

# APPROVAL OF MANUFACTURER CERTIFICATE

Certificate No:  
**AMMM000019R**  
Revision No:  
**1**

**This is to certify:**

**That**

**Jiangsu Asian Star Anchor Chain Co., Ltd.- Forging plant**  
**Dongxing Town, Jingjiang, Jiangsu, China**

is an approved manufacturer of  
**Steel Forgings**

in accordance with  
**DNV GL rules for classification – Ships**  
**DNVGL-OS-E302 – Offshore mooring chain, Edition July 2018**

and the following particulars:

<b>Product</b>	<b>Forgings for hull structures and equipment, Forgings for shafting and machinery, Forgings for chain cable accessories</b>
<b>Steel type/grade</b>	<b>Alloy (see page 2) VL K2, VL K3 R3, R3S, R4, R4S, R5, R6</b>
<b>Max. weight</b>	<b>See page 2</b>
<b>Max. diameter</b>	<b>See pages 2 and 3</b>
<b>Delivery Condition</b>	<b>See pages 2 and 3</b>
<b>Remarks</b>	<b>See particulars of the approval</b>

Manufacturer approved by this certificate is 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 **Høvik** on **2020-06-09**

for **DNV GL**

This Certificate is valid until **2023-03-09**.

DNV GL local station: **Jiangyin**

Approval Engineer: **Dechun Lou**

**Sondre Løken**  
**Head of Section**

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV GL AS, its parent companies and subsidiaries as well as their officers, directors and employees ("DNV GL") 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 300,000 USD.



Job Id: **263.11-010732-1**  
Certificate No: **AMMM000019R**  
Revision No: **1**

## Particulars of the approval

### Forgings for hull structures and equipment:

Steel type	Grade <sup>3)</sup>	Forging method <sup>1)</sup>	Max. weight [kg]	Heat treatment condition <sup>2)</sup>
Alloy	VL F550AW, VL F600AW, VL F650AW	OD	3 600	QT
		CD	800	QT

### Forgings for shafting and machinery:

Steel type	Grade <sup>3)</sup>	Forging method <sup>1)</sup>	Max. weight [kg]	Heat treatment condition <sup>2)</sup>
Alloy	VL F600A, VL F700A, VL F800A, VL F900A, VL F1000A, VL F1100A	OD	3 600	QT
		CD	800	QT

Remarks:

<sup>1)</sup> OD: Open die forging; CD: Close die forging.

<sup>2)</sup> QT: Quenched and tempered.

### Forgings for anchor chain accessories:

Grade	Max. diameter or thickness [mm]	Delivery condition <sup>1)</sup>
VL K2	90	N
VL K3	152	QT

Remarks:

<sup>1)</sup> N: Normalised; QT: Quenched and Tempered.

Job Id: **263.11-010732-1**  
 Certificate No: **AMMM000019R**  
 Revision No: **1**

**Forgings for offshore mooring chain cable accessories:**

Grade <sup>4)</sup>	Delivery conditions <sup>1)</sup>	Max. diameter or thickness [mm]	Material manufacturer <sup>2)</sup>
R3	NQT	262	Jiangyin Xingcheng Special Steel Works, Co., Ltd.
R3S	NQT	262	Jiangyin Xingcheng Special Steel Works, Co., Ltd.
R4	NQT	262	Jiangyin Xingcheng Special Steel Works, Co., Ltd.
	AQT	186 <sup>3)</sup>	Jiangyin Xingcheng Special Steel Works, Co., Ltd.
R4S	NQT	262	Jiangyin Xingcheng Special Steel Works, Co., Ltd.
R5	QT	109	Baoshan Iron & Steel Co., Ltd., Core Base.
R5	NQT	192	Baoshan Iron & Steel Co., Ltd., Core Base.
R6	NQT	125	Baoshan Iron & Steel Co., Ltd., Core Base.
R6	AQT <sup>5)</sup>	125	Jiangyin Xingcheng Special Steel Works, Co., Ltd.

Remarks:

<sup>1)</sup> AQT: Annealing ( $\geq 690^{\circ}\text{C}$ ), Quenched and Tempered; NQT: Normalized, Quenched and Tempered  
 QT: Quenched and Tempered.

<sup>2)</sup> The approval is limited to the listed raw material manufacturer and forging supplier.

<sup>3)</sup> Forging carried out by Jiangyin Tongqing Machinery Manufacture Co. Ltd.

<sup>4)</sup> For approved material specification see table S1.

<sup>5)</sup> Minimum tempering temperature shall be  $600^{\circ}\text{C}$

Job Id: **263.11-010732-1**  
Certificate No: **AMMM000019R**  
Revision No: **1**

Table S1 - Specification for chemical composition <sup>1)</sup> -Offshore mooring chain cable accessories																
Grade, thickness (mm)			C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Al	Nb	V	Ti	N
R3	262 <sup>2)</sup>	Min	.27	.15	1.40	-	-	.10	-	-	-	.010	-	-	-	-
		Max	.33	.35	1.90	.025	.025	.60	.30	.20	.20	.050	-	-	-	.009
R3S	262 <sup>2)</sup>	Min	.20	.15	1.20	-	-	.50	.15	.20	-	.015	.01	-	-	-
		Max	.26	.30	1.60	.025	.025	1.30	.70	.50	.20	.050	.06	-	-	.009
R4	262 <sup>2)</sup>	Min	.22	.15	1.20	-	-	.80	.70	.40	-	.015	.01	-	-	-
		Max	.26	.30	1.60	.025	.025	1.30	1.00	.60	.20	.050	.06	-	-	.009
R4S	262 <sup>2)</sup>	Min	.20	.15	1.00	-	-	.90	.70	.30	-	.015	.02	-	-	-
		Max	.25	.30	1.80	.025	.025	1.90	1.20	.65	.20	.050	.06	-	-	.009
R5	192 <sup>3)</sup>	Min	.18	.15	.30	-	-	.90	.60	.20	-	.015	.010	.03	-	-
		Max	.25	.45	1.80	.020	.008	2.00	1.20	.55	.50	.040	.050	.10	.020	.012
R6 <sup>4)</sup>	125 <sup>3)</sup>	Min	.24	.10	.30	-	-	.70	2.50	.35	-	.015	-	.04	-	-
		Max	.33	.60	.80	.020	.005	1.60	3.50	.80	.30	.050	.01	.11	.010	.012
R6 <sup>5)</sup>	125 <sup>2)</sup>	Min	.18	.15	.10	-	-	1.80	.80	.30	-	.015	.02	.03	-	.005
		Max	.25	.55	.55	.015	.008	3.20	1.50	.80	.50	.050	.08	.12	-	.024

Remarks:

<sup>1)</sup> The content of Sn, Sb, As and B may be required.

In such cases, the max. content shall be 0.020% for Sn, 0.020% for Sb, 0.020% As and 0.001% for B.

<sup>2)</sup> Jiangyin Xingcheng Special Steel Works Co., Ltd

<sup>3)</sup> Baoshan Iron & Steel Co., Ltd., Core Base.

<sup>4)</sup> In addition to <sup>3)</sup>, H≤2 ppm, O≤25ppm.

<sup>5)</sup> In addition to <sup>3)</sup>, H≤1 ppm, O≤15ppm