OVERVIEW OF MAIN REPORTS OF TESTS PERFORMED WITH ZINGA

ZINGA quality label

SGS Systems & Services Certification (Belgium)

Certificate ISO 9001: 2000 for quality management

The company Zingametall has implemented a quality management system that is based on the standard ISO 9001: 2000. Hereby we commit ourselves to strive for continuous improvement and customers' satisfaction.

British Board of Agrément (BBA) (United Kingdom) ***UK-24.20***

BBA certificate n° 03/4047

After thorough evaluation (effect on water quality, fire propagation, surface spread of flame, welding, resistance to abrasion, weathering, etc.) ZINGA received the approval from the BBA, which is the UK's major approval body for new construction products and installers. The BBA, in collaboration with SGS Coating Services, carries out regular inspections of the manufacturing process of ZINGA. This includes all the procedures involved with the production and the control of the delivered raw materials as well as of the quality of the final product. Traceability of the delivered product is assured by means of a specimen of each production batch.

ZINGA versus galvanisation

Bangladesh University of Engineering and Technology (BUET) (Bangladesh) ***BD-10.1***

Immersion test on ZINGA in comparison to hot-dip to determine the corrosion rate per year

In this test is demonstrated that the corrosion rate of ZINGA is less than 1/3 of the corrosion rate of hot-dip galvanising, in immersion.

University of Ghent (RUG) (Belgium) ***BE-1.3***

Measurement of the short circuit current flow of ZINGA in comparison to hot-dip

In this test (based on electro-chemical measurements) is demonstrated that ZINGA offers cathodic protection equal to that of hot-dip.

University of Ghent (RUG) (Belgium) ***BE-2.32***

Comparative salt spray test on ZINGA, hot-dip and metallisation

ZINGA passes the salt spray test with better results than hot-dip galvanisation and metallisation. On the picture, taken after 2000 hours salt spray, ZINGA shows far less rust than the other 2 plates with hot-dip and metallisation. The cross-cut in ZINGA demonstrates the efficiency of the galvanic couple.

Forschungs- und Materialprüfungsanstalt Baden-Württemberg (FMPA) (Germany) ***DE-13.6***

Different tests on the efficiency of ZINGA in comparison to hot-dip : potential measurement and short circuit current measurement

In this test is demonstrated that the electrochemical behaviour of ZINGA is similar to that of a hot-dip layer.

Direction Départementale de l'Equipement – Service Maritime de la Vendée (France) ***FR-12.2***

Field test on the efficiency of ZINGA in comparison with hot-dip on sea buoys

Two buoys (one treated with ZINGA, the other one hot-dip galvanised) have been floating in the Atlantic Ocean for four years. After those four years, the buoy treated with ZINGA showed no trace of rust while the hot-dip galvanised buoy was severely corroded in several places.

Chinese National Cheng Kung University (ACKU) – Materials Corrosion ***TW-22.6***

Prevention Center (Taiwan)

Salt spray test 7500 hours on hot-dip, hot-dip + ZINGA and ZINGA

The sample plates that had only been hot-dipped had started to rust after 172 hours already. This in sharp contrast with the other sample plates, because even after 7500 hours, the sample plates with hot-dip plus ZINGA, as well as the sample plates that were coated with ZINGA as a unique system, had passed the salt spray without any visible formation of red rust.

BNF Fulmer Research Centre (United Kingdom) **UK-23.2**

Electrochemical tests on ZINGA in comparison to hot-dip

The open circuit voltage and galvanic current between the galvanising layers and the bare steel were measured. The potential of the coupled electrodes on both specimens always remained below -800 mV, which is well within the potentials required for the galvanic protection of steel. The conclusion of the report is that ZINGA offers galvanic protection to steel comparable to that offered by hot-dip galvanisation. In other words : a layer of ZINGA is a completely metallic layer exactly like a hot-dip galvanising layer, and will behave as such in all aspects. Moreover, this test demonstrated that the corrosion rate of ZINGA is 1/3 of the corrosion rate of hot-dip galvanising under similar conditions.

South African Bureau of Standards (SABS) (South Africa) **ZA-19.2**

Salt spray test on ZINGA in comparison to hot-dip (loss in weight)

In this test is demonstrated that the loss in weight of ZINGA is 1/10 of the loss in weight of hot-dip galvanising after a 400 hours salt spray test. The layer thickness of ZINGA diminishes because ZINGA is being consumed, contrary to a paint that will start to peel off after a certain period of time. This illustrates the fundamental difference between a paint and a galvanising system.

Recharging with ZINGA

University of Ghent (RUG) (Belgium) **BE-1.4**

Test on how successive ZINGA layers blend with each other

This test demonstrates that a newly applied ZINGA layer makes the former layer liquid again so that both layers blend together to one single homogeneous layer. The new layer recharges the old one. The ZINGA film galvanising system is very easy to maintain and to recharge : there is no need for grit-blasting, contrary to the surface preparation that is required when a traditional paint has been used.

University of Ghent (RUG) (Belgium) **BE-1.9**

Test on the galvanic behaviour of ZINGA on top of hot-dip

When old, weathered hot-dip galvanised steel is coated with ZINGA, ZINGA recharges the hot-dip layer. ZINGA becomes the anode and protects both the hot-dip and the steel.

ZINGA in immersion

COT (The Netherlands) **NL-15.7**

Test according to the NORSOK standard M-501, rev. 5, system 7

ZINGA has passed the 4200 hours seawater immersion test and the 4200 hours cyclic test without any formation of rust, blisters, cracks or flakes. The pull-off adhesion test on ZINGA resulted in values of more than 7MPa.

Det Norske Veritas (DNV) (Norway) **NO-15b.7**

Ballast tank test

ZINGA was applied on blast-cleaned test panels that were placed in a ballast tank filled with sea water with wave movement and cyclic heating. Other test panels were placed in a condensation chamber. No corrosion of the steel substrate could be demonstrated. Based on the results of the testing, ZINGA meets the requirements of a B3 classification. In the report is stated that ZINGA has a beneficial corrosion protective performance.

The Water Quality Centre (United Kingdom) **UK-23.7**

Test on the influence of ZINGA on water quality
These tests were performed according to the standard BS 6920 to determine whether the quality of potable water is not affected when it is in contact with a ZINGA layer. The water was analysed on taste, appearance, growth of micro organisms, extraction of harmful substances and extraction of metals. The obtained results complied with the requirements and ZINGA was found suitable for contact with potable water.

ZINGA on rebars

University of Ghent (RUG) (Belgium) ***BE-4.65***
Pull-out test on zinganised rebars
A pull-out test was performed to evaluate the influence of a ZINGA layer on the bond strength of the rebar with the concrete. The conclusion was that coating with ZINGA does not negatively affect this.

Steel Authority of India (India) ***IN-13a.2***
Measurement of corrosion rate by salt spray and immersion tests
A comparison was made between uncoated steel rebars, fusion bonded epoxy coated rebars (FBEC), hot-dip galvanised rebars (HDG) and zinganised rebars (ZINGA). The corrosion rate per year was measured after immersion and salt spray. This test demonstrated several advantages of ZINGA: the greater degree of galvanic protection, the lower sacrificial zinc consumption due to the dispersion of zinc dust in the binder and the additional barrier protection created by the binder.
➔ ZINGA **>** FBEC **>** HDG **>** Uncoated

Jadavpur University (India) ***IN-13a.3***
Different tests on the efficiency of ZINGA in comparison with other coatings on rebars
A comparison was made between uncoated steel (Mild steel and Stainless steel) rebars, fusion bonded epoxy coated rebars (FBEC), hot-dip galvanised rebars (HDG) and zinganised rebars (ZINGA). The salt spray test pointed out that the zinganised rebars have a corrosion resistance that is about 2 times higher than that of hot-dip galvanised rebars. ZINGA is also least susceptible for stress corrosion cracking.
➔ in NACE solution: ZINGA **>** HDG **>** FBEC **>** Stainless steel **>** Mild steel

Amirkabir University Poly Technic Tehran (Iran) ***IR-14.5***
Different tests on the efficiency of ZINGA in comparison with uncoated rebars
The zinganised rebars passed the 500 hours salt spray test without formation of rust, peeling or blistering, not even in places where the coating was mechanically damaged. The rebars that were not zinganised were heavily corroded.

National Research and Scientific Laboratory for Modified Concrete (Russia) ***RU-17.5***
Tests on different characteristics of ZINGA on rebars
Tests on impact resistance, film hardness, adhesion, bond strength between concrete and steel, chemical resistance, coating stability, hydrothermal treatment, … that demonstrate the suitability of ZINGA for the protection of rebars. The application of ZINGA reduces the bonding strength between the rebars and the concrete with only 4%, which is well within the measuring allowances.

Protection against fire

University of Ghent (RUG) (Belgium) ***BE-2.21***
SGS Yarsley Technical Services (United Kingdom) ***UK-23.5***
Test on the surface spread of flame on ZINGA
The results of the test according to the BS 476: part 7 show that ZINGA has a class 1 surface. That is equal the class A1 in accordance with NBN S21-203. ZINGA did not ignite during exposure to thermal radiation.

Warringtonfiregent (Belgium) **BE-9e.264**

Test on the fire resistance of the Euroflam system

The intumescent paint Aquaflam EX, applied on top of ZINGA, isolates the steel from the heat and proves to be an outstanding protection system against fire.

SGS Yarsley Technical Services (United Kingdom) **UK-23.6**

Test on the fire propagation on ZINGA

The results of the test according to the BS 476: part 6 show that ZINGA has a class 0 surface. ZINGA did not ignite during exposure to heating.

ZINGA performance

CORRPRO Companies Inc. (United States) **US-26.10**

Test on ZINGA doors exposed at Kennedy Space Center (KSC)

This test was performed by Corrpro Co. Inc. evaluation program for US Army Tank-automotive and Armaments Command (TACOM). After 4 years exposure of ZINGA on metal doors in comparison to other systems, it became clear that ZINGA gave the best results on steel substrates.

Friction coefficient

China Ministry of Metallurgical Industry Engineering Quality Supervision Bureau Test Centre (China)

Treatment of 'high strength bolts' surfaces that connect steel sections

This test demonstrates that 'high strength bolts' treated with ZINGA have a higher friction coefficient (based on GB50017 and GB50205) than untreated bolts.

Mechanical Industrial Fasteners Product Quality Test Centre (China)

Friction coefficient based on 'slip-sliding' of friction plates

This test shows that the friction coefficient, based on 'slip-sliding' of friction plates treated with ZINGA, falls within the normal range of GB/T1231-91 and GB50221-95.