

APPROVAL OF MANUFACTURER CERTIFICATE

Certificate no.:
AMMM000000A
Revision No:
13

This is to certify:

that

SIDENOR ACEROS ESPECIALES, S.L.

**Basauri, Reinosa and Azkoitia plants,
Basauri, Vizcaya,
Spain**

is an approved manufacturer of
Steelmaking and Rolled Steel Products

in accordance with

DNV-OS-E302 – Offshore mooring chain, Edition July 2022
DNV class programme – DNV-CP-0237 Offshore mooring chain and accessories
DNV rules for classification – Ships
DNV-OS-B101 – Metallic materials
DNV class programme – DNV-CP-0243 Rolled steel products – non stainless steel

and the following particulars:

Application area	Steelmaking
Product	Round bars for chain cables, Rolled round bars intended to be machined into components, Semi-finished products; ingots, blooms and billets for forging and rolling stock
Steel type/grades	See page 2 and 3
Manufacturing method	See page 2 and 3
Deoxidation	Killed
Fine grain elements	See pages 2, 3 and 4
Max. thickness/diameter	See page 2 and 3
Heat treatment condition	See page 2
Remarks	See pages 2, 3 and 4

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

Issued at **Hamburg** on **2025-11-13**

This Certificate is valid until **2028-11-15**.

DNV local unit: **Area NB/CMC Iberia**

Approval Engineer: **Dechun Lou**



for **DNV**

This document has been digitally signed and will
therefore not have handwritten signature

Stefan Röhr

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to USD 300 000.

Particular of the approval:

Rolled round bars ¹⁾²⁾⁶⁾ intended to be machined into components (as a substitute for forged bars), Semi-finished products for forging or rolling stock.				
Steel types	Steelmaking ³⁾	Fine grain elements	Heat treatment conditions ⁴⁾	Max. diameter [mm]
Carbon and carbon-manganese	EAF, IC or CC	Al or Al+V	N ⁵⁾	220 ⁵⁾
Alloy ⁶⁾	EAF, IC or CC	Al or Al+V	QT ⁵⁾	220 ⁵⁾

Remarks:

- 1) Minimum rolling reduction ratio 6:1
- 2) Sampling, inspection and testing procedures shall comply with the relevant requirements in RU-SHIP Pt.2 Ch.2 Sec. 6
- 3) EAF: Electric Arc Furnace; IC: Ingot Casting; CC: Continuous Casting.
- 4) N: Normalised; QT: Quenched and Tempered.
- 5) Not applicable for semi-finished products.
- 6) Including clean steel of grade 18CrNiMo7-6 according to EN 10084, DNV RU-SHIP Pt.2 Sec.6 and DNV-CP-0247 Sec.3 [2.1].

Round bars for chain cables acc. to DNV-OS-E302 and DNV-CP-0237				
Grade	Max. diameter [mm]	Steelmaking ¹⁾	Fine grain elements	Heat treatment condition ²⁾
R3	185	EAF, VD, IC	Al+V	AR
	78	EAF, VD, CC ³⁾		
	105	EAF, VD, CC ⁴⁾		
	150	EAF, VD, CC ⁵⁾		
	203	EAF, VD, CC ⁵⁾	Al+V	HA
R3S	185	EAF, VD, IC	Al+V	AR
	78	EAF, VD, CC ³⁾		
	96	EAF, VD, CC ⁴⁾		
	150	EAF, VD, CC ⁵⁾		
	186.5	EAF, VD, CC ⁵⁾	Al+V	HA
R3S	185	EAF, VD, CC ⁷⁾	Al	AR/HA
R4	110	EAF, VD, CC ⁴⁾	Al	AR/HA
R4	204	EAF, VD, CC ⁵⁾	Al	AR/HA
R4 ⁶⁾	185	EAF, VD, IC	Al+V	AR
	78	EAF, VD, CC ³⁾		
	88	EAF, VD, CC ⁴⁾		
	191	EAF, VD, CC ⁵⁾		
R4S ⁶⁾	185	EAF, VD, IC	Al+V	AR
	78	EAF, VD, CC ³⁾		
	88	EAF, VD, CC ⁴⁾		
	174	EAF, VD, CC ⁵⁾		
R5 ⁶⁾	230	EAF, VD, IC	Al+V	AR
	78	EAF, VD, CC ³⁾		
	88	EAF, VD, CC ⁴⁾		
	174	EAF, VD, CC ⁵⁾		
R6 ⁸⁾	165	EAF, VD, CC ⁷⁾	Al+V	AR

Remarks:

- 1) EAF: Electric Arc Furnace; VD: Vacuum Degassing; IC: Ingot Casting; CC: Continuous Casting.
- 2) AR: As Rolled; HA: Annealed at 680°C x 8h for Hydrogen diffusion only if it is necessary.
- 3) Dimensions of billet: 185 mm x 185 mm.
- 4) Dimensions of billet: 240 mm x 240 mm.
- 5) Dimensions of bloom: 300 mm x 400 mm or 350 mm x 470 mm.
- 6) Minimum tempering temperature shall be 610°C for quenching and tempering condition.
- 7) Dimension of bloom: 350 mm x 470 mm.

⁸⁾ Minimum tempering temperature shall be 580°C for quenching and tempering conditions.

⁹⁾ Specification for chemical composition according to table S1.

Ingots, blooms and billets for chain cables		
Grade ²⁾	Steelmaking ¹⁾	Fine grain elements
R3S	EAF, VD, CC	Al
R4	EAF, VD, CC	Al
R3, R3S R4, R4S R5	EAF, VD, IC or CC	Al+V
R6 ³⁾	EAF, VD, CC	Al+V

Remarks:

¹⁾ EAF: Electric Arc Furnace; VD: Vacuum Degassing; IC: Ingot Casting; CC: Continuous Casting.

²⁾ Specification for chemical composition according to table S2

³⁾ Specification for chemical composition as per table S1.

Table S1 - Specification for chemical composition ¹⁾ - Round bars for chain cables														
Grade,	dia. [mm]		C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Al	V	N
R3	203	Min.	.23	.20	1.60	-	-	.10	.10	-	-	.015	.05	-
		Max.	.27	.35	1.90	.020	.020	.35	.55	.13	.25	.040	.10	.015
R3S	185	Min.	.23	.20	1.60	-	-	.20	.40	.08	-	.015	.08	-
		Max.	.27	.35	1.90	.020	.020	.35	.55	.13	.25	.040	.10	.015
	186.5	Min.	.22	.20	1.00	-	-	.20	.40	.08	-	.015	.08	-
		Max.	.27	.35	1.90	.020	.020	1.20	.60	.20	.25	.040	.10	.015
R3S	185	Min.	.22	.20	1.00	-	-	.20	.40	.08	-	.020	-	-
		Max.	.27	.35	1.90	.020	.020	1.20	.60	.20	.25	.040	.01	.015
R4 ²⁾	110/204	Min.	.18	.15	.85	-	-	.90	.50	.20	-	.015	-	-
		Max.	.24	.35	1.20	.020	.015	1.25	.80	.40	.25	.040	.01	.015
R4	185	Min.	.18	.15	.85	-	-	.90	.50	.20	-	.015	.04	-
		Max.	.24	.35	1.20	.020	.015	1.25	.80	.40	.25	.040	.10	.015
R4S	185	Min.	.18	.20	1.20	-	-	1.00	.95	.40	-	.015	.09	-
		Max.	.24	.35	1.40	.020	.008	1.10	1.15	.65	.25	.040	.12	.015
R5	185	Min.	.18	.20	1.20	-	-	1.00	.95	.40	-	.015	.09	-
		Max.	.24	.35	1.40	.020	.008	1.10	1.15	.65	.25	.040	.12	.015
R5	230	Min.	.22	.20	1.20	-	-	1.00	1.00	.50	-	.015	.09	-
		Max.	.26	.35	1.40	.020	.008	1.10	1.40	.65	.25	.040	.12	.015
R6 ³⁾	165	Min.	.22	.20	.60	-	-	.80	2.50	.30	-	.015	.06	-
		Max.	.30	.35	.80	.020	.008	1.20	3.50	.60	.25	.040	.08	.015

Remarks:

¹⁾ The content of Sn, Sb and As may be required determined. In such cases, the maximum content shall be 0.030 % for Sn, 0.025% for As, 0.005 % for Sb and 0.001% for B.

²⁾ Maximum content shall be 0.015%Ti.

³⁾ H ≤ 0.00011%, O ≤ 0.0025%.

Table S2 - Specification for chemical composition – Ingots, blooms and billets for chain cables														
Grade		C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Al	V	Ti	N
R3 ¹⁾	Min.	.18	.15	0.85	-	-	0.90	0.50	.20	-	.015	.04	-	-
R3S ¹⁾	Max.	.24	.35	1.20	.020	.015	1.25	0.70	.35	.25	.040	.10	-	.015
R3 ¹⁾	Min.	.21	.20	1.20	-	-	1.00	0.95	.50	-	.015	.09	-	-
R3S ¹⁾	Max.	.24	.35	1.40	.020	.008	1.10	1.15	.65	.25	.040	.12	-	.015
R3S ¹⁾	Min.	.22	.20	1.00	-	-	.20	.40	.08	-	.020	-	-	-
	Max.	.27	.35	1.90	.020	.020	1.20	.60	.20	.25	.040	.01	-	.015
R4 ¹⁾	Min.	.18	.15	.85	-	-	.90	.50	.20	-	.015	-	-	-
	Max.	.24	.35	1.20	.020	.015	1.25	.80	.40	.25	.040	.01	.015	.015
R4 ¹⁾	Min.	.21	.20	1.20	-	-	1.00	0.95	.50	-	.015	.09	-	-
	Max.	.24	.35	1.40	.020	.008	1.10	1.15	.65	.25	.040	.12	-	.015
R4S ¹⁾	Min.	.21	.15	0.50	-	-	1.40	2.50	.40	-	-	.08	-	.007
	Max.	.25	.35	0.80	.015	.015	1.80	3.00	.60	.25	.035	.12	-	.010
R5 ¹⁾	Min.	.21	.15	0.50	-	-	1.40	2.50	.40	-	-	.08	-	.007
	Max.	.25	.35	0.80	.015	.015	1.80	3.00	.60	.25	.035	.12	-	.010
R3 ²⁾	Min.	.29	-	.60	-	-	1.50	1.65	.25	-	.015	-	.010	-
R3S ²⁾														
R4 ²⁾	Max.	.33	.30	.70	.015	.008	1.65	1.70	.28	.40	.030	-	.020	.012
R3 ³⁾	Min.	.30	.10	.50	-	-	1.30	1.30	.20	-	.020	-	-	-
R3S ³⁾														
R4 ³⁾	Max.	.38	.40	.80	.035	.035	1.70	1.70	.30	.40	.060	-	-	.015
R3 ⁴⁾	Min.	.31	.15	.60	-	-	1.5	1.60	.25	-	.020	-	-	-
R3S ⁴⁾														
R4 ⁴⁾	Max.	.34	.30	.75	.015	.010	1.7	1.70	.30	.25	.030	-	-	.012

Remarks:

¹⁾ The content of Sn, Sb and As may be required determined. In such cases, the maximum content shall be 0.030 % for Sn, 0.025% for As, 0.005 % for Sb and 0.001% for B.

²⁾ The content of Sn, Sb, As and B may be required. In such cases, the maximum content shall be 0.030 % for Sn, 0.030 % for Sb, 0.030% for As.

³⁾ The content of Sn, Sb, As and B may be required determined. In such cases, the maximum content shall be 0.040 % for Sn and 0.030 % for Sb, 0.030 % As and 0.001 % for B.

⁴⁾ The content of Sn, Sb and As may be required determined. In such cases, the maximum content shall be 0.030 % for Sn, 0.005 % for Sb and 0.025 % for As.