

TYPE APPROVAL CERTIFICATE

This is to certify:**That the Sacrificial Anode Material for Corrosion Protection**with type designation(s)
BAC Zinc Cd-free Anode Alloy

Issued to

BAC Corrosion Control A/S
Herfolge, Denmarkis found to comply with
DNV GL class programme DNVGL-CP-0107 – Type approval – Sacrificial anode materials**Application :****The mean current capacity of the sacrificial anode material after 12 months free running testing is 800 Ah/kg. The mean closed circuit potential is -940 mV vs. Ag/AgCl/Seawater. The approval is given for use in sea water at temperatures up to maximum 50°C.****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**Issued at **Høvik** on **2019-01-15**This Certificate is valid until **2024-01-14**.DNV GL local station: **Copenhagen**for **DNV GL**Approval Engineer: **Gisle Hersvik**

Rikard Törnqvist
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.



Product description

BAC Zinc Cd-free Anode Alloy: Zinc alloy sacrificial anode material.

Chemical Composition (%):

Fe	Cd	Pb	Cu	Al	In	Sn	Zn
0.005 max	0.005 max	0.005 max	0.005 max	0.10-1.0	0.008-0.03	0.005-1.0	Remainder

Place of manufacture

BAC Corrosion Control A/S, Færøvej 7-9, 4681 Herfølge, Denmark

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 **800 Ah/kg**. The mean closed circuit potential is -940 mV vs. Ag/AgCl_(seawater). The test temperature during the test period was between 8 and 10°C.

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

The approval is given for use in sea water at temperatures below 50°C. For zinc anodes buried in seawater sediments, please refer to below table for design eletrochemical capacity for temperatures up to maximum 50°C:

Seawater temperature [°C]	Design eletrochemical capacity [Ah/kg]		Reference
	Immersed in seawater	Buried in seawater sediments	
≤30	780	700	DNVGL-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 NORSOK M-CR-503, Rev. 1, December 1994, COMMON REQUIREMENTS, CATHODIC PROTECTION and DNV RP B401, Cathodic Protection Design, 1993. Please ref. DNV Technical Report No. 27036BSC.R2, Rev. 01 "LONG TERM ELECTROCHEMICAL TESTING ACCORDING TO NORSOK STANDARD M CR 503 OF A SACRIFICIAL CADMIUM FREE ZINC ANODE ALLOY" of 1999-10-13. Please refer to the report for details on testing performed.

Marking of product

Job Id: **262.1-030066-1**
Certificate No: **TAS00001VE**

Product shall be marked with *manufacturer's name and/or logo*; **BAC Corrosion Control A/S** and *type designation*; **BAC Zinc Cd-free Anode Alloy**, *batch no./anode weight*.

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 2 and 3.5 years (Certificate Retention) and at renewal after 5 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