NLMK Europe - Plate

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NLMK Europe - Plate

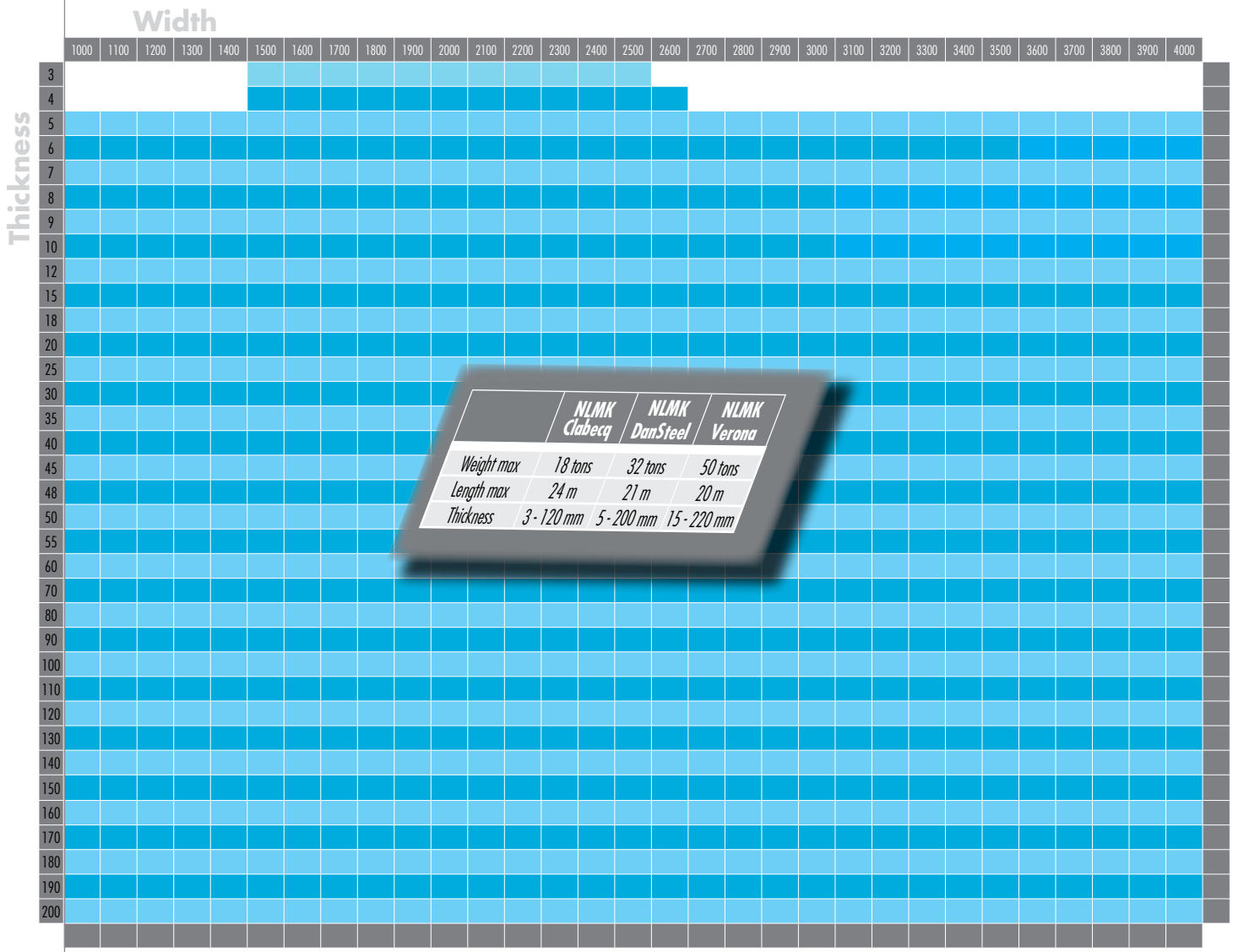
# Dimensional Program

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.

Largest range of thickness 3-1500 mm

## 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.

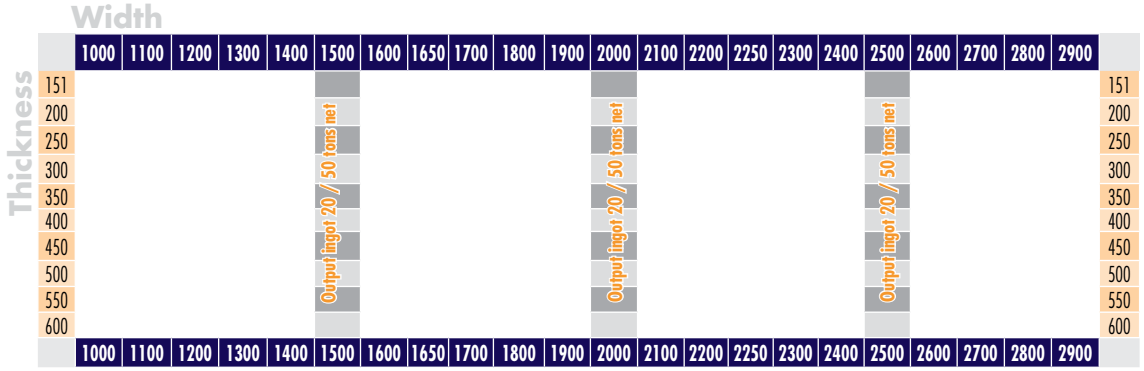



| | NLMK Clabecq | NLMK DanSteel | NLMK Verona |
|---|---|---|---|
| Weight max | 18 tons | 32 tons | 50 tons |
| Length max | 24 m | 21 m | 20 m |
| Thickness | 3 - 120 mm | 5 - 200 mm | 15 - 220 mm |

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

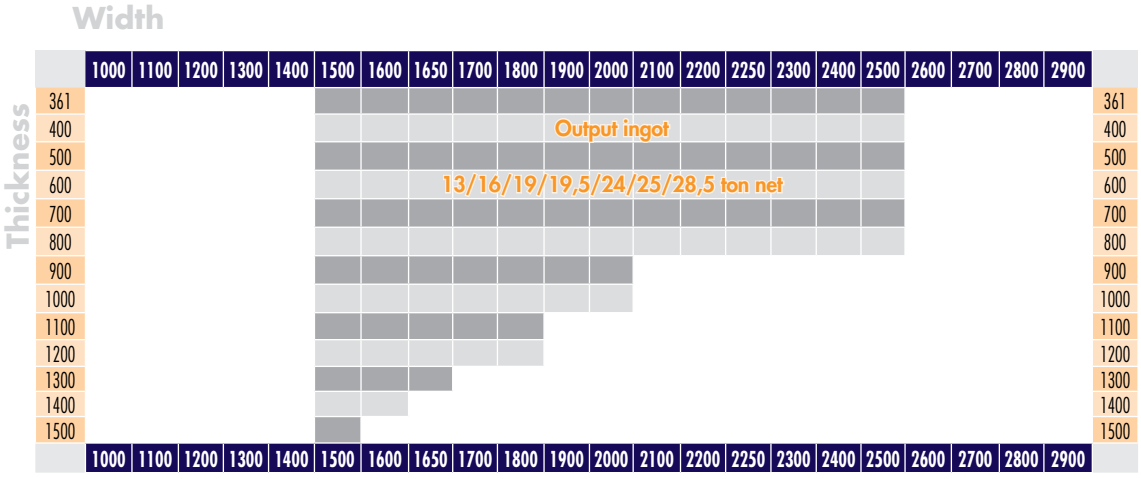
## 2 Forged Plates

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)




## 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 tons)




IMPORTANT: the thickness of 1500mm is reached for tool steels and engineering steels. See the specific data sheet for more details



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NLMK Europe - Plate

# 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.

Very large range of thickness 3-1000 mm

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.

## 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 J0 | 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 J0 | 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 J0C | 1.0115 | | | |
| S235 J2C | 1.0119 | | | |
| S275 JRC | 1.0128 | | | |
| S275 J0C | 1.0140 | | | |
| S275 J2C | 1.0142 | | | |
| S355 JRC | 1.0551 | | | |
| S355 J0C | 1.0554 | | | |
| S355 J2C | 1.0579 | | | |
| S355 K2C | 1.0594 | | | |

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

| EN 10025-6 | USA ASTM |
|---|---|
| S690Q/QL/QL1 | A514 S |
| 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 |
| S550 MC | 1.0986 | A656 Gr. 80 |

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# 3 Dimensions

## 3.1 Hot rolled steels

Main produced steels.

| Grades | | | Hot Rolled Steels | |
|---|---|---|---|---|
| | | | Thickness | Delivery Conditions (1) |
| Structural | EN 10025-2 | S 235 JR | max. thickness range: **3-200** Please contact us for the feasibility! | as rolled (AR), normalized rolled or normalized (N), thermomechanically controlled rolled (TM) |
| | | S 235 J0 | | |
| | | S 235 J2 | | |
| | | S 275 JR | | |
| | | S 275 J0 | | |
| | | S 275 J2 | | |
| | | S 355 JR | | |
| | | S 355 J0 | | |
| | | S 355 J2 | | |
| | | S 355 K2 | | |
| Cold forming | | S 235 JRC | 3-30 | normalized rolled or normalized (N) |
| | | S 235 J2C | | |
| | | S 275 J2C | | |
| | | S 355 J0C | | |
| | | S 355 J2C | | |
| | | S 355 K2C | | |
| | EN 10149-2 | S 355 MC | 3-20 | thermomechanically controlled rolled (TM) |
| | | S 420 MC | 5-16 | |
| | | S 460 MC | | |
| | | S 500 MC | | |
| | | S 550 MC | | |

(1) agreed at the time of the order

| Grades | | | Hot Rolled Steels | |
|---|---|---|---|---|
| | | | Thickness | Delivery Conditions (1) |
| Weldable Fine Grain | EN 10025-3 | S 275 N | 3 - 150 | normalized rolled or normalized (N) |
| | | S 275 NL | | |
| | | S 355 N | | |
| | | S 355 NL | | |
| | | S 420 N | 3 - 120 | |
| | | S 420 NL | | |
| | | S 460 N | 3 - 50 | |
| | | S 460 NL | | |
| | EN 10025-4 | S 275 M | 3 - 50 | thermomechanically controlled rolled (TM) |
| | | S 275 ML | | |
| | | S 355 M | 3 - 50 | |
| | | S 355 ML | | |
| | | S 420 M | | |
| | | S 420 ML | | |
| | | S 460 M | | |
| | | S 460 ML | | |
| Steels With Improved Atmospheric Corrosion Resistance | EN 10025-5 | S 355 J0WP | 3 - 12 | as rolled (AR), normalized rolled or normalized (N) |
| | | S 355 J2WP | | |
| | | S 235 J0W | 3 - 80 (1) | |
| | | S 235 J2W | | |
| | | S 355 J0W | | |
| | | S 355 J2W | | |
| | | S 355 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 | 151-360 | x | x | 361-1000 | x | x |
| | | S 235 JR | | x | | | x | |
| | | S 235 J0 | | x | x | | x | x |
| | | S 235 J2 | | | x | | | x |
| | | S 275 JR | | x | | | x | |
| | | S 275 J0 | | x | x | | x | x |
| | | S 275 J2 | | | x | | | x |
| | | S 355 JR | | x | | | x | |
| | | S 355 J0 | | 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.



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NLMK Europe - Plate

# 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 (S 355 MC, S 420 MC, S 460 MC, S 500 MC)

## 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.

## 5 Dimensions

| Grades | Thickness (mm) | Width (mm) | Length (mm) |
|---|---|---|---|
| Type S 235 JR/J0/J2 | 8 - 25 | max 2730 | max 15000 |
| S 275 JR/J0/J2 | 8 - 25 | | max 15000 |
| Type S 355 JR/J0/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

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NLMK Europe - Plate

# 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<br>S355 J2WP | S235 J0W<br>S235 J2W<br>S355 J0W<br>S355 J2W<br>S355 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<br>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.

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NLMK Europe - Plate

# 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 (0.03937"-0.07874")

### *Tear Plates Type 2*

Pattern
Length = 26 mm
Width = 9,4 mm
Height = 1-1,7 mm (0.03937"-0.06692")

## 2 Available grades

| GRADE | DELIVERIES CONDITIONS* |
|---|---|
| **EN** | in as rolled conditions, normalized rolled, normalized or thermomechanical controlled rolled conditions |
| S235 JR/J0/J2 | |
| S275 JR/J0/J2 | |
| S355 JR/J0/J2/K2 | |
| S460MC | |
| **Shipbuilding qualities** | |
| Grade A, B, D, E | |
| Grade A(H)36, B(H)36, D(H)36, E(H)36 | |
| **ASTM** | |
| 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 | | | | | | | | | | | | | | | | | | | | | 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.



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NLMK Europe - Plate

# 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.

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NLMK Europe - Plate

# 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 | Det Norske Veritas | Germanischer Lloyd | Bureau Véritas | American Bureau of Shipping | RINA | Russian Maritime Register of Shipping | ASTM A131 |
|---|---|---|---|---|---|---|---|
| A | NV A | GL-A | A | A | A | A | A |
| B | NV B | GL-B | B | B | B | B | B |
| D | NV D | GL-D | D | D | D | D | D |
| E | NV E | GL-E | E | E | E | E | E |
| AH 27 S | | | | | | | |
| DH 27 S | | | | | | | |
| EH 27 S | | | | | | | |
| AH 32 | NV A32 | GL-A 32 | AH 32 | AH 32 | AH 32 | A 32 | AH32 |
| DH 32 | NV D32 | GL-D 32 | DH 32 | DH 32 | DH 32 | D 32 | DH32 |
| EH 32 | NV E32 | GL-E 32 | EH 32 | EH 32 | EH 32 | E 32 | EH32 |
| AH 36 | NV A36 | GL-A 36 | AH 36 | AH 36 | AH 36 | A 36 | AH36 |
| DH 36 | NV D36 | GL-D 36 | DH 36 | DH 36 | DH 36 | D 36 | DH36 |
| EH 36 | NV E36 | GL-E 36 | EH 36 | EH 36 | EH 36 | E 36 | EH36 |
| AH 40 | NV A40 | GL-A 40 | AH 40 | AH40 | AH 40 | A 40 | AH40 |
| DH 40 | NV D40 | GL-D 40 | DH 40 | DH40 | DH 40 | D 40 | DH40 |
| EH 40 | NV E40 | GL-E 40 | EH 40 | EH40 | EH 40 | E 40 | EH40 |
| | NV A420 | | | | | | |
| | NV D420 | | | | | | |
| | NV E420 | | | | | | |
| | NV 2-4 | | | | | | |
| | NV 4-4 | | | | | | |

*depending on the mill

## 3 Technical and dimensional characteristics

| STANDARD | GRADE | PLATE THICKNESS (MM) | DELIVERY CONDITIONS * |
|---|---|---|---|
| LR NV BV | Grade A, B, D, E | 3 - 120 | 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 - 50 | |
| ABS GL | Grade A, B, D, E | 3 - 100 | |
| | 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 - 50 | |
| ASTM A 131 | Grade A, B, D, E | 6,36 - 100 | |
| | Grade AH32, DH32, EH32 | | |
| | Grade AH36, DH36, EH36 | | |
| | Grade A(H)40, D(H)40, E(H)40 | 5 - 50 | |

*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.

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NLMK Europe - Plate

# 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 minimum 235 N/mm² to minimum 460 N/mm² and by good weldability.

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

4 m wide*

Project management upon request

* Not in all conditions

## 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 NL 1 | | | | | |
| | P 275 NL 2 | | | | | |
| 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 NL 1 | | P 355 ML 1 | | | |
| | P 355 NL 2 | | P 355 ML 2 | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | P 420 M | | | |
| | | | P 420 MI1 | | | |
| | | | P 420 MI2 | | | |
| | | | P 460 M | | | |
| | P 460 NH | | | | | |
| | P 460 NL1 | | P 460 ML1 | | | |
| | P 460 NI2 | | P 460 ML2 | | | |

| U.K. | U.S.A. |
|---|---|
| BS1501 | ASTM/ ASME |
| 151<br>Gr. 360, 400, 430 | A 285<br>Gr. A, B, C, D |
| 161<br>Gr. 360, 400, 430 | |
| 154<br>Gr. 360E, 400E, 430E | |
| 164<br>Gr. 360, 400 | |
| 223<br>Gr. 460, 490 | A 516<br>Gr. 55, 60, 65, 70 |
| 224<br>Gr. 400, 430, 460, 490 | A 537<br>Class 1 |
| | A 612 |
| 225<br>Gr. 490 | A 662<br>Gr. A, B, C |
| | A387<br>Gr. 11 cl.2 |
| | A 387<br>Gr. 12 cl.2 |
| | A 662<br>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 - 150<br>Forged plates : 150 - 250<br>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 - 150<br>Forged plates : 150 - 250<br>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 | | |
| | | P 355 NL1 | | | |
| | | P 355 NL2 | | | |
| | | P 460 NH | | 3 - 40 | Normalized |
| | | P 460 NL1 | | | |
| | | P 460 NL2 | | | |
| | | P355 M | | 3 - 25, 40 | Thermomechanically controlled rolled |
| | | P355 ML1 | | | |
| | | P355 ML2 | | | |
| | | P420 M | | | |
| | | P420 ML1 | | | |
| | | P420 ML2 | | | |
| | | P460 M | | | |
| | | P460 ML1 | | | |
| | | P460 ML2 | | | |
| | transport hazardous material | P 400 NGJ4 | | 5 - 15 | Normalized |
| Carbon steel with low and intermediate resistance to tension | | ASTM A 285 Gr. C | | 3 - 50 | As rolled |
| Lower and moderate temperature | low and intermediate resistance to tension | ASTM A 516 Gr. 55 | | up to 250 | As rolled or normalized |
| | | ASTM A 516 Gr. 60 | | | |
| | | ASTM A 516 Gr. 65 | | | |
| | | ASTM A 516 Gr. 70 | | | |
| | 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 (*) | | 5 - 60 | Norm. & tempered |
| | | | Also as forged plates | 100 - 250 | Quenched & tempered |
| | | 12CrMo9-10 | | 140 - 250 | Norm. & tempered/ Quenched & tempered |
| | | ASTM A387 Gr.11 Cl. 1 | | | Norm. & tempered/ Quenched & tempered |
| | | ASTM A387 Gr.11 Cl. 2 | | | Norm. & tempered/ Quenched & tempered |
| | | ASTM A387 Gr.12 Cl.1 | | | Norm. & tempered/ Quenched & tempered |
| | | ASTM A387 Gr.12 Cl. 2 (*) | | | Norm. & tempered/ Quenched & tempered |
| C - Mn - Si steels | | ASTM A537 Cl. 1 | | 4,76 - 100 | Normalized |
| | | ASTM A537 Cl. 2 | | 140 - 250 | Quenched & tempered |

(*) '13CrMo4-5' and 'ASTM A387 Gr.12 Cl. 2' are equivalent steels

## 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.



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NLMK Europe - Plate

# 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 (*) Thickness | Delivery Conditions |
|---|---|---|---|---|
| C 35 | 4 - 120 | 120-360 | 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 - 120 | | | 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 - 120 | | | As rolled |
| C 45 E | | | | As rolled |
| C 45 E+N | | | | Normalized or normalized rolled |
| C 45 +N | 7 - 150 | 150-360 | | Normalized or normalized rolled |
| C 45 +S | 30 - 150 | | | 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.

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NLMK Europe - Plate

# 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.

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

- onshore pipelines
- deepwater environment
- fittings

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.

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

In line US testing

Own HIC laboratory

## 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.

∅ 16"- 34"

## 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.

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NLMK Europe - Plate

# 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 SCCrM 1 , 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 to1250 mm (rem: hot rolled steel plates in C45/C55 +N -> class 3 C/c) |
| | W.1.2312 | X | X | X | | | | |
| | W.1.2738 | X | X | X | | | | |
| | AISI-S7 | X | X | X | Hardened and tempered/Annealed | B | | |
| | W.1.2083 | X | X | X | | | | |
| | W.1.2085 | X | X | X | | | | |
| | W.1.2316 | X | X | X | | | | |
| | W.1.2767 | X | X | X | Annealing | | | |
| | W.1.1730 - C45 +S +N | X | X | X | Natural/Annealing/Normalized | A1/A2 | | |
| Hot work steels | W.1.2714 | X | X | X | Hardened and tempered/Annealed | A1/A2 | | |
| | W.1.2343 | | X | X | Annealing EFS according to specification NADCA | B | | |
| | 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 | A1/A2 | | |
| | W.1.2363 - AISI A2 | X | X | X | Annealing | B | | |
| | W.1.2842 | X | X | X | | | | |

(*) Please refer to the table underneath to find the dimensional program to apply to the selected steel.

## 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) |
| 150-400 | 1500/2000 | | |

| A2 | | | |
|---|---|---|---|
| FORGED BLOCKS | | ROUND FORGED BARS | ALL |
| Thickness(mm) | Width (mm) | Diameter (mm) | Length |
| 400-1200 | 1500-2500 | 190-1200 | Based on ingot size (from 24 to 50t) |

| B | | | |
|---|---|---|---|
| FORGED BLOCKS | | ROUND FORGED BARS | ALL |
| Thickness (mm) | Width (mm) | Diameter (mm) | Length |
| 200-1200 | 1500-2500 | 190-1200 | Based on ingot size (from 24 to 50t) |

Can reach up to 1200mm 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.



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NLMK Europe - Plate

# 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/mm², 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 | | | | | |
| | | | | S 550 MC | | | | | |



## 3 Technical & dimensional characteristics

| GRADE | PLATE THICKNESS (MM) | DELIVERY CONDITIONS* |
|---|---|---|
| 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 - 40 | Normalized |
| P 460 NL1 | | |
| P 460 NL2 | | |
| S 420 N | 3 - 120 | Normalized or normalized rolled |
| S 420 NL | | |
| S 460 N | 3 - 60 | |
| S 460 NL | | |
| S 420 M | 3 - 60 | Thermomechanical controlled rolled |
| S 420 ML | | |
| S 460 M | | |
| S 460 ML | | |
| S 420 MC | 5 - 16 | Thermomechanical controlled rolled |
| S 460 MC | | |
| S 500 MC | 5 - 20 | |

(*) Unless otherwise agreed at the time of the order

## 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.





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NLMK Europe - Plate

# Extra High Strength Structural Steels Quend®

Quend®
HIGH YIELD STRENGTH STEEL

www.quend.me

## 1 Applications

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

Quend is recommended for the **following applications:**

- truck chassis
- lifting and hoisting equipment
- handling equipment
- trailers
- crane booms
- 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 - 30 mm | |
| Quend 960 | 4 - 25,4 mm | |

## 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 | 14 % min |
| Quend 960 | 960 MPa min | 980 - 1150 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.
Thickness < 12 mm subsized charpy V specimen have been used.

Testing according to EN 10025.

### 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 - 64 mm | 0,45 | 0,30 |
| Quend 900 | 4 - 30 mm | 0,57 | 0,36 |
| Quend 960 | 4 - 25,4 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

### Cold forming

Quend is very well suited for cold forming operations.
Quend complies with the S690QL, S890QL and S960QL bending requirements but offer even closer R/t ratios:

Minimum recommended R/t ratio when bending of Quend

| | 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 mm | 2.0 | 3.0 | 8 | 9 |
| | t ≥ 20.0 mm | 3.0 | 4.0 | 9 | 10 |
| Quend 900 | t ≤ 8.0 | 2,5 | 3,0 | 9 | 10 |
| | 8 < t < 20 mm | 3,0 | 4,0 | 9 | 10 |
| Quend 960 | t ≤ 8.0 | 2.5 | 3.0 | 9 | 10 |
| | 8 < t < 20 mm | 3.0 | 4.0 | 9 | 10 |
| | t ≥ 20.0 mm | 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, 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.

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## 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.

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NLMK Europe - Plate

# Abrasion Resistant steels Quard®

Quard®
ABRASION RESISTANT STEEL

www.quard.me

## 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 tippers
- 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 - 40 mm | 1500 - 3100 mm |
| Quard 450 | 4 - 40 mm | |
| Quard 500 | 4 - 40 mm | |

NLMK Clabecq carries on the extension of its dimensional program to propose a thickness range from 3 to 60mm

## 3 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)

| | Charpy-V notch impact test (longitudinal at -40°C) | Yield Strength (MPa) | Tensile Strength - Transverse - (MPa) | Elongation A5 (%) |
|---|---|---|---|---|
| Quard 400 | 40 J | 1160 | 1300 | 10 |
| Quard 450 | 35 J | 1250 | 1400 | 10 |
| Quard 500 | 30 J | 1500 | 1700 | 8 |

### Carbon equivalent

| Carbon equivalent, typical values, % | | | |
|---|---|---|---|
| | Plate thickness | CEV(1) | CET(2) |
| Quard 400 | 4,01 - 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 | 4,01 - 7,99mm | 0,41 | 0,30 |
| | 8 - 20 mm | 0,41 | 0,32 |
| | 20,01 - 40 mm | 0,56 | 0,37 |
| Quard 500 | 4 - 20 mm | 0,57 | 0,40 |
| | 20,01 - 40mm | 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

### Cold forming

Quard is very well suited for cold forming operations. The minimum recommended R/t ratio when bending of Quard is 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 ≥ 20.00 | 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 ≥ 20.00 | 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 ≥ 20.00 | 7 | 8 | 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.

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## 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 www.quard.me

www.quard.me



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NLMK Europe - Plate

# Ingots

## 1 Steel description and applications

We offer a large range of heavy plates and forged ingots 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

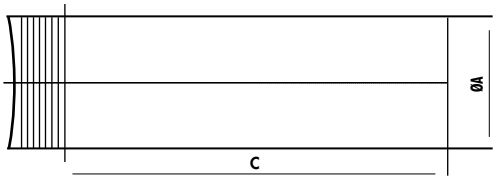
The following table lists the most demanded grades and is in no case exhaustive.
Please contact your representative for all the possible grades.

| 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 |
| Tought at subzero steel | ASTM A350 LF3, LF5 ... | x | x |
| Pressure Vessel steel | P355, P420, P460, 16Mo3 ... | x | x |

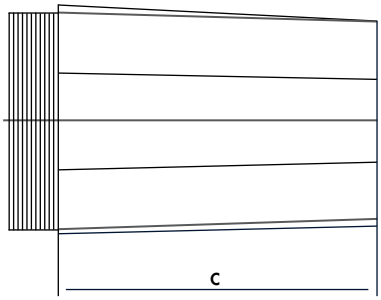


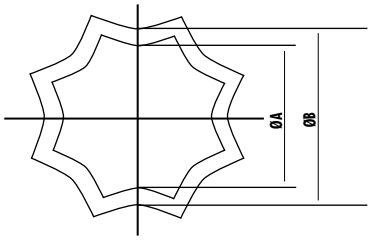
## 3 Dimensional program

| 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 | |
| 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 |

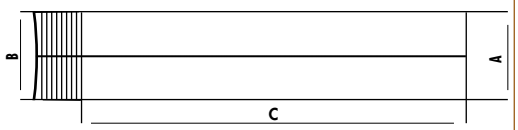



| Poligonal ingots | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Type | N° sides | Ingot key (mm) | A Ø (mm) | B Ø (mm) ** | C (mm) ** | Weight with hot top (kg) | | Net weight (kg) | | N° ingots |
| | | | | | | Min | Max | Min | Max | |
| P05 | 8 | 678 | 648 | 706 | 1420 | 5000 | | 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 | 64500 | | 53000 | | 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 |



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NLMK Europe - Plate

# 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

## 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.

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NLMK Europe - Plate

# Quality System Certifications

## 1 System certifications

| Type | Certification reference | NLMK Clabecq | NLMK DanSteel A/S | NLMK Verona |
|---|---|---|---|---|
| System management | ISO 9001:2008 | X (LRQA) | X (DNV) | X (DNV) |
| Environmental management | ISO 14 001 : 2004 | X (LRQA) | X (DNV) | |
| Energy management system | DS EN ISO 50001: 2011 | | X (DNV) | |
| Safety management system | OHSAS 18001:2008 | | X (DNV) | |

## 2 Mill homologations

| Organism | Type | NLMK Clabecq | NLMK DanSteel A/S | NLMK Verona |
|---|---|---|---|---|
| Bureau Veritas | Industrial Approval – survey mode I | X | X | |
| Lloyd's Register | Quality Scheme | X | X | 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 |
| | QA System (UK) (D) | | X | |
| | CE approval | | | X |
| AFNOR | NF-ACIER | X | | X |
| | CE approval | X | X | |
| Deutsche Bahn | Q1-Lieferant | X | X | |
| Germanischer Lloyd | Rules for Metallic Materials | X | X | X |
| | EP | | X | |
| RINA | Laboratory Recognition Statement | X | X | |
| DNV | Class Pt.2 | X | X | X |
| | 3.1 material certificates | X | X | X |
| | P.E.D. | | | X |
| Russian Maritime Register of Shipping | | X | X | |
| NKK | Approval of manufacturing process | | | X |

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