

# Nickel steel plates

for LNG and LPG industry







## Applications

By liquefying natural gas (LNG) at  $-164\text{ }^{\circ}\text{C}$  its volume is reduced by a factor of more than 600, thus making handling and storage easier and more economical. At these extremely low temperatures standard ferritic structural steels are not suitable anymore, due to lack of sufficient toughness and the risk of brittle fracture. 9% nickel steels achieve the mechanical properties required for building storage tanks and cryogenic pipes used for loading and unloading of LNG tankers and offer a reliable structural integrity down to  $-196\text{ }^{\circ}\text{C}$ .

LPG (liquified petroleum gas) is liquified at ambient temperature under low pressure. It is stored and transported in special tanks made of 5% nickel steels. For those tanks installed on ships we deliver shell plates and heads from a single source.



LPG-tank



LNG-tanks



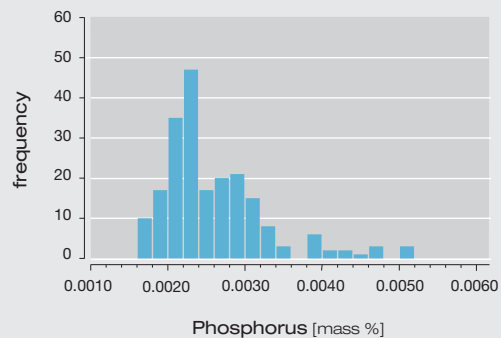
# Quality made by voestalpine Grobblech

The basis for the production of high-quality nickel steel plates are excellent slabs.

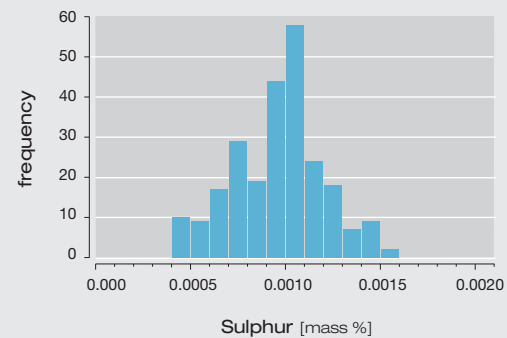
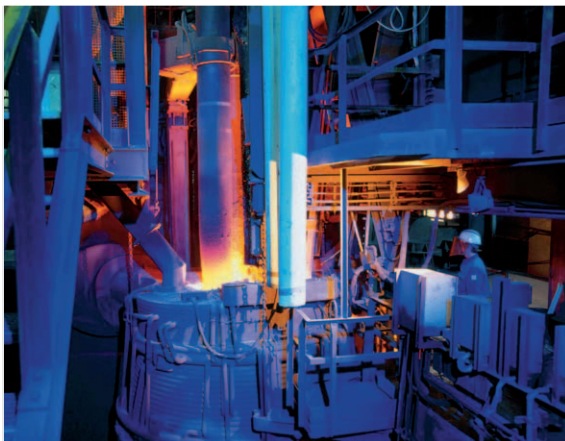
We use continuously cast slabs from our top steel mill at voestalpine Stahl GmbH in Linz.

## Pure steel

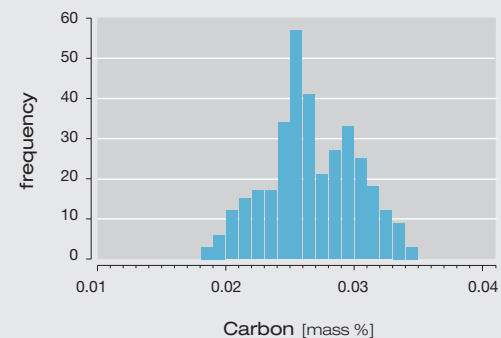
Nickel steels with high purity are produced by LD-process (Linz-Donawitz-process, invented by engineers of voestalpine) with subsequent metallurgical and vacuum treatment. Especially for 9% nickel steels we provide ultra low levels of phosphorus, sulphur and carbon.



LD-process leads to low phosphorus: P max. 50 ppm



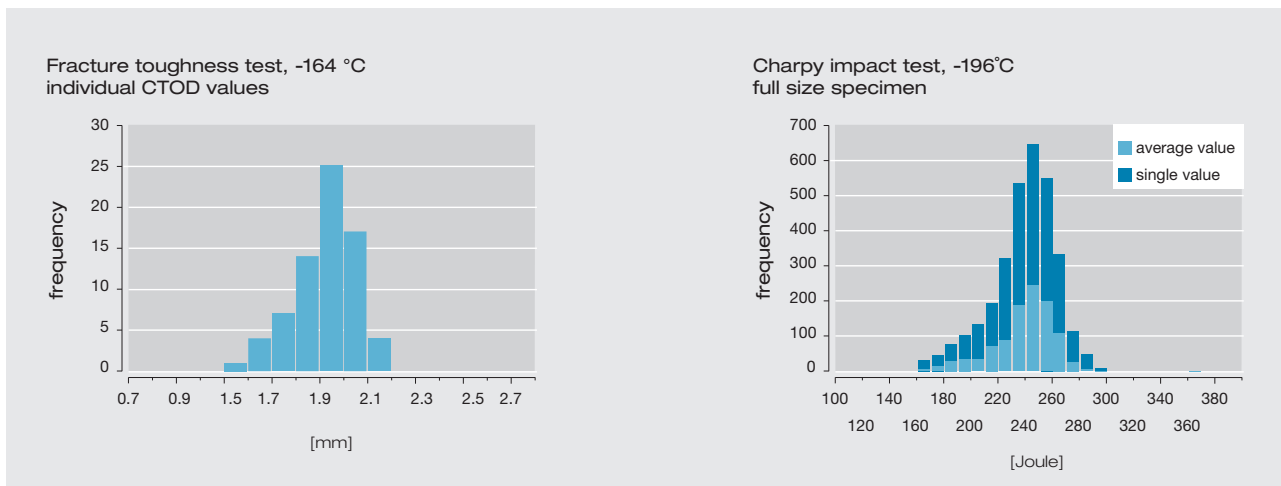
Sophisticated calcium treatment in the ladle furnace for lowest sulphur: S max. 15 ppm



Ultra low carbon for excellent weldability

## Excellent toughness and improved CTOD-values

Our nickel steels provide excellent fracture mechanics test results. The required values in the crack tip opening displacement (CTOD) test were overachieved by far.



## 100% US testing online

Ultrasonic testing is done online and covers 100% of the plate surface. Residual magnetism below 50 Gauss is guaranteed.

## Prefabrication

Nickel steel plates can be offered in prefabricated condition:

- shotblasted or shotblasted & primed
- weld edge preparation: the ultra low carbon content of our Nickel steel plates provides low hardening of the weld edges
- bending of the plates



## Steel grades and standards

| Steel group      | Steel grade       | Standard        |
|------------------|-------------------|-----------------|
| 5% Nickel steels | X12Ni5            | EN 10028-4:2003 |
| 9% Nickel steels | X7Ni9             | EN 10028-4:2003 |
|                  | A / SA 553 Type 1 | ASTM / ASME 553 |

## Dimensions

|                  | Steel group     | Min.     | Max.      | Comment                                                                      |
|------------------|-----------------|----------|-----------|------------------------------------------------------------------------------|
| Thickness        | 5% Nickel steel | 5 mm     | 70 mm     |                                                                              |
|                  | 9% Nickel steel | 5 mm     | 60 mm     |                                                                              |
| Width            |                 | 1,600 mm | 3,800 mm  | extra wide thin plates: up to 2,800 mm for 5 mm thick 9% Nickel steel plates |
| Length           |                 |          | 12,400 mm |                                                                              |
| Weight per plate |                 |          | 10 mt     |                                                                              |

Alternative dimensions on request.

## References

### 9% Nickel steel

| Year      | Project                            | Application            | Destination |
|-----------|------------------------------------|------------------------|-------------|
| 2011-2012 | POLSKIE LNG                        | LNG storage tank       | Poland      |
| 2008-2010 | SKIDKA LNG                         | LNG storage tank       | Algeria     |
| 2008-2009 | GATE Rotterdam, Receiving Terminal | LNG storage tank       | Netherlands |
| 2008      | LANZHOU                            | LNG storage tank       | Spain       |
| 2006-2008 |                                    | Cryogenic storage tank | USA         |
| 2007      | PANIPAT                            | Naphtha cracker        | India       |

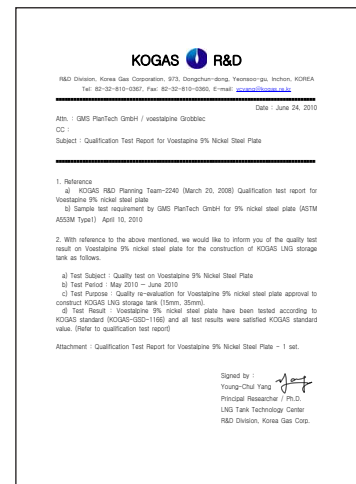
### 5% Nickel steel

| Year      | Application         | Destination |
|-----------|---------------------|-------------|
| 2011-2012 | Ethylene cargo tank | Shanghai    |
| 2007-2009 | Ethylene cargo tank | Italy       |
| 2006-2008 | Ethylene cargo tank | Romania     |
| 2006-2007 | Ethylene cargo tank | Germany     |

## Approvals

voestalpine Grobblech has obtained the top-level approval of KOGAS, the Korean state-owned gas corporation. We are approved by of the following classification companies:

- 5% Nickel steels: Lloyd's Register of Shipping (LRS) / Great Britain, Technischer Überwachungsverein (TÜV) / Germany, Registro Italiano Navale (RINA) / Italy , Germanischer Lloyd (GL) / Germany, American Bureau of Shipping (ABS) / USA, Bureau Veritas (BV) / France
- 9% Nickel steels: Lloyd's Register of Shipping (LRS) / Great Britain, Technischer Überwachungsverein (TÜV) / Germany

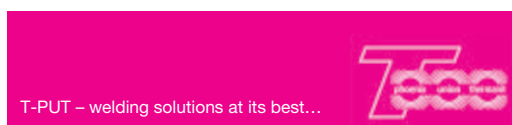


## Your partners for a successful business

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Welding consumables  
 for nickel steels by  
 Böhler Welding Group.  
 Please refer to  
[www.boehler-welding.com](http://www.boehler-welding.com)

## Technically more advanced. Successful together. voestalpine Steel Division – the partner you can trust.

High-quality materials are the basis for our products. We strive to be the best partner for our customers and want to provide them with the best-possible solution. We focus our expertise on two aspects:

The personal aspect, with dedicated and highly competent employees

The technical aspect, with high-quality methods, products and services

The companies in the voestalpine Steel Division and their employees understand partnership to be the following:

- Understanding for their customers' business
- Expertise and reliability
- Responsibility for satisfactory project completion
- Partnerships based on trust

Many years of successful partnerships with our customers prove our point.

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**voestalpine**

ONE STEP AHEAD.