DNV·GL

Certificate No:
TAS0000065

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Sacrificial Anode Material for Corrosion Protection

with type designation(s)
ZANODE

Issued to
Samgong Co., Ltd.
Busan, Republic of Korea

is found to comply with
Det Norske Veritas' Type Approval Programme 1-601.2, 2009, 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 813 Ah/kg. The mean closed circuit potential is -1037 mV vs. Ag/AgCl/Seawater. The approval is given for use in sea water at temperatures below 50ºC.

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.

This Certificate is valid until **2019-10-15**.

Issued at **Høvik** on **2015-10-16**

for **DNV GL**

DNV GL local station: **Pusan**

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.

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Product description

ZANODE: Zinc alloy sacrificial anode material.

Chemical Composition (%):

Fe	Cd	Pb	Cu	Al	Zn
0.005 max	0.07 max.	0.006 max	0.005 max	0.1-0.5	Remainder

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 calculated to be 813 Ah/kg. The mean closed circuit potential is –1037 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 50ºC. For zinc anodes buried in seawater sediments, please refer to below table for design electrochemical capacity for temperatures up to maximum 50ºC:

Seawater temperature [ºC]	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 **Type Approval documentation**.

The long-term testing has been performed with basis in DNV-RP-B401 Cathodic Protection Design (2010), ref. Technical Report No. 2014-5664, Rev. 1 "Long term testing of sacrificial zinc-based anode according to DNV-RP-B401 (2010), Annex C" from DNV GL Bergen, No. of 2015-03-20.

Marking of product

Product shall be marked with *manufacturer's name*; **Samgong** and *type designation;* **Z + charge no**.

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.

Periodical Assessment to be performed after two (2) years (Certificate Retention) and at renewal after four (4) years (Certificate Renewal).

The main elements of the Periodical Assessment are to:

- 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