

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Sacrificial Anode Material for Corrosion Protection**with type designation(s)
Al-Ga-Anode (HDM)

Issued to

Haedong Metal Co., Ltd.
Busan 11, Republic of Korea

is found to comply with

DNV GL class programme DNVGL-CP-0107 – Type approval – Sacrificial anode materials
Det Norske Veritas' Recommended Practices, DNV-RP-B401 Cathodic Protection Design**Application :****The mean current capacity of the sacrificial anode material after 12 months free running testing is 2345 Ah/kg. The mean closed circuit potential is -800 mV vs. Ag/AgCl seawater (or -791 mV vs. SCE). The approval is given for use in sea water at temperatures below 30°C.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**This Certificate is valid until **2022-03-06**.Issued at **Høvik** on **2017-03-10**DNV GL local station: **Pusan**for **DNV GL**Approval Engineer: **Gisle Hersvik**

Martin Strande
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Job Id:
Certificate No: **TAS00000YM**

Product description

Al-Ga-Anode (HDM); Sacrificial Aluminium-Gallium Alloy Anode Material for Corrosion Protection

Chemical composition of **Al-Ga-Anode (HDM)**:

	Al	Ga	Zn	In	Si	Cu	Fe	Hg	Cd
Min.	Rem.	0,09							
Max.		0,11	0,15	0,005	0,10	0,005	0,08	0,005	0,002

Application/Limitation

The mean current capacity of the sacrificial anode material after 12 months free running testing is **2345** Ah/kg. The mean closed circuit potential is -800 mV vs. Ag/AgCl seawater (or -791 mV vs. SCE). Mean anodic current density 0.60 A/m².

The recommended design electrochemical capacity for aluminium based alloys in seawater is 2000 Ah/kg (ref. DNV-RP-B401).

Remarks:

- *DNV-RP-B401 does not include specific recommendations to Al-Ga anode materials.*
- *For anode deliveries where Fe-content is above 0,35%, please consider that current capacity may be lower than 2345 Ah/kg.*

The approval is given for use in sea water at temperatures below 30°C.

Type Approval documentation

Tests carried out

Type Testing carried out in accordance with **Type Approval documentation**, and in accordance with the Annex C of the DNV-RP-B401. Refer to DNV GL Technical Report No. 1XB719L-8/2016-5310, Rev. 0 "Long term anode testing of one Al-Ga based alloy according to DNV-RP-B401 (2010), Annex C" of 2016-10-18 for details on testing performed.

Testing has been performed with basis in DNV-RP-B401 (October 2010).

Marking of product

Product shall be marked with *manufacturer's name* or *trade mark*: **HDM** and *type designation*.

The marking is to be carried out in such a way that it is visible, legible and indelible. The marking of product is to enable traceability to the DNV GL Type Approval Certificate.

Periodical Assessment

The scope of the Periodical Assessment is to verify that the conditions stipulated for the Type Approval is complied with and that no alterations are made to the product design or choice of materials.

Assessment to be performed after 2 and 3.5 years (Certificate Retention) and at renewal after 5 years (Certificate Renewal).

The main elements of the Periodical Assessment are:

- Ensure that **Type Approval documentation** is available.



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- Review design, materials, production process, and performance with respect to possible changes, in order to ensure compliance with **Type Approval documentation** and/or referenced material specifications.
- Ensure traceability between manufacturer's product marking and DNV GL Type Approval Certificate.

END OF CERTIFICATE