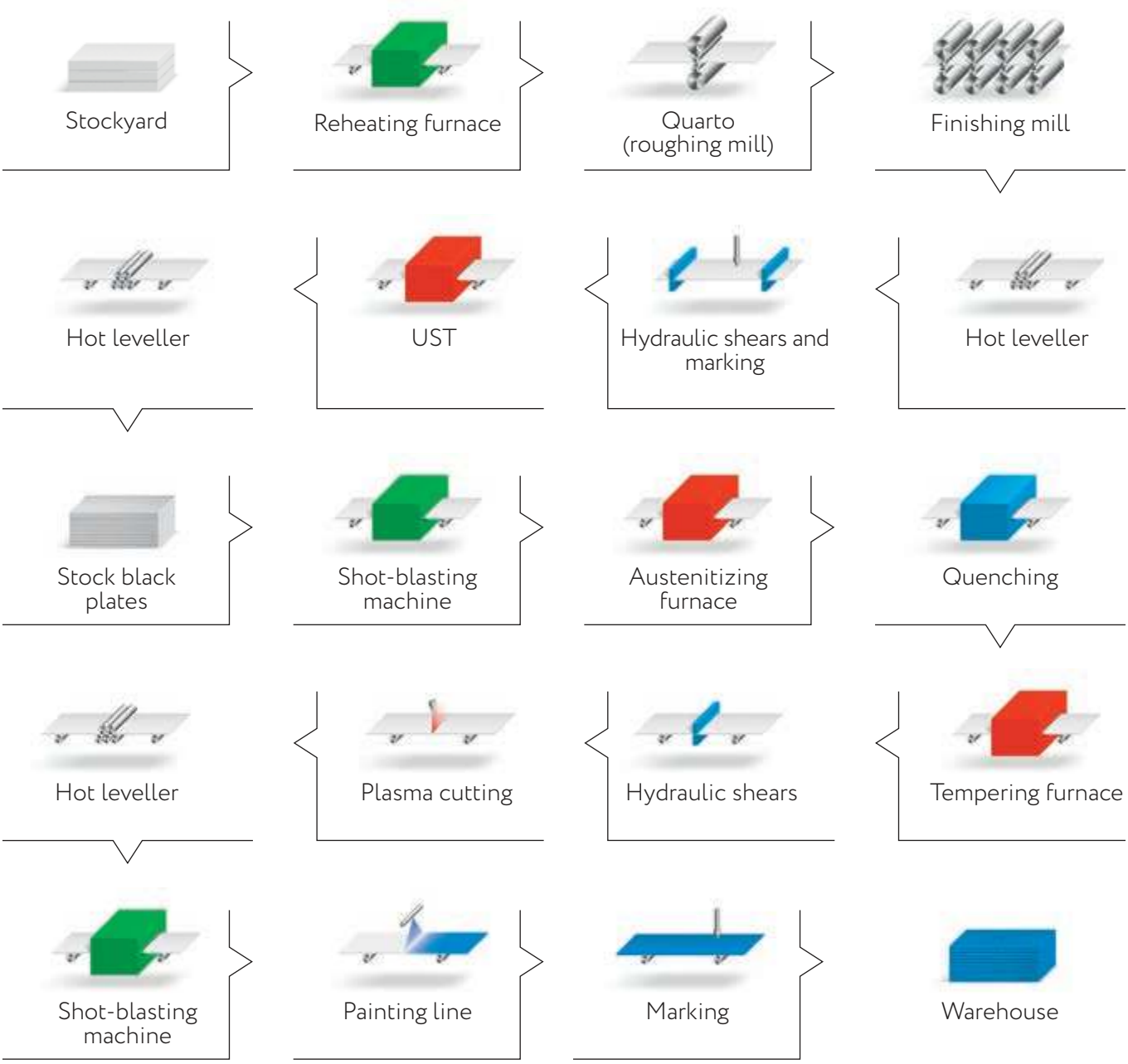
Quend is produced at NLMK Clabecq in Belgium, where it is rolled and then quenching and tempered in a recent and modern heat treatment unit.

The production is made from slabs coming from the NLMK's Lipetsk production site.

The Quend high yield strength steels plates are delivered with a yield strength of 700 MPa (Quend 700), 900 MPa (Quend 900) and 960 MPa (Quend 960), with thicknesses ranging from 4 mm to 64 mm and widths from 1,500 to 3,100 mm.

They are designed for lifting and hoisting equipment, truck chassis, handling equipment, trailers, and other applications where high structural strength is of critical importance.

QUEND PRODUCTION PROCESS



NLMK QUEND PRODUCTION FACILITIES

Facility	Description
Hot-rolling	
Reheating furnace	Slab heating before hot-rolling
Quarto (roughing mill)	Finished plate or semis for finishing mill
Finishing mill	Thin plate rolling
Hot leveler	Plate levelling
Hydraulic shears	Finishing cutting
Ultrasonic testing machine	Plate testing for discontinuities
Quenching & Tempering (Q&T)	
Shot-blasting machine	Scale removal from plate surface
Austenitizing furnace	Plate heating to austenitizing temperature
Quenching	Quenching of plates
Tempering furnace	Plate heating to tempering temperature
Leveller	Cold-levelling of plates
Online hardness testing machine	Plate hardness testing online
Plasma cutting machine	Cutting to size
Hydraulic shears	Cutting to size
Painting line	Protective priming of plates

Description and applications

Description and applications Quend is extra high yield strengthstructural steel obtained as a result of quenching and subsequent tempering with minimum yield strength of 700 MPa, 900 MPa & 960 MPa. Quend complies with S690QL, S890QL, S960QL requirements given in the EN 10025-6 standard, where a minimum impact toughness of 27 J is guaranteed at -40°C.

Quend is recommended for the following applications:
— truck chassis;
— lifting equipment;
— handling and charging equipment;
— truck trailers, etc.

Dimensions

The following Quend product mix is currently available:

	Толщина	Ширина
Quend 700	4–64 mm	1,500–3,100 mm
Quend 900	4–35 mm	
Quend 960	4–30 mm	

For more detailed information, please visit our website or contact a local NLMK Clabecq representative.

Technical characteristics

Tensile properties

	Transverse testing		
	Yield strength, Rp 0,2	Tensile strength, Rm	Elongation, A5
Quend 700	700 MPa min.	780–930 MPa	14% min.
Quend 900	900 MPa min.	940–1,100 MPa	14% min.
Quend 960	960 MPa min.	980–1,150 MPa	12% min.

Impact toughness

	Minimum values at		
	0°C	-20°C	-40°C
Quend 700	35 J	30 J	27 J
Quend 900	35 J	30 J	27 J
Quend 960	35 J	30 J	27 J

Transverse testing according to EN 10025, option 30. For plate thickness <12 mm subsized Charpy V specimen are used.

Chemical composition

Steel is grain refined.

	Ladle analysis, % (max.)													
Grade	C	Si	Mn	P	S	Nb	Cr	V	Ti	Ni	Al	Mo	N	B
Quend 700	0.20	0.60	1.50	0.02	0.01	0.04	0.60	0.07	0.04	1.00	0.07	0.50	0.014	0.005
Quend 900	0.20	0.50	1.50	0.02	0.01	0.04	0.70	0.06	0.01	1.50	0.06	0.70	0.005	0.005
Quend 960	0.20	0.50	1.50	0.02	0.01	0.04	0.70	0.06	0.01	1.50	0.06	0.70	0.005	0.005

Carbon equivalent

Carbon equivalent, typical values, %			
	Plate thickness	CEV(1)	CET(2)
Quend 700	4–15 mm	0.45	0.29
	15.01–25 mm	0.44	0.30
	25.01–40 mm	0.45	0.30
	40.01–64 mm	0.54	0.33
Quend 900	4–30 mm	0.57	0.36
Quend 960	4–30 mm	0.57	0.36

(1) CEV = C +Mn/6 + (Ni+Cu)/15 + (Cr+Mo+V)/5.
(2) CET = C + (Mn+Mo)/10 + Ni/40 + (Cr+Cu)/20.

Tolerances and surface properties

Quend offers a unique combination of excellent flatness, tight thickness tolerances and superior surface finish.

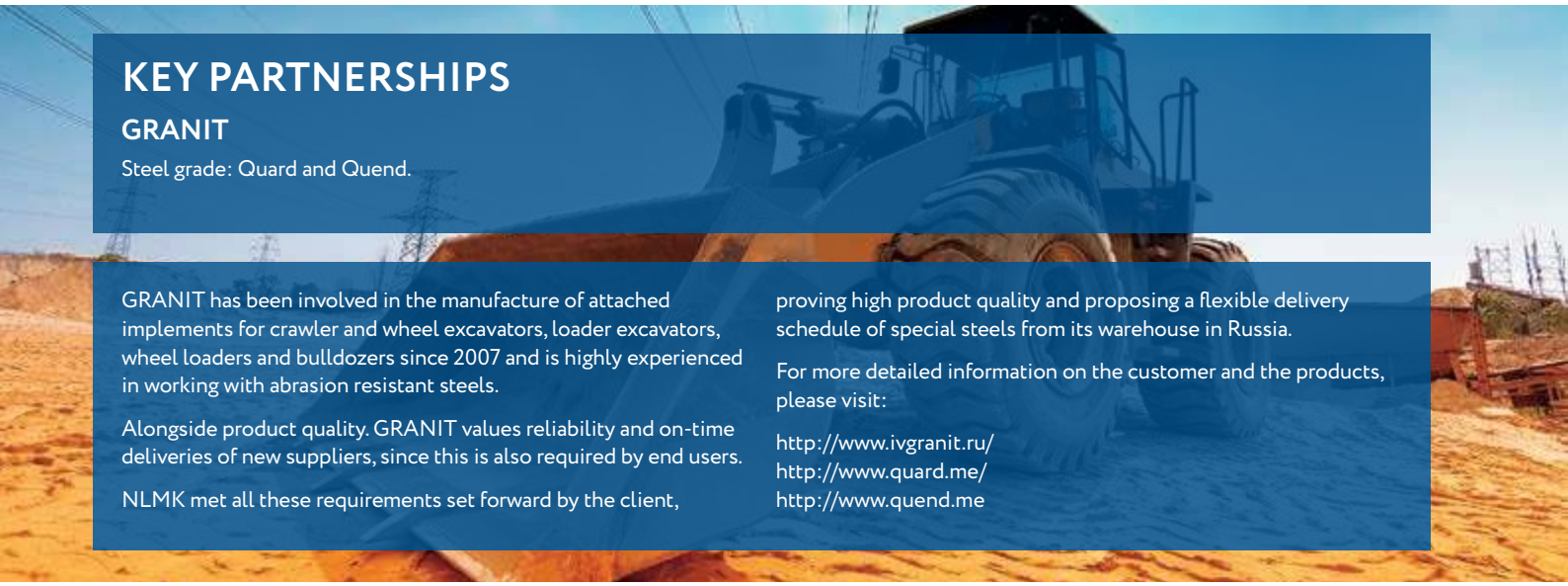
Indicator	Grade		
	Quend 700	Quend 900	Quend 960
Flatness	EN 10029: class N (standard) and class S		
Thickness tolerance	Meet and exceed EN 10029. Tighter tolerances upon request		
Shape, length, width and thickness tolerances	Comply with EN 10029		
Surface properties	Exceed existing market standards EN 10163-2 Class B3		

Delivery terms

Quend plates are supplied in the shotblasted and primed condition. Plates can also be delivered unpainted. In order to maintain a good weldability and laser cutting performance, a low zinc silicate primer can be applied.

Heat treatment

Quend steels obtain their properties through quenching with subsequent tempering. For these properties to be retained, Quend plates should not be used in applications requiring heat treatment or service temperatures above 550°C.



KEY PARTNERSHIPS

GRANIT

Steel grade: Quard and Quend.

GRANIT has been involved in the manufacture of attached implements for crawler and wheel excavators, loader excavators, wheel loaders and bulldozers since 2007 and is highly experienced in working with abrasion resistant steels.

Alongside product quality. GRANIT values reliability and on-time deliveries of new suppliers, since this is also required by end users.

NLMK met all these requirements set forward by the client, proving high product quality and proposing a flexible delivery schedule of special steels from its warehouse in Russia.

For more detailed information on the customer and the products, please visit:

http://www.ivgranit.ru/
http://www.quard.me/
http://www.quend.me

Ultrasonic test

Ultrasonic testing (UT) is used to identify such discontinuities as inclusions, cracks and porosity. In thickness from 8 mm and higher, all plates are UT tested and controlled against class S2, E2 in accordance with EN 10160.

General processing guidelines

To attain optimal processing productivity for Quend steel plates, it is essential to use the recommended procedures and tools given below.

Thermal cutting

Quend plates can be cut using oxygen, plasma or laser cutting without any restrictions. After cutting, plates should be left to cool down to room temperature. Slow cooling reduces the risk of edge cracking. Never use accelerated cooling.

NLMK GROUP'S ENVIRONMENTAL PROGRAMME 2014–2020

In May 2014, NLMK Group announced the launch of a new stage of its Environmental Programme, covering the period up to 2020. This programme is part of the Group's development strategy and investment programme. It is aimed at further minimizing NLMK's environmental footprint and achieving the best possible environmental standards in global steel production.

Investments in environmental initiatives and projects at NLMK Group companies will total over 164 mdollars. Most of the funds will be invested at NLMK's Lipetsk production site, a core asset of the Group.

Cold forming

Due to the homogeneous properties and narrow thickness tolerances of Quend steel plates, variations in springback is kept at alow level:

	Thickness (mm)	Transverse to rolling (R/t)	Longitudinal to rolling (R/t)	Trans. width (W/t)	Long. width (W/t)
Quend 700	t < 8.0	1.5	2.0	8	9
	8 ⩽ t < 20	2.0	3.0	8	9
	t ⩾ 20.0	3.0	4.0	9	10
Quend 900	t < 8.0	2.5	3.0	9	10
	8 ⩽ t < 20	3.0	4.0	9	10
	t ⩾ 20.0	4.0	5.0	10	12
Quend 960	t < 8.0	2.5	3.0	9	10
	8 ⩽ t < 20	3.0	4.0	9	10
	t ⩾ 20.0	4.0	5.0	10	12

R — recommended punch radius (mm), t — plate thickness (mm),
W — die opening width (mm) (bending angle ⩽90°).

Due to the homogeneous properties and narrow thickness tolerances of Quend steel plates, variations in springback is kept at a low level.
Grinding of flame cut or a sheared edge in the bending area is recommended to further prevent cracking during bending.

PARAGON OF LEAN WATER HANDLING

Since 2007 NLMK Group has reduced its waste water discharge **by more than 54 times**. On NLMK sites, waste water discharge has been completely eliminated.

NLMK Group has exceeded the global BAT level in terms of water consumption. Specific water consumption at the Group's companies amounted to 5.2 m^3 per tonne of steel vs the BAT level of 7 m^3.

Welding

Quend can be welded using any conventional welding method, both manual and automatic.

In the thickness range of up to12 mm, no preheating is required if a heat input of 1.7 kJ/mm is used.

It is recommended to weld Quend plates at ambient temperatures of no lower than +5°C. After welding, the welded parts should be left to cool down to room temperature. Never use accelerated cooling. It is recommended to use only low hydrogen electrodes when welding Quend.

Machining

Quend has superior machinability and can be drilled, counter sinked and milled in the same way as any other 700, 900, 960 Mpa, or S 690 QL, S 890 QL, S 960 QL Q&T steels.

CLEAN AIR IN CITIES WHERE WE OPERATE

NLMK Group implements investment projects aimed at reducing the impact on atmospheric air. As a result, labour conditions at production facilities will be improved and a favourable environment will be set up around the plants.

Specific emissions at NLMK Group's production facilities decreased twofold in 15 years, coming close to the BAT level.

NOTES