

APPROVAL OF MANUFACTURER CERTIFICATE

This is to certify:

That
thyssenkrupp Steel Europe AG
Plant Hüttenheim,
Duisburg, Germany

is an approved manufacturer of
Rolled Steel Products

in accordance with
DNV GL rules for classification – Ships
DNV GL rules for classification – Naval vessels
DNV GL offshore standards

and the following particulars:

Product Grade(s)	Hot rolled steel plates (including plates cut from wide strip) Rolled steel for structural application, Rolled steel for boilers, pressure vessels and special applications, Special materials for naval ships
Steelmaking Deoxidation	Basic oxygen furnace and continuous casting Killed
Fine grain elements	See particulars of the approval
Delivery conditions	See particulars of the approval
Max. thickness/diam.	See particulars of the approval
Remarks	See particulars of the approval

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 GL classed object shall fulfill the material requirements in the applicable DNV GL class rules.

Issued at **Hamburg** on **2019-04-08**

for **DNV GL**

This Certificate is valid until **2022-04-30**.

DNV GL local station: **Essen**

Approval Engineer: **Stefan Röhr**

Thorsten Lohmann
Head of Section



Job Id: **263.11-004275-3**
 Certificate No: **AMMM00000RY**
 Revision No: **4**

Particulars of the approval

Rolled products:

Grade	Product	Supply Condition	Thickness [mm], max.	Microalloy	Z-Quality
Normal strength steels					
VL A, VL B	BL	AR	50	Al	Z25 / Z35
VL D	BL	AR	35	Al	Z25 / Z35
VL A, VL B, VL D	BL	NR	85 / 150 ¹⁾	Al	Z25 / Z35
VL A, VL B, VL D	BL	N	100 / 150 ¹⁾	Al	Z25 / Z35
VL E	BL	N	85 / 150 ¹⁾	Al	Z25 / Z35
VL A, VL B, VL D, VL E	BL	TM	70	Al	Z25 / Z35
High strength steels					
VL A27S, VL D27S	BL	AR	20	Al	-
		N, NR	50	Al	-
VL E27S	BL	N	30	Al	-
VL A32, VL D32	BL	AR	20	Al	-
VL A32, VL D32, VL A36, VL D36	BL	AR	20	Al+N, Al+Nb	-
VL A32, VL D32	BL	NR	20	Al	-
VL A32, VL D32, VL A36, VL D36	BL	NR	85 / 100 ¹⁾	Al+Nb+Ti	Z25 / Z35
			50	Al+N, Al+Nb	-
VL A32, VL D32, VL E32	BL	N	50	Al	-
VL A32, VL D32, VL E32, VL F32, VL A36, VL D36, VL E36, VL F36	BL	N	85 / 100 ¹⁾	Al+Nb	Z25 / Z35
VL A32, VL D32, VL E32, VL A36, VL D36, VL E36	BL	N	50	Al+N	-
VL A32, VL D32, VL A36, VL D36	BL	N	90 / 100 ¹⁾	Al+Nb+Ti	-
VL E32, VL E36	BL	N	55	Al+Nb+Ti	-
VL A40, VL D40	BL	NR	50	Al+Nb	Z25 / Z35
VL A40, VL D40, VL E40, VL F40	BL	N	85 / 100 ¹⁾	Al+Nb	Z25 / Z35
VL A32, VL D32, VL E32, VL F32, VL A36, VL D36, VL E36, VL F36	BL	TM	70	Al+Nb	Z25 / Z35
VL A40, VL D40, VL E40, VL F40	BL	TM	60	Al+Nb	Z25 / Z35

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Grade	Product	Supply Condition	Thickness [mm], max.	Microalloy	Z-Quality
Extra high strength steels					
Note: Subject to special approval. CTOD test is to be performed in acc. with IACS UR W16 for marine and offshore structures contracted for construction on or after 1 July 2017.					
VL AO420, VL DO420, VL EO420, VL FO420, VL AO460, VL DO460, VL EO460, VL FO460, VL AO500, VL DO500, VL EO500, VL FO500	BL	N, TM	50	Al+Nb	Z25 / Z35
VL AO420, VL DO420, VL EO420, VL FO420, VL AO460, VL DO460, VL EO460, VL FO460, VL AO500, VL DO500, VL EO500, VL FO500, VL AO550, VL DO550, VL EO550, VL FO550, VL AO620, VL DO620, VL EO620, VL FO620, VL AO690, VL DO690, VL EO690, VL FO690	BL	QT	70	Al+Nb	Z25 / Z35
Steels for boilers and pressure vessels					
VL 360-0NR, VL 360-1FNR, VL 410-0NR, VL 410-1FNR	BL	NR	85 / 100 ¹⁾	Al	-
VL 460-0NR, VL 460-1FNR, VL 490-0NR, VL 490-1FNR, VL 520-1FNR	BL	NR	85 / 100 ¹⁾	Al+Nb	-
VL 360-0N, VL 360-1FN, VL 360S-1FN, VL 410-0N, VL 410-1FN, VL 410S-1FN	BL	N	85 / 100 ¹⁾	Al	-
VL 460-0N, VL 460-1FN, VL 460S-1FN, VL 490-0N, VL 490-1FN, VL 510-1FN, VL 510S-1FN	BL	N	85 / 100 ¹⁾	Al+Nb	-
VL 0.3Mo, VL 0.3MoS	BL	N	85 / 100 ¹⁾	-	-
VL 1Cr0.5Mo, VL 1Cr0.5MoS	BL	NT	85 / 100 ¹⁾	-	-
VL 2.25Cr1Mo	BL	NT	85 / 100 ¹⁾	-	-
VL 2.25Cr1MoS	BL	NT, QT	85 / 100 ¹⁾	-	-
Steels for low temperature service					
VL 2-2, VL 2-3, VL 2-4, VL 2-4L, VL 4-2, VL 4-3, VL 4-4, VL 4-4L	BL	N	20	Al+N	-
			40	Al+Nb+N	-
VL 0.5Ni/a, VL 0.5Ni/b	BL	N, NT	30	Al	-
VL 1.5Ni/a, VL 1.5Ni/b, VL 2,25Ni, VL 3.5Ni	BL	N, NT, QT ²⁾	30	Al	-
			50 ³⁾	Al	-
VL 5Ni	BL	QT ²⁾	50 ³⁾	Al	-
VL 9Ni	BL	QT	50 ³⁾	Al	-

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Liquid quenched and tempered structural steels					
VL-M550	BL	QT	85 / 150 ¹⁾	Al	-
VL-M700	BL	QT	76	Al	-
Non-alloy structural steels acc. to EN 10025-2					
S235JR, S235J0, S235J2 S275JR, S275J0, S275J2 S355JR, S355J0, S355J2, S355K2	BL	AR, N, NR	150	acc. to standard	-
Normalized/normalized rolled weldable fine grain structural steels acc. to EN 10025-3					
S275N, S355N, S420N, S460N S275NL, S355NL, S420NL, S460NL	BL	N, NR	80	acc. to standard	-
Thermomechanical rolled weldable fine grain structural steels acc. to EN 10025-4					
S275M, S355M, S420M, S460M S275ML, S355ML, S420ML, S460ML	BL	TM	63	acc. to standard	-
Structural steels with improved atmospheric corrosion resistance acc. to EN 10025-5					
S235J0W, S235J2W S355J0W, S355J2W, S355K2W	BL	AR, N, NR	150	acc. to standard	-
S355J0WP, S355J2WP	BL	AR, N, NR	12	acc. to standard	-
High yield strength structural steels acc. to EN 10025-6					
S460Q, S460QL, S460QL1 S500Q, S500QL, S500QL1 S550Q, S550QL, S550QL1 S620Q, S620QL, S620QL1 S690Q, S690QL, S690QL1 S890Q, S890QL, S890QL1 S960Q, S960QL	BL	QT	100	acc. to standard	-
Non-alloy and alloy steels with specified elevated temperature properties acc. to EN 10028-2					
P235GH, P265GH, P295GH, P355GH	BL	N, NR	100	acc. to standard	-
16Mo3	BL	N, NT	100	-	-
13CrMo4-5	BL	NT	100	-	-
10CrMo9-10	BL	NT, QT	100	-	-
18MnMo4-5, 15NiCuMoNb5-6-4, 13CrMoSi5-5, X12CrMo5, 13CrMoV9-10, 12CrMoV12-10, X10CrMoVNb9-1	BL	NT	100	-	-

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Weldable fine grain steels, normalized acc. to EN 10028-3					
P275NH, P275NL1, P275NL2 P355N, P355NH, P355NL1, P355NL2	BL	N, NR	100	acc. to standard	-
P460NH, P460NL1, P460NL2	BL	N	100	acc. to standard	-
Nickel alloy steels with specified low temperature properties acc. to EN 10028-4					
11MnNi5-3, 13MnNi6-3	BL	N, NT	80	acc. to standard	-
15NiMn6, 12Ni14	BL	N, NT, QT	80	acc. to standard	-
X12Ni5, X8Ni9	BL	N, NT, QT	50	acc. to standard	-
X7Ni9	BL	QT	50	acc. to standard	-
Weldable fine grain steels, thermomechanically rolled acc. to EN 10028-5					
P355M, P355ML1, P355ML2 P420M, P420ML1, P420ML2 P460M, P460ML1, P460ML2	BL	TM	63	acc. to standard	-
Weldable fine grain steels, quenched and tempered acc. to EN 10028-6					
P355Q, P355QH, P355QL1, P355QL2 P460Q, P460QH, P460QL1, P460QL2 P500Q, P500QH, P500QL1, P500QL2 P690Q, P690QH, P690QL1, P690QL2	BL	QT	100	acc. to standard	-
Steels used for pipes for pipelines for combustible fluids acc. to EN 10208-2					
L 245NB, L 290NB, L 360NB, L 415NB	BL	AR, N, NR	40	acc. to standard	-
L 245MB, L 290MB, L 360MB, L 415MB, L 450MB, L 485MB, L 555MB	BL	TM	40	acc. to standard	-
Non-alloy steels for quenching and tempering acc. to EN 10083-2					
C22E, C22R, C35, C35E, C35R, C40, C40E, C40R, C45, C45E, C45R, C50E, C50R, C55, C55E, C55R, C60, C60E, C60R	BL	acc. to standard	30	-	-
34CrMo4, 34CrMoS4, 42CrMo4, 42CrMoS4, 50CrMo4, 51CrV4	BL	acc. to standard	30	-	-
Weldable structural steels for fixed offshore structures acc. to EN 10225					
S355G7+M	BL	TM	30	acc. to standard	Z25 / Z35
S355G8+M	BL	TM	30	acc. to standard	Z25 / Z35
S355G9+M	BL	TM	30	acc. to standard	Z25 / Z35
S355G10+M	BL	TM	30	acc. to standard	Z25 / Z35

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Grade	Product	Supply Condition	Thickness [mm], max.	Microalloy	Z-Quality
Liquid quenched and tempered structural steels acc. to other standards					
15NiCrMo10-6 acc. to WL 1.6780-1	BL	QT	150	acc. to standard	-
16NiCrMo12-6 acc. to WL 1.6782-1	BL	QT	76	acc. to standard	-
HY-80 acc. to MIL-S-16216K	BL	QT	150	acc. to standard	-
HY-100 acc. to MIL-S-16216K	BL	QT	76	acc. to standard	-
Steels acc. to TKSE - Technical Data Sheets					
XABO® 355 (T), XABO® 460 (T)	BL	TM	63	acc. to standard	-
N-A-XTRA® 550 / 620 / 700	BL	QT	50	acc. to standard	-
N-A-XTRA® M 550 / 620 / 700	BL	QT	100	acc. to standard	-
SECURE 500	BL	QT	20	acc. to standard	-

BL: plates (including plates cut from wide strip) AR: as rolled NR: normalized rolled
 N: normalized TM: thermo-mechanically rolled NT: normalized + tempered QT: quenched + tempered

Remarks:

- Subject to special approval, normal and higher strength hull structural steels with a reduction ratio of less than 3 to 1 (slab to plate) need special approval. Requirements are:
 - Tensile test, through thickness
 - Tensile test, sample location t/2
 - Notch bar impact tests, sample location t/2, longitudinal and transverse
 - Notch bar impact tests, sample location t/2, longitudinal and transverse, strain aged

Additional testing may be required, based on the assessment of the achieved test results. These additional tests are to be carried out once per grade.

- Subject to special approval, direct quenching as an alternative to the conventional quenched and tempered process for plate thicknesses < 30 mm.
- For plate thicknesses > 40 mm the requirements of mechanical properties shall be agreed. Unless otherwise agreed, mechanical properties given as follows:

Grade	Supply Condition	Thickness Range [mm]	Tensile Test			Impact Energy		Design Temp. [°C]
			Yield Strength [N/mm ²] min.	Tensile Strength [N/mm ²]	Elongation A5 [%] min.	Test Temp. [°C]	KV [J] min. trans. long.	
VL 1.5Ni/a	QT	40 < t ≤ 50	265	470 - 640	22	-80	32 49	-60
VL 1.5Ni/b			355	490 - 640	22	-80	32 49	-60
VL 2.25Ni			395	500 - 660	22	-85	32 49	-65
VL 3.5Ni			345	540 - 690	22	-110	32 49	-90
VL 5Ni			380	570 - 710	21	-125	32 49	-105
VL 9Ni			480	640 - 840	19	-196	32 49	-165

QT: quenched + tempered