



Tantaline Treated Fasteners for Marine and Offshore Applications



Paul Egginton - JANUARY 2023

INTRODUCTION

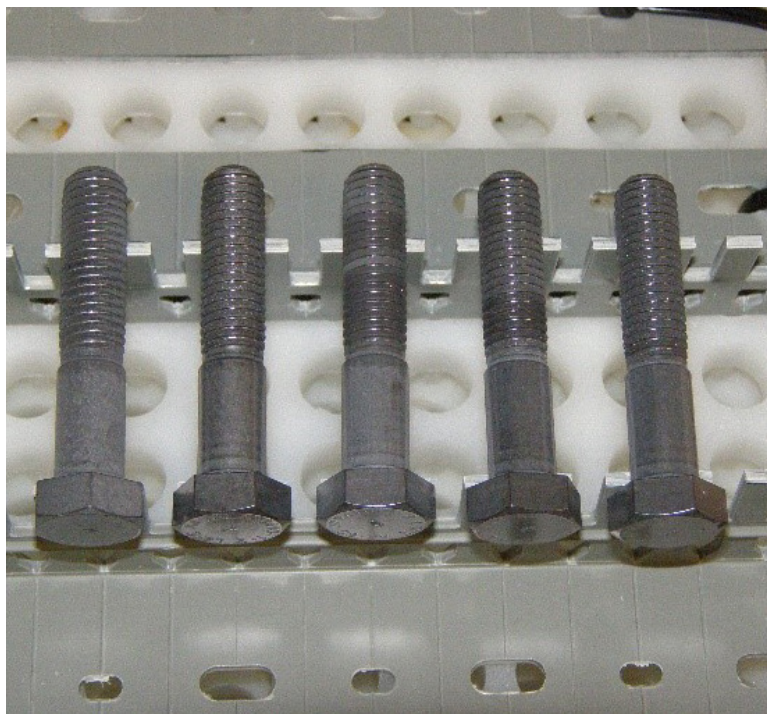
The life span of fasteners being used in marine and offshore environments is a continuing issue. In the past some solutions such as using protective coatings, paints and mechanical shielding have all been used, with varying degrees of success. Tantaline® has a solution. Initially developed for extreme chemical and corrosion resistance in the manufacturing industry, the technology is now being applied to protect fasteners. Testing carried out to DS/EN ISO 9227 NSS: 2017 and ASTM B117: 2019 confirmed that the Tantaline® treatment will survive in offshore applications.

The Tantaline® process deposits a thin (50 micron) layer of Tantalum onto a metal (usually 316 SS) surface. At the interface, an alloy is formed ensuring complete integrity of the treatment. For this discussion, several M12 x 1.75 x 60 mm bolts were treated and tested. For comparison, carbon steel bolts treated with zinc, plus untreated A4-80 SS bolts were included in the same test (2000 hours salt spray).





BEFORE SALT SPRAY TEST

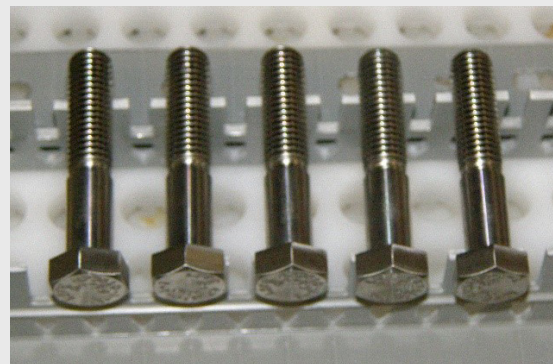


Tantaline Treated

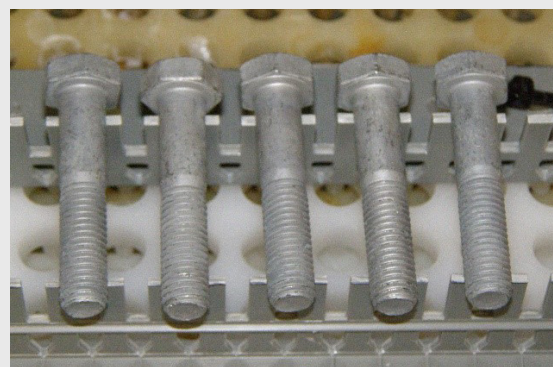
This tantalum surface treatment is normally exposed to strong acids when used in chemical and petrochemical installations. Offshore and maritime applications present, in many ways, a less challenging environment.

This report describes a 2000-hour neutral salt spray test of bolts treated with the Tantaline® process. Conventional zinc-based surface treatments, Stainless Steel 316 and carbon steel bolt materials are included in the test as a reference.

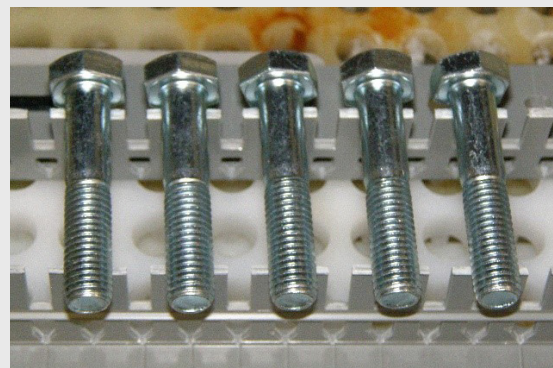
The test specimens are placed in an enclosed chamber and exposed to a continuous indirect spray of a neutral (pH 6.5 to 7.2) salt water solution at +35°C. This chamber is maintained under steady state conditions.



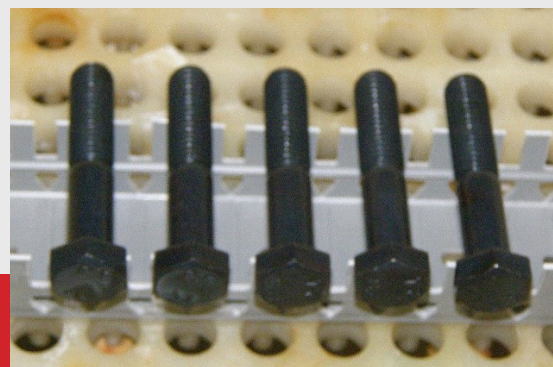
Stainless Steel, Untreated Bolts



Hot Zinc Galvanized



Zinc electroplated & Chrome III passivated



Low Carbon Steel Bolts

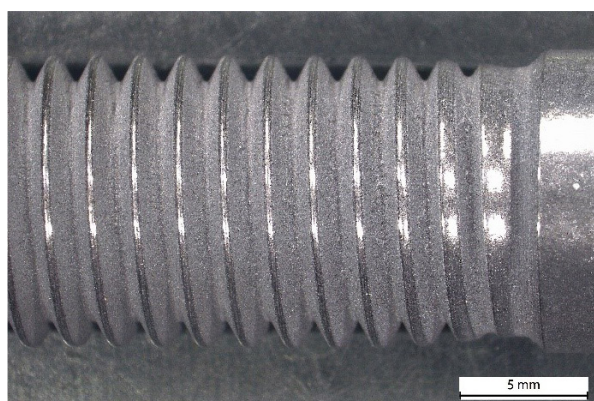
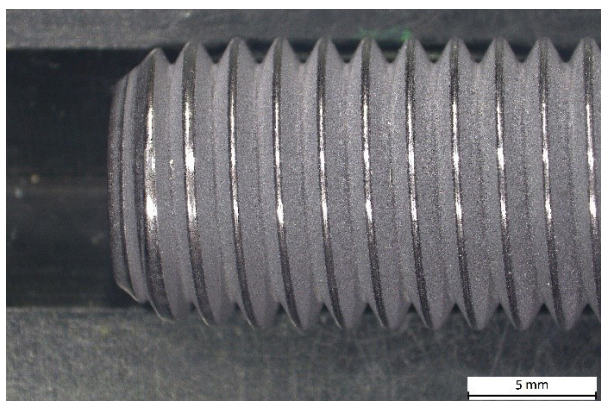




2000 HOUR SALT SPRAY TEST

Tantalum treated bolts after 12 weeks (2000 hours) salt spray test.

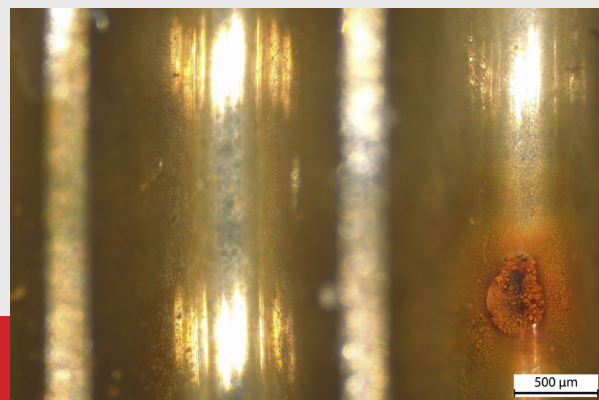
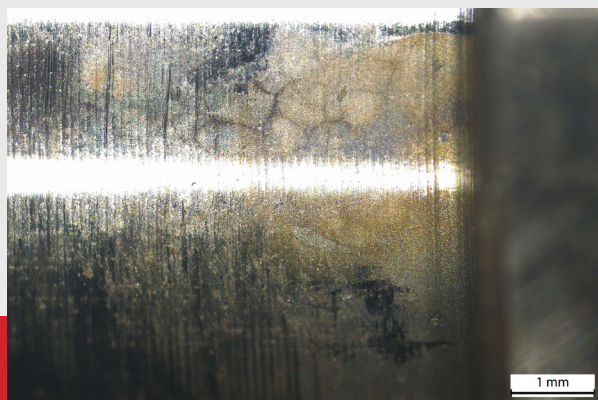
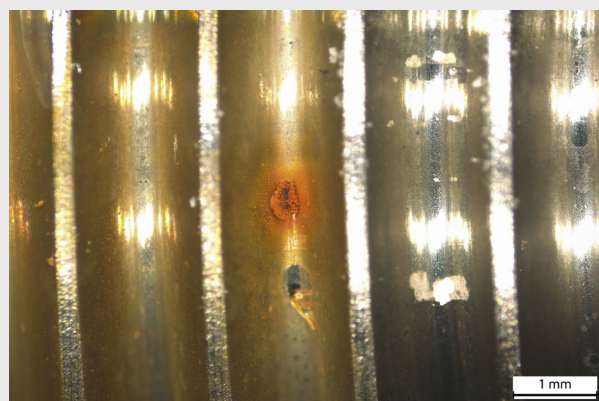
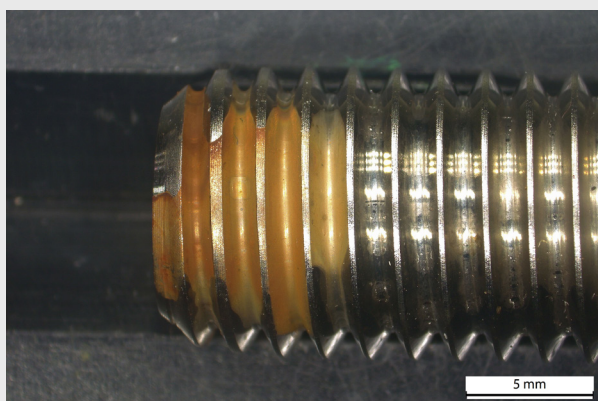
- The Tantaline treated bolts show no sign of corrosion.





2000 HOUR SALT SPRAY TEST

After 2000 hours salt spray tests the untreated stainless-steel bolts show signs of initial corrosion.



2000 HOUR SALT SPRAY TEST

Significant corrosion and material degradation was observed on the hot zinc galvanized, Zinc electroplated & chrome passivated, and on the low carbon steel bolts as shown.



Heat zinc galvanized bolts after 12 week test.



Zn electroplated and Cr III passivated bolts after 12 week test.



Untreated bolts with oil-film protection, after 12 week test.

SUMMARY

The Tantaline® treatment provides excellent resistance to salt spray based on the 2000 hour salt test used to qualify components for offshore and maritime applications. Moreover, all Tantaline® treated parts are subjected to a 100% quality inspection, including immersion in 20% Hydrochloric acid at 75 °C for 48 hours. This acid test alone would significantly erode 316 stainless steels.

Tantaline® provides superior corrosion resistance to protect stainless steel materials from corrosion which should be considered to protect fasteners for marine and offshore applications.



We are grateful to FORCE Technology, Nordborg, Denmark, for performing the testing.