

TYPE APPROVAL CERTIFICATE

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

Issued to

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

is found to comply with

Det Norske Veritas' Recommended Practices, DNV-RP-B401 Cathodic Protection Design
DNV GL class programme CP-0107 – Type Approval of metallic materials – Sacrificial anode materials**Application :****The mean current capacity of the sacrificial anode material after 12 months free running testing is 817 Ah/kg. The mean closed circuit potential is -1032 mV vs. Ag/AgCl seawater. The approval is given for use in sea water at temperatures below 50°C.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**This Certificate is valid until **2021-01-26**.Issued at **Høvik** on **2016-01-27**DNV GL local station: **Pusan**Approval Engineer: **Helene Bjerke**for **DNV GL**

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.



Job Id: **262.1-004046-6**
Certificate No: **TAS00000AW**

The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

Zn-Anode (HDM); Sacrificial Zinc Alloy Anode Material for Corrosion Protection

Application/Limitation

Approval is given for the sacrificial anode material; not for anode design.

The mean current capacity of the sacrificial anode material after 12 months free running testing is 817 Ah/kg. The mean closed circuit potential is -1032 mV vs. Ag/AgCl seawater.

The recommended design electrochemical capacity for zinc based alloys in seawater is 780 Ah/kg (ref. DNV-RP-B401).

Approval is given for use of the sacrificial anode material in seawater below 50°C. For zinc anodes buried in seawater sediments, please refer to below table for design electrochemical capacity for temperatures up to maximum 50°C:

Seawater temperature [°C]	Design electrochemical capacity [Ah/kg]		Reference
	Immersed in seawater	Buried in seawater sediments	
≤30	780	700	DNV-RP-B401
30	780	750	ISO 15589-2
40	780	580	
50	780	580	

* ISO 15589-2:2012 *Petroleum, petrochemical and natural gas industries -- Cathodic protection of pipeline transportation systems -- Part 2: Offshore pipelines.*

Type Approval documentation

Tests carried out

Type Testing carried out in accordance with **Type Approval documentation**, including 12 months testing carried out at DNV Bergen, ref. Report No. BGN-R2707023 of 2007-02-09.

Testing has been performed with basis in DNV-RP-B401 (1993).

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.



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Assessment to be performed after 2.5 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.
- 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 the DNV GL Type Approval Certificate.

END OF CERTIFICATE