DNV·GL

APPROVAL OF MANUFACTURER CERTIFICATE

Certificate No:
AMMM000012M
Revision No:
1

This is to certify:

That

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

is an approved manufacturer of
Rolled Steel Products

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

and the following particulars:

Product	**Plates**
Grade(s)	**Rolled steel for structural application,** **Rolled steel for boilers, pressure vessels and special applications**
Steelmaking	**Basic Oxygen Converter,** **Continuous Casting**
Deoxidation	**Killed**
Fine grain elements	**See particulars**
Delivery conditions	**See particulars**
Max. thickness	**See particulars**

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 **2018-01-16**

This Certificate is valid until **2019-11-29**.
DNV GL local station: **Seoul**

Approval Engineer: **Stefan Röhr**

for **DNV GL**
Digitally Signed By: Wildhagen, Christian
Location: DNV GL Hamburg, Germany
Signing Date: 2018-01-16 , on behalf of

Thorsten Lohmann
Head of Section

Particulars of the approval

Rolled steel for structural application

Normal Strength Steels					
Grade	Steelmaking [1)]	Fine grain treatment	Delivery condition[2)]	Max. Thickness (mm)	Z-quality
VL A, VL B	BOC, CC	Al	AR	100	Z35
			NR	50	-
			N	100	Z35
			TM	83	-
VL D	BOC, CC	Al	AR	35	-
			NR	50	-
			N	100	Z35
			TM	83	-
VL E	BOC, CC	Al	N	83	Z35
		Al+Nb+Ti	TM	83	Z35
High Strength Steels					
Grade	Steelmaking[1)]	Fine grain treatment	Delivery condition[2)]	Max. Thickness (mm)	Z-quality
NV A32, VL A36	BOC, CC	Al+Nb+Ti	AR	35	Z35
VL D32, VL D36	BOC, CC	Al+Nb+Ti	AR	25	Z35
VL A32, VL D32, VL A36, VL D36	BOC, CC	Al+Nb+Ti	NR	50	Z35
VL A32, VL D32, VL E32	BOC, CC	Al+V or Al+Nb+Ti	N	70	Z35
VL A36, VL D36, VL E36	BOC, CC	Al+Nb+V+Ti	N	73	Z35
VL F32, VL F36	BOC, CC	Al+Nb+Ti	TM	50	Z35
VL A32, VL D32, VL E32 VL A36, VL D36, VL E36 VL A40, VL D40, VL E40	BOC, CC	Al+Nb+Ti	TM	83	Z35

Extra High Strength Steels					
Grade	Steelmaking [1)]	Fine grain treatment	Delivery condition [2)]	Max. Thickness (mm)	Z-quality
VL A420, VL D420, VL E420 VL DW420, VL EW420	BOC, CC	Al+Nb+Ti	TM	70	Z35
VL A460, VL D460, VL E460, VL A500, VL D500, VL E500,	BOC, CC	Al+Nb+Ti	TM	50	Z35
VL A620, VL D620, VL E620, VL F620 VL A690, VL D690, VL E690, VL F690 [5)]	EAF, IC + Forging [3)]	Al+V	QT [4)]	210	Z35

Remarks:
[1)] BOC: Basic Oxygen Converter; EAF: Electric Acr Furnace; CC: Continuous Casting; IC: Ingot Casting.
[2)] AR: As Rolled; NR: Normalising Rolling; N: Normalising; TM: Thermo-Mechanical rolling.
[3)] Forging reduction ratio of ingot to slab: 3:1.
[4)] Direct quenching: Direct cooling procedure (Multi Purpose Interrupted Cooling).
[5)] Chemical composition: 0.45 - 0.75%Cr, 2.30 - 3,5%Ni, 0.40 - 0.55%Mo, depending on the plate thickness (i.e. from 100 mm to 210 mm). Ceq ≤ 0.76, Pcm ≤ 0.32.

Rolled steel for boilers, pressure vessels and special applications

Steel plate for low temperature services					
Grade	Steelmaking [1)]	Fine grain treatment	Delivery condition [2)]	Max. Thickness [3)] (mm)	Z-quality
VL 2-2, VL 2-3, VL 2-4, VL 2-4L	BOC, CC	Al+Nb+Ti	TM	50	Z35
VL 4-2, VL 4-3, VL 4-4, VL 4-4L	BOC, CC	Al+Nb+Ti	TM	50	Z35

Remarks:
[1)] BOC: Basic Oxygen Converter; CC: Continuous Casting.
[2)] TM: Thermo-Mechanical rolling.
[3)] For thickness exceeding 40 mm, the requirements shall be agreed before certification.

Differential thickness and tapered plates

Differential thickness plates [3]							
Grade	Steel-making [1]	Fine grain treatment	Delivery condition [2]	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

Tapered plates [3]							
Grade	Steel-making [1]	Fine grain treatment	Delivery condition [2]	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

Remarks:
1. BOC: Basic Oxygen Converter; CC: Continuous Casting.
2. AR: As rolled: NR: Normalised rolling
3. Thickness of the slabs: 250 mm; Application is subject to special approval