CERTIFICATE NUMBER
STML-T2528004-7

ISSUING OFFICE
GCD Materials

CERTIFICATE OF
STEEL MILLS
FACILITY AND PROCESS APPROVAL

This is to certify that a representative of ABS did, at the request of

JIANGSU SHAGANG STEEL CO., LTD.
JINFENG TOWN,ZHANGJIAGANG CITY,JIANGSU PROVINCE, ZHANGJIAGANG, China

attend its facilities as indicated in the ABS City CN GZ Nantong Port port office survey report number 4247328 dated 03 June 2020 in order to carry out a survey of the facilities and associated quality procedures. The facility is considered capable of manufacturing

Semi-finished product and Plate components for marine applications

in accordance with the ABS Approval letter (Reference T2536147), ABS Rules, designated standards and ABS approved drawings. The approval is valid till 02 June 2025 subject to adherence to relevant ABS Rules and Survey requirements.

Marcus Cridland
Chief Metallurgist, ABS

ISSUE DATE: 23 April 2024
EXPIRY DATE: 02 June 2025

Task – T2536147
Steel Mill Approval – Extension
Certificate No. STML-T2528004-7

Attention: Mr. Li Yu-Cang, JIANGSU SHAGANG STEEL CO., LTD. (WCN: 488574)

The documents shown in the attached list are reviewed in accordance with the applicable requirement of the following and the facility is considered approved to manufacture products for hull application as outlined in the process/product approval.

1. ABS Rules for Materials and Welding Part 2 (2024)
2. EN 10028-4:2017- Flat Products made of Steels for Pressure Purpose – Part 4: Nickel Alloy Steels with Specified Low Temperature Properties.

Please note it is the responsibility of the facility to inform ABS of any changes to the manufacturing parameters and request renewal of approval prior to the five-year expiry date.

For any clarifications, contact Ms. Lin Li-Hong at +86-21-23270994, llin@eagle.org.

Very truly yours,

Gareth Burton
Senior Vice President

Electronically Signed by: Satya Meruva

Documents List

Drawing No.	Rev. No.	Title	Status
AP-Client acceptance Template for MMdb Listing-signed	-	AP-Client acceptance Template for MMdb Listing-signed	Filed by ABS for Reference Only
Part 1	1	Info	Reviewed
Part 2	3	Test Plan	Reviewed
Test Report of 5Ni steel plates	-	Test Report of 5Ni steel plates	Reviewed

An electronic copy of the documents appropriately stamped will be returned by FTP/e-mail.

Process/Product Approval

Product	Grade	Thickness	Fine Grain Practice	Casting Practice[1]	Delivery condition[1]
Extension of Approval					
Slab	Non-ABS – EN 10028-4 X12Ni5	220 mm	Al	CC	As Cast
Plate	Non-ABS – EN 10028-4 X12Ni5 Z35	50 mm	Al	CC	QT
Steel Making Practice[1]: BOF+LF+RH **Deoxidation Practice**: Aluminum Killed **Heat treatment Facility:** In-house					
Previously Approved Products					
Slab	ABS – AH*/DH 32*/36	220 mm	Al+Nb+Ti	CC	As Cast
Slab	ABS – AH*/DH 32*/36	220 mm	Al+Ti	CC	As Cast
Slab	ABS – A*/B*/D*/E	220 mm	Al	CC	As Cast
Slab	ABS – A*/B*/D	220 mm	Al	CC	As Cast
Slab	ABS – VH36-O75	220 mm	Al+Nb+Ti	CC	As Cast
Slab	ABS – V/VH32-O75	220 mm	Al+Nb+Ti	CC	As Cast
Slab	ABS – AH*/DH*/EH 32*/36	320 mm	Al+Nb	CC	As Cast
Slab	ABS –AH*/DH*/EH*/ FH32	320 mm	Al+Nb+Ti	CC	As Cast
Slab	ABS – A*/B*/D*/E	320 mm	Al+Nb	CC	As Cast

Product	Grade	Thickness	Fine Grain Practice	Casting Practice[1]	Delivery condition[1]
Slab	ABS – A*/B*/D*/E	320 mm	Al+Nb+Ti	CC	As Cast
Slab	ABS – A*/B*/D	320 mm	Al	CC	As Cast
Slab	ABS – A*/B	320 mm	Al+Ti	CC	As Cast
Plate	ABS – AH/DH/EH40 BCA Z35	85 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – AQ*/DQ*/EQ70 Z35	177.8 mm	Al+Nb+V+ Ti	CC	QT
Plate	ABS – AQ*/DQ*/EQ*/ FQ 63*/70 Z35	100 mm	Al+Nb+Ti	CC	QT
Plate	ABS –AQ*/DQ*/EQ*/ FQ 51*/56 Z35	100 mm	Al+Nb+Ti	CC	QT
Plate	ABS – AQ*/DQ*/EQ*/ FQ56 Z35	60 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS –AQ*/DQ*/EQ*/ FQ51 Z35	60 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – AQ*/DQ*/EQ*/ FQ47 Z35	60 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – AH*/DH 32*/36 Z35	40 mm	Al+Nb+Ti	CC	TMCP +AcC
Plate	ABS – AH*/DH 32*/36 Z35	40 mm	Al+Ti	CC	CR
Plate	ABS – A*/B*/D*/E Z35	40 mm	Al	CC	TMCP +AcC
Plate	ABS – A*/B*/D Z35	40mm	Al	CC	CR
Plate	ABS – A*/B Z35	40 mm	Al	CC	AR
Plate	ABS – EQ70 Z35	152.4 mm	Note 1)	CC	QT
Plate	ABS – VH36-O75 Z35	40 mm	Al+Nb+Ti	CC	TMCP +AcC
Plate	ABS – V*/VH32-O75 Z35	40 mm	Al+Nb+Ti	CC	TMCP +AcC
Plate	ABS – AH*/DH*/EH47 Z35	80 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – AH*/DH*/EH*/ FH 32*/36 Z35	60 mm	Al+Nb	CC	TMCP
Plate	ABS – A*/B Z35	40 mm	Al	CC	AR
Plate	ABS – A*/B*/D Z35	35 mm	Al	CC	AR

Product	Grade	Thickness	Fine Grain Practice	Casting Practice[1]	Delivery condition[1]
Plate	ABS – AH*/DH 32*/36 Z35	40 mm	Al+Nb+Ti	CC	N/CR
Plate	ABS – AH*/DH32 Z35	40 mm	Al+Ti	CC	N/CR
Plate	ABS – A*/B Z35	60 mm	Al	CC	N/CR
Plate	ABS – AH*/DH*/EH*/ FH 32 Z35	100 mm	Al+Nb+Ti	CC	N
Plate	ABS – AH*/DH*/EH*/ FH 36*/40 Z35	100 mm	Al+Nb+V+ Ti	CC	N
Plate	ABS – AH*/DH*/EH*/ FH40 Z35	60 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – AH*/DH*/EH 32*/36 BCA Z35	85 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – A*/B*/D*/E Z35	100 mm	Al+Nb+Ti	CC	N
Plate	ABS – A*/B Z35	100 mm	Al+Ti	CC	N/CR
Plate	ABS – AQ*/DQ*/EQ47 Z35	80 mm	Al+Nb+V+ Ti	CC	TMCP
Slab	ABS – AQ*/DQ*/EQ*/FQ43*/ 47*/51*/56*/63*/70	320 mm	Al+Nb+Ti	CC	N/A
Slab	ABS – AH*/DH*/EH*/FH 36*/40	320 mm	Al+Nb+V+ Ti	CC	N/A
Plate	ABS – AH 32/*36	30 mm	Al	CC	AR
Plate	ABS – A*/B Z35	60 mm	Al	CC	N/CR
Plate	ABS – A*/B*/D*/E Z35	60 mm	Al+Nb	CC	TMCP
Plate	ABS – AQ*/DQ*/EQ*/ FQ43 Z35	60 mm	Al+Nb+V+ Ti	CC	TMCP
Plate	ABS – AQ*/DQ*/EQ*/ FQ 43*/47 Z35	100 mm	Al+Nb+Ti	CC	QT
Plate	Non-ABS – ASTM A514/A517 Gr. Q MOD	177.8 mm	Al+Nb+V+ Ti	CC	QT
Plate	Non-ABS – ASTM A514/A517 Gr. Q MOD	152.4 mm	Note a)	CC	QT

Product	Grade	Thickness	Fine Grain Practice	Casting Practice[1]	Delivery condition[1]
Steel Making Practice[1]: BOF, BOF +LF+RH **Deoxidation Practice**: Aluminum, Silicon - Aluminum Killed **Heat treatment Facility:** In-house Note a) Slab is sourced from Jiangsu Sunan Heavy Machinery Technology Co., Ltd. (WCN 867484)					
Slab	ABS – A*/B*/D*/AH32*/DH32, AH*/DH 36*/40, E*/EH32, EH36*/EH40	320 mm	Al+Nb+Ti	CC	N/A
Plate	ABS – A*/B*/D Z35, E Z35, AH*/DH32 Z35, EH32 Z35, AH*/DH 36*/40 Z35, EH36*/40 Z35	100 mm	Al+Nb+Ti	CC	TMCP +AcC
Steel Making Practice[1]: BOF+LF+RH **Deoxidation Practice**: Silicon - Aluminum Killed **Heat treatment Facility:** In-house					
Slab	Non-ABS – EN 10028-4 X7Ni9	220 mm	Al	CC	N/A
Plate	Non-ABS – EN 10028-4 X7Ni9 Z35	(8 ~ 50) mm	Al	CC	QT
Plate	ABS – AH*/DH*/EH32-W200	35 mm	Nb+V+Ti	CC	TMCP
Plate	ABS – AH*/DH*/EH36-W200	35 mm	Nb+V+Ti	CC	TMCP
Plate	ABS – AH*/DH*/EH32-W100	70 mm	Nb+V+Ti	CC	TMCP
Plate	ABS – AH*/DH*/EH36-W100	70 mm	Nb+V+Ti	CC	TMCP
Steel Making Practice[1]: BOF+LF+RH **Deoxidation Practice**: Aluminum Killed **Heat treatment Facility:** In-house					
Plate	ABS – AH*/DH*/EH40 BCA1 Z35	85 mm	Al+Nb+V+Ti	CC	TMCP
Plate	ABS – AH*/DH*/EH47 BCA1 Z35	80 mm	Al+Nb+V+Ti	CC	TMCP

Product	Grade	Thickness	Fine Grain Practice	Casting Practice[1]	Delivery condition[1]

Steel Making Practice: BOF+LF+RH

Deoxidation Practice: Silicon - Aluminum Killed

Heat treatment Facility: In-house

[#] Small scale production tests in lieu of large-scale test for BCA1 grade.

The test parameters are as follows,

1. NDTT test as per ASTM E208, with P-1, P-2 and P-3 type specimens.
2. Frequency of test: Once per mother plate, two successful tests (2 specimens) for following positions.
3. Acceptance criteria

Grade/ Sample Location	Surface	Mid-Depth	Side Section
EH40 BCA1	No break at -60°C (NDTT ≤ -65°C)	No break at -35°C (NDTT ≤ -40°C)	No break at -40°C (NDTT ≤ -45°C)
EH47 BCA1	No break at -60°C (NDTT ≤ -65°C)	No break at -30°C (NDTT ≤ -35°C)	No break at -35°C (NDTT ≤ -40°C)

4. Crack Arrest Toughness can be estimated from the NDTT test during production, using the equation proposed by Jiangsu Shagang Group. During production, if NDTT does not meet the specified acceptance criteria as stipulated in above table, the plates will be either designated without BCA properties or as scrap iaw manufacturer decision to satisfaction of ABS surveyor.

Plate	ABS – EH36 BCA1 Z35, EH40 BCA1/BCA2 Z35	100 mm	Al+Nb+Ti	CC	TMCP-AcC
Plate	ABS – EH47 Z35, EH47 BCA1/BCA2 Z35	100 mm	Al+Nb+Ti	CC	TMCP-AcC

Steel Making Practice[1]: BOF+LF+RH

Deoxidation Practice: Aluminum Killed

Heat treatment Facility: In-house

[#] Small scale production tests in lieu of large-scale test for BCA1/BCA2 grade.

The test parameters are as follows,

5. NDTT test as per ASTM E208, with P-3 type specimens.
6. Frequency of test: Once per mother plate
7. Acceptance criteria

Grade/ Sample Location	Surface	¼ Depth	½ Depth	Side Section
EH36/40 BCA1/BCA2	No break at -60°C (NDTT ≤ -65°C)	No break at -40°C (NDTT ≤ -45°C)	No break at -40°C (NDTT ≤ -45°C)	No break at -45°C (NDTT ≤ -50°C)

Product	Grade	Thickness	Fine Grain Practice	Casting Practice[1]	Delivery condition[1]
EH47 BCA1/BCA2	No break at -65°C (NDTT ≤ -70°C)	No break at -55°C (NDTT ≤ -60°C)	No break at -45°C (NDTT ≤ -50°C)	No break at -30°C (NDTT ≤ -35°C)	

Note: As specified by Jiangsu Shagang Group Co., Ltd., for NDTT test, two test specimens are to be taken from above each location, and plate is considered accepted when all the results meet the criteria.

8. Crack Arrest Toughness will be estimated from the NDTT, using the equation proposed by Jiangsu Shagang Group Co., Ltd. During production, if NDTT does not meet the specified acceptance criteria as stipulated in above table, a large-scale test (double tension test or CAT test) will be carried out to determine Kca ≥ 6000 $N/mm^{1.5}$ (for BCA1) or 8000 $N/mm^{1.5}$ (for BCA2) at -10°C or CAT to be ≤ -10°C.

* Approval of these grades is based on qualification tests carried out on the higher grade.

Note 1:

a. CC: Continuous Casting
b. AR: As Rolled
c. N: Normalized
d. CR: Controlled Rolling
e. TMCP: Thermo-Mechanical Controlled Processing
f. TMCP+AcC: Thermo-Mechanical Controlled Processing with Accelerated Cooling
g. QT: Quench and Tempered
h. BOF: Basic Oxygen Furnace
i. LF: Ladle Furnace Refining
j. RF: Ruhrstahl Heraeus – Vacuum Recirculation Process

Note 2: Use of Non-ABS grades on ABS classed vessels are subject to specific review at the time of application.

Note 3: Properties decrease with increase in thickness is to be considered in design.

Include: Manufacturer Approval Certificate (STML-T2528004-7)