



APPROVAL OF MANUFACTURER CERTIFICATE

Certificate No:
AMMM000012M
Revision No:
7

This is to certify:

That

Dongkuk Steel Mill Co., Ltd.
Dangjin Works
Dangjin-si, Chungcheongnam-do,
Republic of Korea

is an approved manufacturer of
Rolled Steel Products

in accordance with
DNV GL rules for classification – Ships
DNVGL-OS-B101 – Metallic materials

and the following particulars:

Application area	Normal strength steel High strength steel Extra high strength steel Z-grade steels (plates with through thickness properties) Steels for boiler and pressure vessels
Products	Plates
Manufacturing method	Basic Oxygen Converter, Continuous Casting
Max. thickness	See page 2 ff.
Heat treatment condition	See page 2 ff.

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 **2021-11-09**

for **DNV**

This Certificate is valid until **2023-01-08**.

DNV local station: **Seoul**

Approval Engineer: **Christian Wildhagen**

Thorsten Lohmann
Head of Section

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Particulars of the approval

Normal strength steel

Grade	Product	Steel making ¹⁾	Fine grain elements	Max. thickness [mm]	Heat treatment condition ²⁾	Z- quality
VL A, VL B	Plates	BOC, CC	Al	100	AR	Z35
				50	NR	-
				100	N	Z35
				83	TM	-
VL D	Plates	BOC, CC	Al	35	AR	-
				50	NR	-
				100	N	Z35
				83	TM	-
VL E	Plates	BOC, CC	Al	83	N	Z35
			Al+Nb+Ti	83	TM	Z35

High strength steel

Grade	Product	Steel making ¹⁾	Fine grain elements	Max. thickness [mm]	Heat treatment condition ²⁾	Z- quality
VL A32, VL A36	Plates	BOC, CC	Al+Nb+Ti	35	AR	Z35
VL D32, VL D36	Plates	BOC, CC	Al+Nb+Ti	25	AR	Z35
VL A32, VL D32, VL A36, VL D36	Plates	BOC, CC	Al+Nb+Ti	50	NR	Z35
VL A32, VL D32, VL E32	Plates	BOC, CC	Al+V or Al+Nb+Ti	70	N	Z35
VL A32S ^{5) 6)}	Plates	BOC, CC	Al	25	CR	Z35
VL A36S ^{7) 8)}	Plates	BOC, CC	Al	20	CR	-
VL A36S ^{7) 8)}	Plates	BOC, CC	Al	25	TM	-
VL A40	Plates	BOC, CC	Al	15	CR	-
VL A36, VL D36, VL E36	Plates	BOC, CC	Al+Nb+V+Ti	73	N	Z35
VL F32, VL F36	Plates	BOC, CC	Al+Nb+Ti	50	TM	Z35
VL A32, VL D32, VL E32, VL A36, VL D36, VL E36, VL A40, VL D40, VL E40	Plates	BOC, CC	Al+Nb+Ti	83	TM	Z35

Extra high strength steel

Grade	Product	Steel making ¹⁾	Fine grain elements	Max. thickness [mm]	Heat treatment condition ²⁾	Z-quality
VL A420, VL D420, VL E420	Plates	BOC, CC	Al+Nb+Ti	70	TM	Z35
VL DW420, VL EW420						
VL A460, VL D460, VL E460, VL A500, VL D500, VL E500	Plates	BOC, CC	Al+Nb+Ti	50	TM	Z35

Steels for low temperature service

Grade	Product	Steel making ¹⁾	Fine grain elements	Max. thickness [mm] ³⁾	Heat treatment condition ²⁾	Z-quality
VL 2-2, VL 2-3, VL 2-4, VL 2-4L	Plates	BOC, CC	Al+Nb+Ti	50	TM	Z35
VL 4-2, VL 4-3, VL 4-4, VL 4-4L	Plates	BOC, CC	Al+Nb+Ti	50	TM	Z35

Differential thickness plates ⁴⁾

Grade	Steel making ¹⁾	Fine grain elements	Heat treatment condition	Max. thickness [mm]	Taper Ratio (mm/m)	Max. Gap of thickness (mm)	Taper Zone (mm)
VL A, VL B, VL D	BOC, CC	Al	AR	35	Min. 5 Max. 80	Max. 8	Min. 50 Max. 200
VL A32, VL D32	BOC, CC	Al or Al+Nb/Ti or Al+Nb+Ti	AR	25	Min. 5 Max. 60	Max. 6	Min. 50 Max. 200
VL A32, VL D32, VL A36, VL D36	BOC, CC	Al or Al+Nb/Ti or Al+Nb+Ti	NR	35	Min. 5 Max. 60	Max. 6	Min. 50 Max. 200
VL A32, VL D32, VL E32, VL A36, VL D36, VL E36	BOC, CC	Al	TM	60	Min. 2 Max. 50	Max. 10	Min. 50 Max 200
VL A, VL B, VL D	BOC, CC	Al	NR	50	Min. 2 Max. 50	Max. 10	Min. 50 Max 200
VL A32, VL D32, VL A36, VL D36	BOC, CC	Al+Nb+Ti	NR	50	Min. 2 Max. 50	Max. 10	Min. 50 Max 200

Tapered plates ⁴⁾

Grade	Steel making ¹⁾	Fine grain elements	Heat treatment condition	Max. thickness [mm]	Taper Ratio (mm/m)	Max. Gap of thickness (mm)	Taper Zone (mm)
VL A, VL B, VL D	BOC, CC	Al	AR	35	Min. 0.1 Max. 10	Max. 25	Min. 400
VL A32, VL D32	BOC, CC	Al or Al+Nb/Ti or Al+Nb+Ti	AR	25	Min. 0.1 Max. 10	Max. 15	Min. 400
VL A32, VL D32, VL A36, VL D36	BOC, CC	Al or Al+Nb/Ti or Al+Nb+Ti	NR	35	Min. 0.1 Max. 8	Max. 20	Min. 400
VL A32, VL D32, VL E32, VL A36, VL D36, VL E36	BOC, CC	Al+Nb+Ti	TM	60	Min. 0.1 Max. 15	Max. 15	Min. 400
VL A, VL B, VL D	BOC, CC	Al	NR	50	Min. 0.1 Max. 15	Max. 15	Min. 400
VL A32, VL D32, VL A36, VL D36	BOC, CC	Al+Nb+Ti	NR	50	Min. 0.1 Max. 15	Max. 15	Min. 400

Remarks:

- 1) BOC: Basic oxygen converter; CC: Continuous casting; IC: Ingot casting
- 2) AR: As rolled; CR: Controlled rolled; NR: Normalizing rolling; TM: Thermo-mechanical rolling; N: Normalised
- 3) For thickness exceeding 40 mm, the requirements shall be agreed before certification
- 4) Thickness of the slabs: 250 mm; Application is subject to special approval
- 5) Specially approved with min. Mn content 0.85% wt
- 6) **Chemical composition and specification:**
 C max. = 0.16 % (i.e. up to 0.164 %); Mn min. = 0.85 %. In case of % C \geq 0.17 (i.e. \geq 0.165) for representative AH32S, then charpy testing on strain aged material shall be performed. After successful testing of such, condition C max. = 0.16 % will be waived and approval is valid up to max. carbon content tested; Specification as per reference Dongkuk Steel Mill Co., Ltd. Document no. 200702-01 dated 2020-07-02 (DNVGL NPS-job 263.11-003066-11)
- 7) Specially approved with max. C content 0.194 % wt
- 8) Specifications as per reference Dongkuk Steel Mill Co., Ltd. Document nos. DKD-ATP-20-002 Rev.1 and DKD-ATP-20-003 Rev.0 dated 2020-10-15 (DNVGL NPS-job 263.11-003066-13)