

# Index

Doc. Réf.	Description	
A01_2018/01_E	Dimensional Program	
B01_2018/01_E	Structural Steels	
B02_2018/01_E	Laser Cutting Steels	
B03_2018/01_E	Steels with improved resistance to atmospheric corrosion	
C01_2018/01_E	Floor plates	
D01_2018/01_E	Offshore Steels	
E01_2018/01_E	Shipbuilding Steels	
F01_2018/01_E	Boiler Plate and Pressure Vessel Steels	
F02_2018/01_E	High Carbon Steels	
F03_2018/01_E	Line Pipe Steels	
G012018/01_E	Tool steels - Engineering steels	
H01_2018/01_E	High Yield Strength Steels	
I01_2018/01_E	Quend® - Extra High Strength Structural Steels (Quenched & Tempered)	
I02_2018/01_E	Quard® - Abrasion Resistant Steels (Quenched & Tempered)	
J01_2018/01_E	Ingots	
K01_2018/01_E	Shot Blasting & Priming	
K02_2018/01_E	Quality System Certifications	

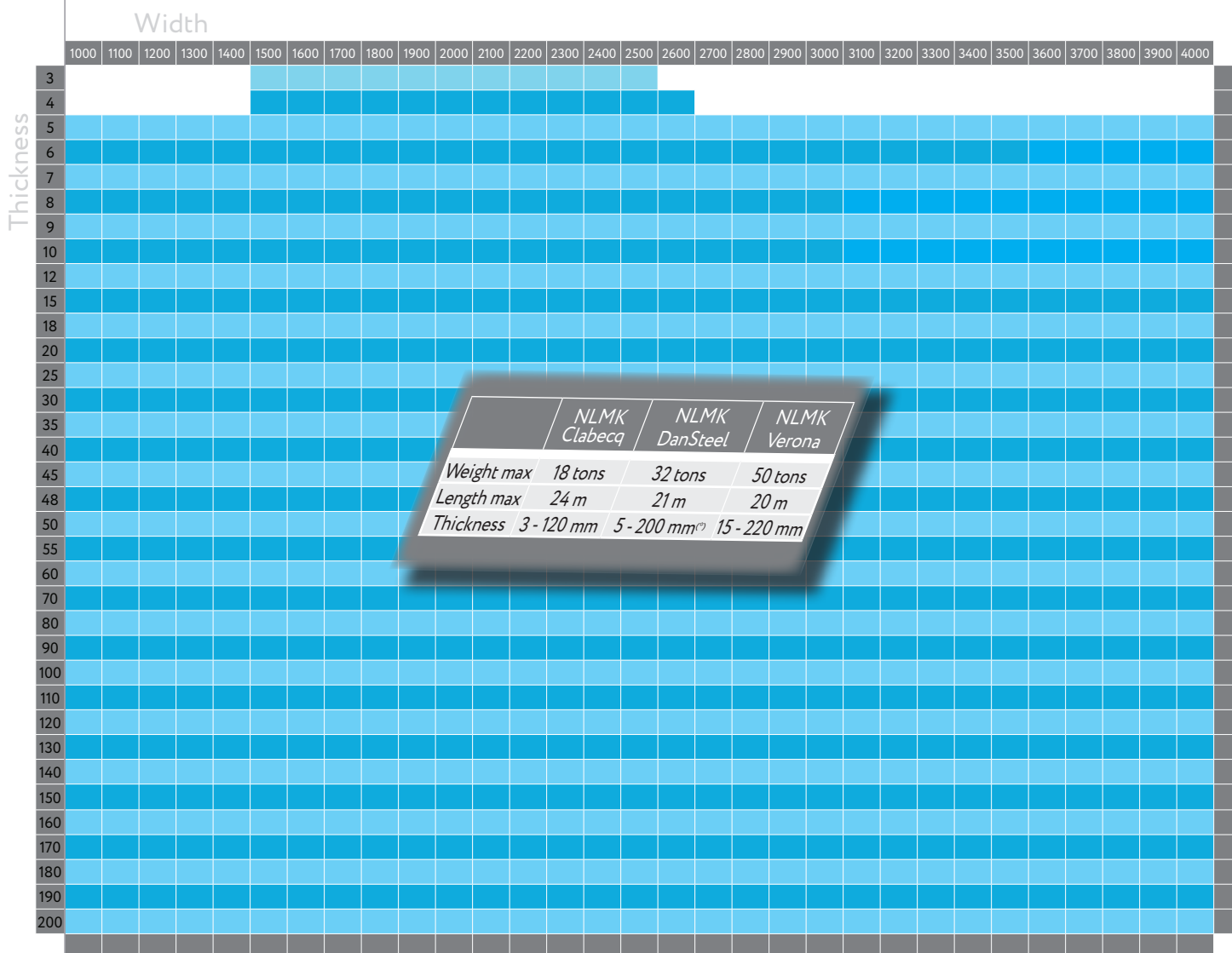
The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Dimensional Program

NLMK Europe - Plate offers an incomparable range of dimensions. Thanks to its plant configurations, it can deliver its steels as hot rolled plates, forged plates or forged bars.

## 1 Hot Rolled Steel Plates

The following table gives an indication of the dimensional capabilities of our production mills. For the specific dimensional mix of the steel and the grade of your choice, please consult the information on the datasheet or contact your sales representative.



<sup>(\*)</sup> 203 mm is available, 220 mm is coming soon

Note : dimensions outside standard program : please enquire our sales department.

## 2 Forged Plates

The coloured cells of this table indicate the possible dimensional mix (thickness/width).  
The maximum length depends on the net weight of the output ingot (20-50 tons)

		Width																							
		1000	1100	1200	1300	1400	1500	1600	1650	1700	1800	1900	2000	2100	2200	2250	2300	2400	2500	2600	2700	2800	2900		
Thickness	151																							151	
	200																								200
	250																								250
	300																								300
	350																								350
	400																								400
	450																								450
	500																								500
	550																								550
	600																								600

Vertical labels in the table: "Output ingot: 20 / 50 tons net" (repeated in columns 1500, 2000, 2500)

## 3 Forged Bars

The coloured cells of this table indicate the possible dimensional mix (thickness/width).  
The maximum length depends on the net weight of the output ingot (13/16/19/19,5/24/25/28,5/45 tons)

		Width																							
		1000	1100	1200	1300	1400	1500	1600	1650	1700	1800	1900	2000	2100	2200	2250	2300	2400	2500	2600	2700	2800	2900		
Thickness	361																							361	
	400																							400	
	500																							500	
	600																							600	
	700																							700	
	800																							800	
	900																							900	
	1000																							1000	
	1100																							1100	
	1200																							1200	
	1300																							1300	

Text labels in the table: "Output ingot" (row 400, column 2000), "13/16/19/19,5/24/25/28,5/45 ton net" (row 600, column 1500-2000)

**IMPORTANT:** the thickness of 1300mm is reached for tool steels and engineering steels. See the specific data sheet for more details

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Structural Steels

## 1 Steel description and applications



As a result of joining the forces of NLMK Clabecq, NLMK DanSteel A/S and NLMK Verona into one unique division, we offer one of the largest range of thickness in structural steels.

Our long experience in these steels is another advantage, as we can meet most of your technical requirements.

For a long time, we have proven our know-how in the following sectors:

- earthmoving, mining and quarrying machinery
- mechanical construction
- structural steelwork
- oil & gas storage tanks
- wind energy
- etc.

## 2 Available grades

NLMK Europe - Plate can produce steel according to numerous norms like EN, BS, ASTM, CSA, DIN grades. If you don't find a particular grade in this table, please check with your sales representative for the feasibility.

EN 10025-2		Japanese JIS 3106	Canada CSA G40-21	USA ASTM
S235JR	1.0038	SM 400 A	230 G	A283 Gr. A,B,C,D
S235J0	1.0114	SM 400 B		
S235 J2	1.0117	SM 400 C		
S275 JR	1.0044		260 W, WT	A572 Gr. 42
S275 JO	1.0143			A36
S275 J2	1.0145			A573 Gr. 65
S355 JR	1.0045	SM 490 A	350 W, WT	A633 Gr. C,D
S355 JO	1.0553	SS 490 B		
S355 J2	1.0577	SS 490 C		A573 Gr. 70
S355 K2	1.0596	SS 490 YB		
S235 JRC	1.0122			
S235 JOC	1.0115			
S235 J2C	1.0119			
S275 JRC	1.0128			
S275 JOC	1.0140			
S275 J2C	1.0142			
S355 JRC	1.0551			
S355 JOC	1.0554			
S355 J2C	1.0579			
S355 K2C	1.0594			

Our structural steels are also developed to enhance processability:

- laser steels make it possible to cut them with high precision
- cold forming steels optimize the forming properties in order to guarantee an excellent finishing
- normalised rolled for surface critical applications
- thermomechanically controlled rolled for improved weldability

As you sometimes expect more of your steel for outside applications, we also propose special solutions:

- steels with improved resistance to atmospheric corrosion combine strength and inner protection against weathering effects
- floor plates, with their numerous combinations of grades and thicknesses, are an answer for higher security in long-lasting hard weather and utilization conditions
- special steel for fracture critical applications
- steel for harsh weather environments

Whether you are looking for a widespread mix of thicknesses, small quantities in any grade or when you have special requirements, our plates and bars keep each time the same high quality which makes their reputation. Our sales representatives help you to find the most appropriate plates to fulfill your specific requirements. Don't hesitate to contact us.

EN 10025-3		USA ASTM	EN 10025-5		USA ASTM
S275 N	1.0490		S235 J0W	1.8958	
S275 NL	1.0491		S235 J2W	1.8961	
S355 N	1.0545		S355 J0W	1.8959	A588 A,B,C,K
S355 NL	1.0546	A572 Gr. 50	S355 J2W	1.8965	A588 A,B,C,K
S420 N	1.8902	A572 Gr. 60	S355 K2W	1.8967	A588 A,B,C,K
S420 NL	1.8912		S355 J0WP	1.8945	
S460 N	1.8901		S355 J2WP	1.8946	
S460 NL	1.8903				

EN 10025-4		USA ASTM
S275 M	1.8818	
S275 ML	1.8819	
S355 M	1.8823	
S355 ML	1.8834	A945
S420 M	1.8825	
S420 ML	1.8836	A945
S460 M	1.8827	
S460 ML	1.8838	

EN 10025-6		USA ASTM
S690Q/QL/QL1		A514 S
S890Q/QL		
S960Q/QL		

EN 10149-2		USA ASTM
S315 MC	1.0972	
S355 MC	1.0976	A656 Gr. 50
S420 MC	1.0980	A656 Gr. 60
S460 MC	1.0982	
S500 MC	1.0984	A656 Gr. 70

### 3 Dimensions

#### 3.1 Hot rolled steels Main produced steels.

Grades		Hot Rolled Steels	
		Thickness	Delivery Conditions <sup>(1)</sup>
Structural	EN 10025-2	S 235 JR	max. thickness range: 3-220  as rolled (AR), normalized rolled or normalized (N, thermo-mechanically controlled rolled (TM))
		S 235 JO	
		S 235 J2	
		S 275 JR	
		S 275 JO	
		S 275 J2	
		S 355 JR	
		S 355 JO	
		S 355 J2	
		S 355 K2	
Cold forming	EN 10149-2	S 235 JRC	3-50  normalized rolled or normalized (N)
		S 235 J2C	
		S 275 J2C	
		S 355 JOC	
		S 355 J2C	
		S 355 K2C	
		S 355 MC	
		S 420 MC	
		S 460 MC	
		S 500 MC	
		S 550 MC	5-16  thermo-mechanically controlled rolled

(1) agreed at the time of the order

Grades			Hot Rolled Steels		
			Thickness	Delivery Conditions <sup>(1)</sup>	
Weldable Fine Grain	EN 10025-3	S 275 N	3 - 220	normalized rolled or normalized (N)	
		S 275 NL			
		S 355 N			
		S 355 NL			
		S 420 N			
		S 420 NL			
	EN 10025-4	S 460 N	3 - 150	thermomechanically controlled rolled (TM)	
		S 460 NL			
		S 275 M	3 - 50		
		S 275 ML			
		S 355 M	3 - 100		
		S 355 ML			
		S 420 M			
		S 420 ML			
EN 10025-5	S 460 M	8 - 40	as rolled (AR), normalized rolled or normalized (N)		
	S 460 ML				
	S 500 M				
	S 500 ML				
	S 355 JOWP	3 - 12			
	S 355 J2WP	3 - 150 <sup>(1)</sup>			
S 235 JOW					
S 235 J2W					
S 355 JOW					
Atmospheric Corrosion Resistance	EN 10025-5	S 355 J2W	5-30	as rolled (AR), normalized rolled or normalized (N)	
		S 355 K2W			
		S 420 JOW			
		S 420 J2W			
		S 420 K2W			5 - 25
		S 460 JOW			
S 460 J2W					
S 460 K2W					

#### 3.2 Forged Plates & Forged Bars

Grades		Forged Plates			Forged Bars		
		Thickness	Delivery Conditions		Thickness	Delivery Conditions	
			As rolled	Normalized		As rolled	Normalized
Structural	EN 10025-2	S 185	x	x	361-1000	x	x
		S 235 JR	x			x	
		S 235 JO	x	x		x	x
		S 235 J2		x			x
		S 275 JR	x			x	
		S 275 JO	x	x		x	x
		S 275 J2		x			x
		S 355 JR	x			x	
		S 355 JO	x	x		x	x
		S 355 J2		x			x
		S 355 K2	x	x		x	x

### 4 Elementary precautions

As the properties of structural steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and

in the technical guides before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Laser Cutting Steels



## 1 Steel description and applications

Laser steels are designed to meet the stringent requirements of thermal and automated cutting. They were especially developed to ensure a perfect laser cutting.

Due to their chemical composition, optimised surface quality and improved flatness, the laser cutting steels offer cost-effective advantages such as:

- cutting speed increase
- excellent cut quality
- easy tailored blanking

Laser steels are suitable for galvanizing. The weldability is excellent, independently from the welding technology used.

## 2 Available grades

Laser cutting steels are available in accordance with following standards:

- EN 10025 (S 235, S 275, S 355)
- EN 10149 (S355MC, S420MC, S460MC, S500MC)

## 5 Dimensions

Grades	Thickness (mm)	Width (mm)	Length (mm)
Type S 235 JR/JO/J2	8 - 25	max 2730	max 15000
S 275 JR/JO/J2	8 - 25		max 15000
Type S 355 JR/JO/J2/K2	8 - 25		max 15000
Type S 355MC	8 - 20		max 15000
Type S 420MC	8 - 20		max 15000
Type S 460MC	8 - 20		max 15000
Type S 500MC	8 - 16		max 15000

Note: for other grades and sizes, please enquire our sales department

## 3 Delivery conditions

This steel is delivered at least in thermomechanically controlled rolled conditions.

## 4 Technical characteristics

This kind of steel is guaranteed with:

- low SILICON content: Si ≤ 0.04%
- SULPHUR content: S ≤ 0.008%
- PHOSPHORUS content: P ≤ 0.025%

### Surface Properties

Laser steels have an improved surface quality which leads to a constant and optimum cutting speed. The surface quality is in accordance with EN 10163-2 Class B3.

### Tolerances

Thickness tolerances are in accordance with EN 10029 Class A, unless otherwise agreed. Flatness tolerances can be in accordance with EN 10029 Class S. We guarantee this flatness before, during and after the cutting.

### Packaging (optional)

Waterproof paper wrapping.

# Steels with improved resistance to atmospheric corrosion



## 1 Steel description and applications

Our weathering steels are produced with a good balanced presence of copper and chromium and can be efficiently integrated in many industrial, architectural or artistic projects. Their structure enables a good regular self regenerating protection layer on the surface. They combine inner high strength with nice natural brown aspect. Their resistance and their aspect make them a cost-effective solution, especially for outdoor use, with or without painting.

We produce numerous grades for a large panel of applications:

- steel frame structures
- bridges
- façades
- sculptures
- containers
- contemporary interiors



## 2 Standards and technical specifications

	A	B
Standard	EN 10025-5 / 04	
Grades	S355 J0WP S355 J2WP	S235 J0W S235 J2W S355 J0W S355 J2W S355 K2W S 420 J0W S 420 J2W S 420 K2W S 460 J0W S 460 J2W S 460 K2W
Delivery conditions	in as rolled conditions, normalized rolled or normalized	
Chemical specifications	phosphorus level: 0.20-0.60%	phosphorus: max 0.025%
Advantages	enhanced weathering protection	higher toughness good weathering protection
Dimensions	according to standard	according to mill capabilities

## 3 Elementary precautions

As the properties of these steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and

in the technical guides before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Floor Plates

## 1 Steel description and applications

Thanks to its four stand continuous finishing mill, NLMK Clabecq produces floor plates in an unrivalled range of sizes and steel grades. That unique combination makes them perfect in all circumstances and in all environments.

**Their specific shape gives them undisputed advantages:**

- maximise anti-slip properties, especially in greasy and outdoor environments
- resistant to continuous passing
- long lasting in hard weather and utilization conditions
- supports common impacts

**The floor plates of NLMK Clabecq are mainly made for:**

- building applications
- ship and offshore platforms decks
- stairways
- mobile bridges, dock levellers
- etc.

### Tear Plates Type 1



Pattern

Length = 31 mm  
Width = 10 mm  
Height = 1-2 mm

### Tear Plates Type 2



Pattern

Length = 26 mm  
Width = 9,4 mm  
Height = 1-1,7 mm

## 2 Available grades

GRADE	DELIVERIES CONDITIONS*
<b>EN</b>	in as rolled conditions, normalized rolled, normalized or thermomechanical controlled rolled conditions
S235 JR/JO/J2	
S275 JR/JO/J2	
S355 JR/JO/J2/K2	
S420MC	
S460MC	
<b>Shipbuilding qualities</b>	
Grade A, B, D, E	
Grade A(H)36, B(H)36, D(H)36, E(H)36	
<b>ASTM</b>	
A36	
A283 Grade A, B, C, D	
A572 Grade 50 type 1	

\* depending on the steel and width



### 3 Dimensional program

Width																						
Thickness		1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	1930	2000	2100	2200	2300	2400	2500	2600	2700	2730	
	3																					
4																						4
5																						5
6																						6
7																						7
8																						8
9																						9
10																						10
12																						12
20																						20
25.4																						25.4
		1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	1930	2000	2100	2200	2300	2400	2500	2600	2700	2730	

Note : the following table gives an indication of the dimensional capabilities of our production mills. Dimensions outside standard program : please enquire our sales department.

### 4 Elementary precautions

As the properties of these steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and

in the technical guides before using advanced techniques for cutting,welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Offshore Steels



## 1 Steel description and applications

Offshore materials are used in the harsh environments around the world such as the North Sea and the Gulf of Mexico.

They are specifically developed to use low level alloy additions in order to give superior properties, reducing the carbon content and CEV.

They are delivered with low temperature impact properties, ultrasonic inspection and enhanced mechanical properties compared to the EN10025 materials.

The type of applications for offshore materials are: oil and gas platforms, spars, FPSO constructions, jackets (both in the oil & gas and wind sectors) and subsea components.

## 2 Dimensions

Group	EN10225:2009	Thickness max(mm)
1	S355G2+N	20
1	S355G3+N	40
1	S355G5+M	20
1	S355G6+M	40
2	S355G7	90 (+N) / 60 (+M)
3	S355G8	90 (+N) / 60 (+M)
2	S355G9	90 (+N) / 60 (+M)
3	S355G10	90 (+N) / 60 (+M)
2	S420G1	60 (+M)
3	S420G2	60 (+M)
2	S460G1	60 (+M)
3	S460G2	60 (+M)

Grade	EN10225:2009	Thickness max(mm)
50	API 2H	100
50	API 2MT1	100
50	API 2W	63.5
60	API 2W	63.5

## 3 Technical characteristics

Plates are supplied according to both the API and EN standard requirements. However, options and supplements need to be agreed for each order, if necessary.

For plates that are delivered according to EN10225:2009 in the +N condition, the Prequalified Weldability packages (according to Annex E) are already granted for thickness up to 90 mm.

Furthermore, the prequalification packages are also approved by NORSOK for thickness up to 80 mm.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Shipbuilding Steels



## 1 Steel description and applications

Thanks to its knowledge of the specific needs of the shipbuilding sector, NLMK Europe - Plate delivers steel plates in the proper time and place, fully integrating the strict requisites for a particular use in this sector.

It produces these plates in accordance with relevant national and international standards (Lloyd's Register, American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, Germanischer Lloyd, RINA, Russian Maritime Register of Shipping, ASTM A 131, etc.)

The plates of NLMK Europe - Plate are designed for the following applications:

- commercial ships (container vessels, specialized vessels)
- passengers vessels (Cruise & Ferries Vessels, Yachts)
- military ships
- submarines
- etc.

For improved working conditions, the plates can be supplied shot blasted and primed.

## 2 Available grades\*

Lloyd's Register	DNV GL	Bureau Veritas	American Bureau of Shipping	RINA	Russian Maritime Register of Shipping	ASTM A131
A	A B D E	A	A	A	A	A
B		B	B	B	B	B
D		D	D	D	D	D
E		E	E	E	E	E
AH 27 S						
DH 27 S						
EH 27 S						
AH 32	A 32	AH 32	AH 32	AH 32	A 32	AH32
DH 32	D 32	DH 32	DH 32	DH 32	D 32	DH32
EH 32	E 32	EH 32	EH 32	EH 32	E 32	EH32
AH 36	A 36	AH 36	AH 36	AH 36	A 36	AH36
DH 36	D 36	DH 36	DH 36	DH 36	D 36	DH36
EH 36	E 36 + F 36	EH 36	EH 36 + F 36	EH 36	E 36	EH36 + FH40
AH 40°	A 40	AH 40	AH40°	AH 40	A 40	AH40
DH 40°	D 40	DH 40	DH40°	DH 40	D 40	DH40
EH 40°	E 40 + F 40	EH 40	EH40°	EH 40	E 40	EH40 + FH40
	A420				F 32	
	D420				F 36	
	E420				F 40	
	2-4					
	4-4					

\*depending on the mill

### 3 Technical and dimensional characteristics

STANDARD	GRADE	PLATE THICKNESS (MM)	DELIVERY CONDITIONS <sup>o</sup>
LR NV BV	Grade A, B, D, E	3 - 150	According to the agreement, shipbuilding plates can be delivered in following conditions: - as rolled conditions - normalized rolled conditions - thermomechanically controlled rolled conditions - normalized condition
	Grade A(H)32, D(H)32, E(H)32		
	Grade A(H)36, D(H)36, E(H)36		
	Grade A(H)40, D(H)40, E(H)40	5 - 60	
ABS GL	Grade A, B, D, E	3 - 150	
	Grade A(H)32, D(H)32, E(H)32		
	Grade A(H)36, D(H)36, E(H)36		
	Grade A(H)40, D(H)40, E(H)40	5 - 60	
ASTM A 131	Grade A, B, D, E	6,36 - 150	
	Grade AH32, DH32, EH32		
	Grade AH36, DH36, EH36		
	Grade A(H)40, D(H)40, E(H)40	5 - 60	

<sup>o</sup>unless otherwise agreed at the time of the order/according to classification society approval

### 4 Elementary precautions

As the properties of these steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and

in the technical guides before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Boiler Plate and Pressure Vessel Steels



## 1 Steel description and applications

We offer carbon and alloy steels enabling manufacturers to produce large high-pressure vessels. Our range varies from medium plates of small thickness, produced by NLMK Clabecq or NLMK DanSteel A/S, to very thick bars forged by NLMK Verona. They meet the requirements of a variety of relevant national and international standards.

Our steels find their way in the following applications :

- storage tanks, storage spheres
- pressure vessels
- boilers
- heat exchangers
- gas turbines

These steel grades are characterized by yield strengths from maximum 235 N/mm<sup>2</sup> to minimum 460 N/mm<sup>2</sup> and by good weldability.

The fine-grain structural steel grades are suitable for mechanical forming and excellent welding.



## 2 Available grades

We produce all major standards: EN, BS, ASTM and ASME.

Europe				India	Japan	
EN 10028-2	EN 10028-3	EN 10028-4	EN 10028-5	IS 2002	JIS G 3115	JIS G 3103
P 235 GH				Gr.1	SPV 235	SB 410
				Gr.2 A		
P 265 GH						
	P 275 NH			Gr.2 B		
	P 275 NL1					
	P 275 NL2					
16 Mo3						SB450M
P 295 GH					SPV 315	SB 450
13 Cr Mo 4-5						
P 355 GH	P 355 N	11 Mn Ni 5-3	P 355 M		SPV 355	SB 480
	P 355 NH	13 Mn Ni 6-3				
	P 355 NL1		P 355 ML1			
	P 355 NL2		P 355 ML2			
			P 420 M			
			P 420 ML1			
			P 420 ML2			
			P 460 M			
	P 460 NH					
	P 460 NL1		P 460 ML1			
	P 460 NL2		P 460 ML2			

U.K.	U.S.A.
BS1501	ASTM/ ASME
151	A 285
Gr. 360, 400, 430	Gr. A, B, C, D
161	
Gr. 360, 400, 430	
154	
Gr.360 E,400 E,430E	
164	
Gr. 360, 400	
223	A 516
Gr. 460, 490	Gr.55,60,65,70
224	A 537
Gr.400,430,460,490	Class 1
	A 612
225	A 662
Gr. 490	Gr. A, B, C
	A387
	Gr. 11 cl.2
	A 387
	Gr. 12 cl.2
	A 662
	Gr. A, B, C

### 3 Technical & dimensional characteristics

All the hereunder grades are available as hot rolled steel plates. A remark mentions if they are available in another form.

	Grades	Remark	Thickness	Delivery conditions	
High temperature	P 235 GH	Also as forged plates or forged bars	HR plates : 3 - 220 Forged plates : 150 - 250 Forged bars : 361 - 1000	Normalized rolled or normalized	
	P 265 GH				
	P 295 GH				
	P 355 GH	Also as forged plates or forged bars			
Fine grain weldable	P 275 NH	Also as forged plates or forged bars	HR plates : 3 - 220 Forged plates : 150 - 250 Forged bars : 361 - 1000	Normalized rolled or normalized	
	P 275 NL1				
	P 275 NL2				
	P 355 N				
	P 355 NH	Also as forged plates or forged bars	3 - 150	Thermomechanically controlled rolled	
	P 355 NL1				
	P 355 NL2				
	P 460 NH				
	P 460 NL1				
	P 460 NL2 <sup>(*)</sup>				
	P355 M				
	P355 ML1				
	P355 ML2				
	P420 M				
	P420 ML1				
	P420 ML2				
P460 M					
P460 ML1					
P460 ML2					
transport hazardous material	P 400 NGJ4				
Carbon steel with low and intermediate resistance to tension	ASTM A 285 Gr. C		3 - 50	As rolled	
Lower & moderate temperature	low and intermediate resistance to tension	ASTM A 516 Gr. 55 ASTM A 516 Gr. 60 ASTM A 516 Gr. 65 ASTM A 516 Gr. 70		up to 250	As rolled or normalized
	high resistance to tension	ASTM A 612		8 - 25,40	Normalized rolled or normalized
Alloyed	Mo	16 Mo 3	Also as forged plates	3 - 250	Normalized
		13CrMo4-5 <sup>(*)</sup>	Also as forged plates	5 - 60	Norm. & tempered
		12CrMo9-10		100 - 250	Quenched & tempered
		ASTM A387 Gr.11 CL.1			
		ASTM A387 Gr.11 CL.2			
		ASTM A387 Gr.12 CL.1			
ASTM A387 Gr.12 CL.2 <sup>(*)</sup>					
C - Mn - Si steels	ASTM A537 CL.1		4,76 - 100	Normalized	
	ASTM A537 CL.2		10-50	Quenched & tempered	

(\*) '13CrMo4-5' and 'ASTM A387 Gr.12 CL. 2' are equivalent steels <sup>(\*)</sup> by agreement

### 4 Technical precautions

As the properties of boiler plates and pressure vessels steels differs from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions

given in the norms and in the technical guides before using advanced techniques for cutting, welding, forming, welding, etc... Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# High carbon steels



## 1 Steel description and applications

As a result of its expertise in forging and rolling high carbon steel plates, NLMK Europe - Plate is supplying its plates in accordance with a variety of relevant national and international standards.

The high carbon steels are characterized by their higher hardness level, and good machinability.

All these steels are preferred for applications with elevated temperature and where long life service is required, as:

- tools steels
- dies
- forgings
- etc.

## 2 Available grades

Heat Treatable Steels		
Europe		U.S.A.
EN 10083-2	EN 10083-2	ASTM A830
C 35 (E/R)	C 35	1033
C 40 (E/R)	C 40	to
C 45 (E/R)	C 45	1046

Note : (E) = S 0,025% (R) = S = 0,020 - 0,040%

## 3 Dimensions

GRADE	Hot Rolled Steels Thickness	Forged Plates Thickness	Forged Bars <sup>(*)</sup> Thickness	Delivery Conditions
C 35	4 - 200	from 200mm and above	upon request	As rolled
C 35 E				As rolled
C 35 +N				Normalized or normalized rolled
C 35 E+N				Normalized or normalized rolled
C 40	5 - 200			As rolled
C 40 E				As rolled
C 40 +N				Normalized or normalized rolled
C 40 E+N				Normalized or normalized rolled
C 45	7 - 200			As rolled
C 45 E				As rolled
C 45 E+N				Normalized or normalized rolled
C 45 +N				Normalized or normalized rolled
C 45 +S	30 - 200			Stress relieved

(\*) max. length: 12m

## 4 Technical precautions

As the properties of boiler plates and pressure vessels steels differs from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions

given in the norms and in the technical guides before using advanced techniques for cutting, welding, forming, welding, etc...

Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Line pipe Steels

## 1 Steel description and applications

NLMK Plate Europe offers premium plates thermomechanically rolled in order to produce pipes with excellent mechanical properties. Thanks to its extended research, it has gained a valuable experience in delivering high quality line pipe steels.

They are available for *sweet* or *sour service* application levels PH3 and PH5. They meet the highest requirements needed for all the constraints of these applications.

The pipeline plates of NLMK Europe Plate are suitable for liquid or gas transport in:

- onshore pipelines
- deepwater environment
- fittings

Thermomechanical rolling enables the production of API grades plates in a thickness range from 6,35 to 50,00 mm with stringent mechanical properties.



## 2 Standards and dimensions\*

ISO 3163:2012 / API 5L:2012

PSL1		PSL2					
NON SOUR SERVICE		NON SOUR SERVICE				SOUR SERVICE	
Grade	Thickness Max	Grade	Thickness Max	Grade	Thickness Max	Grade	Thickness Max
X52 or L360	50 mm (1.96")	X52N or L360N	40 mm (1.57")	X52M or L360M	30 mm (1.18")	X52MS or L360MS	25,4 mm (1")
X60 or L415	30 mm (1.18")	X60N or L415N	25,4 mm (1")	X60M or L415M	25,4 mm (1")	X60MS or L415MS	25,4 mm (1")
X65 or L450	25,4 mm (1")	X65N or L450N	25,4 mm (1")	X65M or L450M	25,4 mm (1")	X65MS or L450MS	25,4 mm (1")
X70 or L485	20,6 mm (0.81")	X70N or L485N	20,6 mm (0.81")	X70M or L485M	20,6 mm (0.81")	X70MS or L485MS	19,05 mm (0.75")
				X80M or L555M	20,6 mm (0.81")	X80MS or L555MS	15,9 mm (0.62")

(\*) subject to approval by NLMK Europe - Plate depending on grade, dimensions and technical specifications.



## 3 Technical precautions

As the properties of the line pipe steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and in the technical guides before using

advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.



# Tool Steels Engineering Steels

## 1 Steel description and applications

We offer a large range of tool and engineering steels which can easily combine toughness with conditioning, shaping and cutting. All these steels respond adequately to your needs of manufacturing hard and resistant tools and moulds. Whether you need them to withstand impact loading or to enable sharp cutting edges, they are made to ensure performance and durability.

As a result of the right balance in alloys, our tool steels support high temperature without deformation. Their structure enhances their polishing properties.

Thanks to the flexibility of our tools, we can deliver quality tool steels as blocks (raw or machined) or as round bars (raw or peeled). Our extremely large range of thickness renders steels that meet your highest expectations.

We propose numerous grades for a large panel of applications:

- plastic molding dies
- die-casting die blocks
- blanking and stamping dies
- metal cutting tools
- extrusion tools
- hammers and sledges

## 2 Standards

DIN	Chemical	DE	SS	AISI	JAPAN
W.1.7131 / W.1.7147	16 MnCr5 / 20MnCr5		2511-08		
	18NiCrMo5				
	20MnCrMo2				
	34CrNiMo6		2541-03		
	36CrNiMo4				
	39NiCrMo5				
W.1.6562	40NiCrMo7			E4340	
W.1.7225	42CrMo4		2244-05	4140	
W.1.7218	25CrMo4			4130	JIS SCCrM1, JIS SCM 2
				420 Grade-C	
Wnr.1.1730	C45+S or +N	Extra Nr.45	1672-08	1148 /1045	S45C
Wnr.1.2820	C55+S or +N	Extra Nr.55			
W.1.2363	X100CrMoV5	PM5		A2	SKD12
W.1.2842	90MnCrV8	Z1B		O2	
W.1.2343	X37CrMoV5-1	WP5		H11	
W.1.2344	X40CrMoV5-1	WP5V		H13	SKD61
W.1.2367	X38CrMoV5-3	DM3X			
W.1.2714	55NiCrMoV7	A50		L6	
				S7	
W.1.2083	X40Cr14	HC50		420 modified	SUS420
Wnr.1.2085				420F	
Wnr.1.2311	40CrMnNiMo8-6-4	MCM		P20	
W.1.2312	40CrMnNiMo8-6-4	MCMS		P20+S	
W.1.2316	X38CrMo16	R65			
W.1.2738	40CrMnNiMo8-6-4			P20+Ni	
W.1.2767	X45NiCrMo4	VNC4		6F7	SNCM 2



### 3 Technical characteristics

Category	Steel grade	Hot Rolled plates	Forged blocks	Round forged bars	Delivery conditions	Dimensional Program	Certificates
Plastic mould steels	W.1.2311	X	X	X	Hardened and tempered	A1/A2	3.1 US SEP 1921 Class 3 from 20 to 1250 mm (rem: hot rolled steel plates in C45/C55 +N -> class 3 C/c)
	W.1.2312	X	X	X			
	V:1200	X	X				
	V:1300	X	X				
	W.1.2738	X	X	X			
	AISI-S7	X	X	X			
	V:1400	X	X		Hardened and tempered/ Annealed		
	W.1.2083	X	X	X			
	W.1.2085	X	X	X			
	V:15STAINLESS	X	X				
	W.1.2316	X	X	X			
	V:16/V:16 ESR	X	X				
V:16 HH	X	X		Hardened and tempered Hardened and tempered/ Annealed			
W.1.2767	X	X	X				
W.1.1730 - C45 +S +N	X	X	X	Natural/Annealing/Normalized			
Hot work steels	W.1.2714	X	X	X	Hardened and tempered/ Annealed		
	W.1.2343		X	X	Annealing EFS according to specification NADCA		
	W.1.2344		X	X			
	W.1.2367		X	X			
Cold work steels	W.1.1820 - C55 +S +N	X	X	X	Natural/Annealing/Normalized		
	W.1.2363 - AISI A2	X	X	X	Annealing		
	W.1.2842	X	X	X			
High polishing precision mould steel ESR	V:1400 ESR	X	X		Hardened and tempered		
	W 1.2738		X				
	W 1.2083		X			Annealing	
	W 1.2343		X			EFS	
	W 1.2344		X			EFS	
Steel for quenching & tempering	C45-C50-C55	X	X		Natural/Annealing/Normalized		
	SAE4140/4142	X	X				
	42CrMo4	X	X				

G01\_2018/01\_E

### 4 Dimensional program

A1			
Hot Rolled Plates Forged Rolled Plates		Round Forged Bars	All
Thickness (mm)	Width (mm)	Diameter (mm)	Length
20-150	2000/2500	190-1200	Based on ingot size (25 or 50 t)
150-600	1500/2000		
A2			
Forged blocks		Round Forged Bars	All
Thickness(mm)	Width (mm)	Diameter (mm)	Length
600-1300	1200-2500	190-1200	Based on ingot size (from 24 to 50t)

Can reach up to 1300mm thickness on blocks

### 5 Technical precautions

As the properties of these steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and

in the technical guides before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# High Yield Strength Steels



## 1 Steel description and applications

NLMK Europe - Plate produces plates for pressure vessel applications and structural qualities with high strength point in accordance with relevant international standards.

These steel grades are characterised by a minimum yield strength of 380 to 700 N/mm<sup>2</sup>, by good weldability and high resistance to brittle cracking.

These fine-grain steel grades offer excellent cold-forming properties and are often used for special applications at low temperatures (-20°C and below).

Based on its unique combination of a quarto reversing mill and a four stand continuous finishing line, NLMK Plate Europe is supplying these qualities mainly used for :

### “P”- qualities :

- pressure vessels
- boilers

### “S”- qualities:

- bridges and steel buildings
- heavy machinery
- road and mining machines (bulldozer, excavator, lift truck)
- special trucks

## 2 Available grades in the major standards

Europe					Germany	U.K.	Canada	Japan	U.S.A.
EN 10028-3	EN 10028-5	EN 10025-3	EN 10025-4	EN 10149-2	DIN 17102	BS 4360	CSA G40-21	JIS	ASTM
					St E 380		400 W, WT	(3101) SS 540	A 572
					W St E 380				Gr. 60, 65
					T St E 380				
					E St E 380				A 633
									Grade E
	P 420 M	S 420 N	S 420 M	S 420 MC	St E 420				A 537 Cl 2
	P 420 ML 1	S 420 NL	S 420 ML		W St E 420				
	P 420 ML 2				T St E 420				
					E St E 420				
								(3115) SPV 450	A 656
	P 460 M	S 460 N	S 460 M		St E 460	55 C		(3106) SM 570	Gr. 60, 70, 80
P 460 NH		S 460 NL	S 460 ML	S 460 MC	W St E 460	55 EE			
P 460 NL 1	P 460 ML 1				T St E 460				
P 460 NL 2	P 460 ML 2				E St E 460				
				S 500 MC					



### 3 Technical & dimensional characteristics

GRADE	PLATE THICKNESS (mm)	DELIVERY CONDITIONS <sup>(*)</sup>
P 420 M	3 - 60	Thermomechanical controlled rolled
P 420 ML1	3 - 60	
P 420 ML2		
P 460 M	3 - 60	
P 460 ML1	3 - 60	
P 460 ML2		
P 460 NH	3 - 150	Normalized
P 460 NL1		
P 460 NL2 <sup>(**)</sup>		
S 420 N	3 - 200	Normalized or normalized rolled
S 420 NL		
S 460 N	3 - 150	
S 460 NL		
S 420 M	3 - 100	Thermomechanical controlled rolled
S 420 ML		
S 460 M		
S 460 ML		
S 500 M	8 - 40	
S 500 ML		
S 420 MC	5 - 16	Thermomechanical controlled rolled
S 420 JOW	5 - 30	
S 420 J2W		
S 420 K2W		
S 460 MC	5 - 16	Thermomechanical controlled rolled
S 460 JOW	5 - 25	
S 460 J2W		
S 460 K2W		
S 500 MC	5 - 16	Thermomechanical controlled rolled

(\*) Unless otherwise agreed at the time of the order    (\*\*) by agreement

### 4 Technical precautions

As the properties of these steels differ from the one to the other, it is recommended to observe elementary precautions and to strictly follow the instructions given in the norms and in the technical guides

before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.



The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Extra High Strength Structural Steels

## Quend®



### 1 Applications

Quend is extra high strength structural steel produced as quenched and tempered.

Quend is recommended for the following applications:

- truck chassis
- trailers
- lifting and hoisting equipment
- crane booms
- handling equipment
- stabilising support
- undercarriage

### 2 Dimensions

Quend is currently supplied in the following range:

	Thickness	Width
Quend 700	4 - 64 mm	1500 - 3100 mm
Quend 900	4 - 35 mm	
Quend 960	4 - 30 mm	
Quend 1100	4 - 12 mm	

For more information, please check our website or contact your local NLMK Clabecq representative.

### 3 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 - 1100 MPa	12% min
Quend 960	960 MPa min	980 - 1150 MPa	12% min
Quend 1100	1100 MPa min	1250 - 1500 MPa	10% 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
Quend 1100	35 J	30 J	27 J

Transverse testing according to EN 10025 option 30.  
Thickness < 12 mm sub-sized charpy V specimen have been used.

Testing according to EN 10025.

#### Carbon equivalent

	Carbon equivalent, typical values, %		
	Plate thickness	CEV <sup>(1)</sup>	CET <sup>(2)</sup>
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 - 35mm	0,57	0,36
Quend 960	4 - 30 mm	0,57	0,36
Quend 1100	4 - 12 mm	0,57	0,36

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

#### Cold forming

Quend is very well suited for cold forming operations.

	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
Quend 1100	t < 6.0	3.5	4	10	10
	6 ≤ t < 12	4.5	5	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, variations in springback are 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.

### 4 Delivery conditions

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



## 5 Heat treatment

The mechanical properties of Quend has been obtained by quenching and tempering. For not losing the guaranteed properties of Quend, the plate should not be used in applications requiring hot working and service temperatures above 550 °C for Quend 700, Quend 900 and Quend 960. In the case of Quend 1100, service temperature should be kept below 200°C.

## 6 Ultrasonic testing

Ultra sonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks and porosity. In thickness from 8 mm and up, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

## 7 Technical precautions

Due to the properties of Quend, it's recommended to observe elementary precautions and to strictly follow the instructions given in the norms and in the technical guides before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

For more information regarding welding, cold forming and machining, please consult the respective manuals with technical recommendations on [qt.nlmk.com](http://qt.nlmk.com)

# Abrasion Resistant steels

## Quard®



### 1 Applications

Quard is a martensitic abrasion resistant steel. Its very high resistance to abrasive wear and impact makes it ideal where long service life is required.

Quard is mainly recommended for the following applications:

- mining and earthmoving machinery
- buckets, knives, grapples
- dumper bodies and on road tipplers
- refuse haulers, scrap containers
- screeners
- crushing and pulverizing equipment
- scrap presses
- cement drum mixer barrels
- feeders, skips, screw conveyors
- conveyors belts
- slurry pipe systems

### 2 Dimensions

Quard at present is supplied in the following range:

	Thickness	Width
Quard 400	4 - 50 mm	1500 - 3100 mm
Quard 450	3,2 - 64 mm	
Quard 500	4 - 64 mm	
Quard 550	6 - 30 mm	

### 3 Technical characteristics

#### Hardness guarantee

	Hardness	
Quard 400	HBW = 370 - 430	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.
Quard 450	HBW = 420 - 480	
Quard 500	HBW = 470 - 530	
Quard 550	HBW = 520 - 580	

#### Other mechanical properties (typical values)

	Charpy-V notch impact test (longitudinal at -40°C)	Yield Strength (MPa)	Tensile Strength - Transverse - (MPa)	Elongation A5 (%)
Quard 400	50 J	1160	1300	10
Quard 450	45 J	1250	1400	10
Quard 500	30 J	1500	1700	8
Quard 550		1575	1750	7

#### Carbon equivalent

Carbon equivalent, typical values, %			
	Plate thickness	CEV <sup>(1)</sup>	CET <sup>(2)</sup>
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
Quard 450	40,01 mm - 50 mm	0,64	0,36
	3,2 - 7,99 mm	0,41	0,30
	8 - 20 mm	0,41	0,32
	20,01 - 40 mm	0,56	0,37
Quard 500	40,01 - 64 mm	0,64	0,40
	4 - 20 mm	0,56	0,39
	20,01 - 40 mm	0,60	0,42
Quard 550	40,01 - 64 mm	0,70	0,45
	6 - 30 mm	0,68	0,46

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

#### Cold forming

Quard is very well suited for cold forming operations.

	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
Quard 500	t > 20.0	5.0	6.0	12	14
	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, 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.

### 4 Delivery conditions

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



## 5 Heat treatment

Quard receives its properties by quenching and when applicable by subsequent tempering. The properties of the delivery condition can not be retained after exposure at service or preheating temperatures above 250 °C. Quard is not intended for any further heat treatment.

## 6 Ultrasonic testing

Ultrasonic testing (UT), is applied to secure the plate from discontinuities like inclusions, cracks and porosity. In thickness from 8 mm and up, all plates are UT tested and controlled against class S2, E2, according to EN 10160.

## 7 Technical precautions

Due to the properties of Quard, it's recommended to observe elementary precautions and to strictly follow the instructions given in the norms and in the technical guides before using advanced techniques for cutting, welding, forming, etc... Our technical experts are at your disposal for any request or requirement.

For more information regarding welding, cold forming and machining, please consult the respective manuals with technical recommendations on [qt.nlmk.com](http://qt.nlmk.com)



# Ingots



## 1 Steel description and applications

We offer a large range of ingots for forging for the following markets:

- Oil & gas : flanges, valve bodies, valve balls, shells, B.O.P., spool body, pipes etc.
- Wind power generation : flanges, shafts, gear wheels, pinions, etc.
- Shipbuilding : shafts, fin shafts, Intermediate shafts, rudder stocks, etc.
- Heavy engineering : pinion shaft, forging bars, etc.
- Nuclear Power : turbine shafts, rotors, heat exchanger parts, flanges, etc.
- Automotive : plastic molds, lift arm, bearings, etc.

## 2 Main grades

The following table lists the most demanded grades and is in no case exhaustive. Please contact your representative for all the possible grades.

Category	Steel grade	FORGED BLOCKS	FORGED BARS
Case hardening steel	16MnCr5, 17NiCrMo6.4, 18NiCrMo7.6 ...	x	x
Heat treatable steel	C40/45, 28Mn6, A350 LF2, 42CrMo4, 34CrNiMo6, 30CrNiMo8 ...	x	x
Creep resistance steel	F11, F12, F22, F5, F9, F91, F92 ...	x	x
Martensitic stainless steel	X10Cr13, X20Cr13, X46Cr13, X22CrMoV12.1 ...	x	x
Ball and roller bearing steel	100Cr6, 100CrMo7 ...	x	x
Tool steel	1.2065, 1.2343, 1.2344, 1.2714, 1.2311, 1.2312 ...	x	x
Micro alloy steel	A694 F50/F70, A350LF6 ...	x	x
Nitriding steel	41CrAlMo7, 34CrAlNi7 ...	x	x
Tough at subzero steel	ASTM A350 LF3, LF5 ...	x	x
Pressure Vessel steel	P355, P420, P460, 16Mo3 ...	x	x

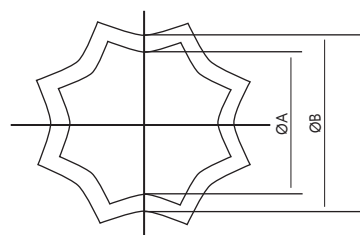
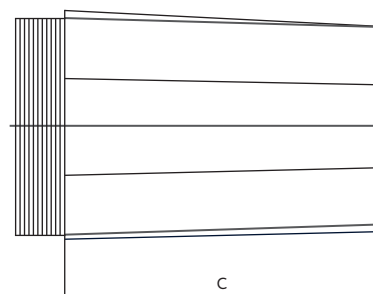


### 3 Dimensional program

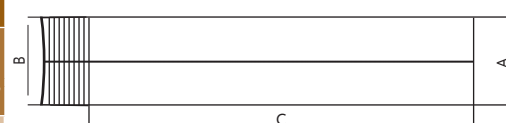
Round ingots										
Type	N° sides	A Ø (mm)	C (mm) **	Weight with hot top (kg)		Step	Net weight without hot top (kg)		N° ingots	
				Min	Max		Min	Max		
400	Ø 400	Tondo	397	4550	4500		-	4250		12
T04	Ø 480		490	4700	7200		-	6600		8
T05	Ø 500		510	4700	7600		-	7000		8
T06	Ø 600		610	4640	10000	11000	500	9300	10300	6
T07	Ø 700		700	4600	13000	14500	500	12100	13600	4
T08	Ø 800		810	4600	17500	19000	500	16300	17800	3-4
T08	Ø 800		810	4100	15000	17000	500	13800	15800	4
T09	Ø 900		880	4750	22500	24000	500	21100	22600	3
T10	Ø 1000		990	4560	26500	29100	500	24500	27100	2
T10	Ø 1000		990	4200	24000	27000	500	22000	25000	3
C12	Ø1200	24	1208	3200	28000	30500	500	25000	27500	2
T12	Ø 1200	Tondo	1210	3180	28000	31000	500	25000	28000	2
T12	Ø 1200	Tondo	1210	2400	22000	25000	500	19000	22000	3
C12	Ø 1200	24	1208	3540	33500		-	30500		2
T15	Ø 1500	24	1470	3150	35000	41000	500	31000	37000	2
T15	Ø 1500	24	1470	3300	41500	43000	500	37500	39000	1
C18	Ø 1800	24	1815	3480	53000	81000	500	46500	74500	1



Poligonal ingots										
Type	N° sides	Ingot key (mm)	A Ø (mm)	B Ø (mm) **	C (mm) **	Weight with hot top (kg)		Net weight (kg)		N° ingots
						Min	Max	Min	Max	
P05	8	678	648	706	1420	5000		4200		10
P09	8	818	783	852	1794	9200		7800		6
P12	8	880	812	946	1880	11800		10000		4
P15	8	935	848	1020	2279	12500	15400	10500	13000	4
6	8	994	952	1035	2085	15500		12800		4
P17	8	945	848	1042	2570	17800		15200		4
P21	8	1260	1187	1331	1570	19000	21200	15500	17700	3
P25	8	1272	1187	1358	1970	25300		20700		2
P28	8	1409	1319	1500	1726	25500	27200	20500	22000	2
P30	16	1386	1293	1479	2038	30000		25000		2
P34	8	1424	1319	1530	2017	33800		27500		2
P54	20	1880	1815	1945	2023	50000	54000	42500	46500	1
P64	20	1893	1815	1970	2411	65500		53000		1
P68	20	1990	1800	2140	2150	67500		55000		1
P80	24	2150	1800	2240	2500	79000		62500		1



Square ingots										
Type	N° sides	A (mm)	B (mm)	C (mm)	Weight with hot top (kg)		STEP	Net weight (kg)		N° ingots
					Min	Max		Min	Max	
Q07	4	600	700	1750	6500		-	5750		8
Q17	4	870	970	2030	11100	12500	700	9300	10700	6
Q17	4	870	970	2030	13200	17400	700	11400	15600	4



The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.

# Shot Blasting & Priming

## 1 General description

NLMK Europe - Plate has developed a modern, fully mechanised shot blasting and priming line which can be used for treating its whole range of medium and heavy plates, including floor plates, from 3 mm up.

Shot blasted and primed plates are destined for many applications like vessels, tanks, pipes, handling equipment, frames, bridges or heavy plate mechanical structures.

Using shot blasting and priming prevents spending unnecessary time in the workshop or on site while sand blasting or trying to access difficult parts. Shot blasted and primed plates provide therefore considerable cost savings and improve working conditions.

## 2 Shot blasting

### Advantages:

- clean surfaces
- facilitates and accelerates cutting and welding
- enables a homogeneous and stable priming thanks to its roughness

### Main characteristics :

- one or two sides
- standard of cleanliness after shot blasting: SA 2 ½ as per ISO 8501-1 or SIS 055900

Note: the process is compliant with the requirements of the IMO PSPC (Performance Standard for Protective Coatings)

## 3 Priming

### Advantages:

- preserves plates and parts longer
- enables final coating to adhere strongly

### Main characteristics :

- one or two sides
- airless process
- standard type of paint : epoxy primer, zinc rich epoxy primer or zinc rich ethyl silicate primer; all other priming upon request
- thickness of film 15-25µm and above (depending on the type of paint and the primer manufacturer)

## 4 Standard dimensional program

Thickness	Width	Length	Weight
up to 110 mm	1 - 3,4 m	2 - 20 m	2 tons/m

Upon request, plates with dimensions outside this standard dimensional program can be shotblasted and primed.

# Quality System Certifications

## 1 System certifications

Type	Certification reference	NLMK Clabecq	NLMK DanSteel A/S	NLMK Verona
Quality management	ISO 9001:2015	X (AFNOR)	X (DNVGL)	X (DNV)
Environmental management	ISO 14 001 : 2015	X (AFNOR)	X (DNVGL)	X (DNV)
Energy management	DS EN ISO 50001: 2011		X (DNVGL)	In progress
Safety management	OHSAS 18001:2008		X (DNVGL)	X (DNV)

## 2 Mill homologations

Organism	Type	NLMK Clabecq	NLMK DanSteel A/S	NLMK Verona
Bureau Veritas	Industrial Approval – survey mode I	X		In progress
	Approval certificate for Materials		X	
Lloyd's Register	Quality Scheme	X		
	Approval of Steel plates		X	
	Steel making and semi-finished products			X
ABS	Quality Assurance Program	X	X	
	13-MMPQA-703		X	
	Casting facility and process approval			X
TÜV	AD-Merkblatt & P.E.D.	X	X	X
	CE approval		X	X
	P.E.D.		X	
AFNOR	NF-ACIER	X	X	X
	CE approval	X		
	AQAP 2110	X		
Deutsche Bahn	Q1-Lieferant	X	X	
Germanischer Lloyd	Rules for Metallic Materials	X	X	X
RINA	Certificate of approval	X	X	
DNV	Class Pt.2	X	X	X
	P.E.D.			X
Russian Maritime Register of Shipping	Certificate of approval	X	X	
NKK	Approval of manufacturing process			X

The elements in the datasheet are given for information only and reflect the information known at the time of publishing. This document is intended to give a general guideline for the purchasing and use of the steels only. The transmitter of this document doesn't accept any liability for any error or omission in the content of this document. Values and components quoted must not be considered as being guaranteed unless specifically confirmed separately in writing.