

APPROVAL OF MANUFACTURER CERTIFICATE

Certificate No:
AMMM000014N
Revision No:
3

This is to certify:

That

**Georgsmarienhütte GmbH
Neue neue Hüttenstraße 1, 491246 Georgsmarienhütte,
Niedersachsen, Germany**

is an approved manufacturer of
Steelmaking and Rolled Steel Products

in accordance with
**DNV GL rules for classification – Ships
DNVGL-OS-E302 – Offshore mooring chain, Edition July 2018**

and the following particulars:

Product	Rolled bars intended to be machined into components, Round bars for anchor chain cables, Semi-finished products; Ingots for offshore mooring chain cables
Grades	See page 2
Steelmaking	Electric arc furnace, continuous or ingot cast
Deoxidation	Killed
Fine grain elements	See pages 2 and 3
Delivery conditions	See page 2
Max. diameter	See page 2
Remarks	See particulars of the approval

Manufacturer approved by this certificate is accepted to deliver according to DNV GL, DNV and GL rules. Materials to be applied to DNV GL classed object shall fulfill the material requirements in the applicable DNV GL class rules.

Issued at **Høvik** on **2020-07-13**

for **DNV GL**

This Certificate is valid until **2023-07-02**.

DNV GL local station: **Essen**

Approval Engineer: **Dechun Lou**

Sondre Løken
Head of Section

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Job Id: **263.11-003978-5**
 Certificate No: **AMMM000014N**
 Revision No: **3**

Particulars of the approval

Rolled steel products:

Rolled bars intended to be machined into components ¹⁾²⁾				
Steel type	Steelmaking ³⁾	Fine grain elements	Delivery conditions ⁴⁾	Max. diameter (mm)
Carbon and carbon-manganese	EAF, IC	Al	*)	280
	EAF, CC	Al	*)	110
Alloy	EAF, IC	Al	*)	280
	EAF, CC	Al	*)	110

Remarks:

- 1) Minimum rolling reduction ratio 6:1
- 2) Sampling, inspection and testing requirements shall be according to RU SHIP Pt.2 Ch.2 Sec.6.
- 3) EAF: electric arc furnace; IC: ingot casting; CC: continuous casting.
- 4) *) as rolled or according standard / DNV GL Rules

Round bars for anchor chain cables				
Grades	Steelmaking ¹⁾	Fine grain elements	Delivery conditions ²⁾	Max. diameter (mm)
VL K1, VL K2	EAF, IC	Al	*)	200
	EAF, CC	Al	*)	100
VL K3	EAF, IC	Al or Al+V	*)	130
	EAF, CC	Al or Al+V	*)	100

Remarks:

- 1)EAF: electric arc furnace; IC: ingot casting; CC: continuous casting.
- 2)*) as rolled or according standard / DNV GL Rules

Semi-finished products:

Ingots for offshore mooring chain cables		
Grades ¹⁾	Steelmaking ²⁾	Fine grain elements
R3S, R4, R5	EAF, IC	Al

Remarks:

- 1) For approved material specification see table S1.
- 2) EAF: electric arc furnace; IC: ingot casting.

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Table S1 - Ingots for offshore mooring chain cables - Specification for chemical composition ¹⁾												
Grade		C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Al	N
R3S, R4, R5	Min	.30	-	.50	-	-	1.30	1.30	.20	-	.020	-
	Max	.38	.40	.80	.025	.015	1.70	1.70	.30	.25	.040	.010
R3S, R4, R5	Min	.26	-	.50	-	-	1.80	1.80	.30	-	.020	-
	Max	.34	.40	.80	.025	.015	2.20	2.20	.50	.25	.035	.013

Remarks:

¹⁾ The content of Sn, Sb, As and B may be required. In such cases, the maximum content shall be 0.025% for Sn, 0.020% for Sb, 0.030% (0.040% for R3S and R4) for As and 0.001% for B.