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NOFIRNO rubber and sealant:

Resistance to neutral salt spray test (NSS) according to EN-ISO 9227

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Title	NOFIRNO rubber and sealant: resistance to neutral salt spray test
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Preface

NOFIRNO sealing systems for fire safe pipe and cable penetrations, consisting of NOFIRNO rubber and NOFIRNO sealant, are applied in offshore installations. Due to the climate conditions the sealing materials are in contact with air with a high humidity and a high salt concentration.
A salt spray test was carried out to show the resistance of these materials.

The test was carried out in the test laboratory of Beele Engineering BV in Aalten, The Netherlands and witnessed by Mr Hans Naus of Kiwa Nederland BV.

Contents

1 Test description and test program

1.1 Introduction

A neutral salt spray test (NSS) was carried out on NOFIRNO rubber sheets and NOFIRNO sealant specimens according to EN-ISO 9227:2012 “Corrosion tests in artificial atmospheres – Salt spray tests”.
Test principle: a 5 % sodium chloride solution in the pH range from 6,5 to 7,2 was atomized under a controlled environment and sprayed on test specimens at a controlled temperature of 35 °C during 24 hours.

1.2 Test solution

Sodium chloride was dissolved in distilled water with a conductivity not higher than 20 µS/cm at 18 °C to produce a concentration of 50 g/l ± 5 g/l. The sodium chloride used had a purity of 99,5 %.
The pH of the salt solution was adjusted; the pH of the sprayed solution collected within the test cabinet was 6,7.

1.3 Spray cabinet

The used spray cabinet was a Weiss Umwelttechnik salt spray humidity test chamber type SC / KWT 1000.
WKD calibration certificate number 400 36403 dated 12 May 2014, calibration of the parameters temperature and humidity.

For this test no reference specimens were used to verify the apparatus operation, because the objective of the test was not to control the corrosion of metal test specimens.

1.4 Test specimens

NOFIRNO rubber sheets
Number of sheets: 2
Dimensions: 199,2 x 199,6 x 15,1 mm
Production date: 15 December 2014

NOFIRNO sealant
Number of test pieces: 2
Dimensions of the test pieces: 84,8 x 92,1 mm and 103,4 x 106,4 mm, thickness about 20 mm.
The test pieces were prepared from a hardened sheet of sealant that was exposed to outside climate conditions in Aalten, The Netherlands, for more than two years.

1.5 Arrangement of the test specimens

The NOFIRNO rubber sheets and NOFIRNO sealant test pieces were arranged in the spray cabinet as indicated on picture 1.

Picture 1. Arrangement of specimens in the spray cabinet.

1.6 Operating conditions of neutral salt spray test (NSS)

Temperature: 35 °C ± 2 °C.
Average collection rate for a horizontal collecting area of 80 cm2: 1,5 ml/h ± 0,5 ml/h.
Concentration of sodium chloride (collected solution): 50 g/l ± 5 g/l.
pH (collected solution): 6,9.

1.7 Duration of test

The period of exposure was 24 hours.

1.8 Treatment of specimens after test

The specimens were dried and cleaned with paper towel.

1.9 Evaluation of test results

The influence of the exposure to neutral salt spray to the specimens was evaluated with respect to:

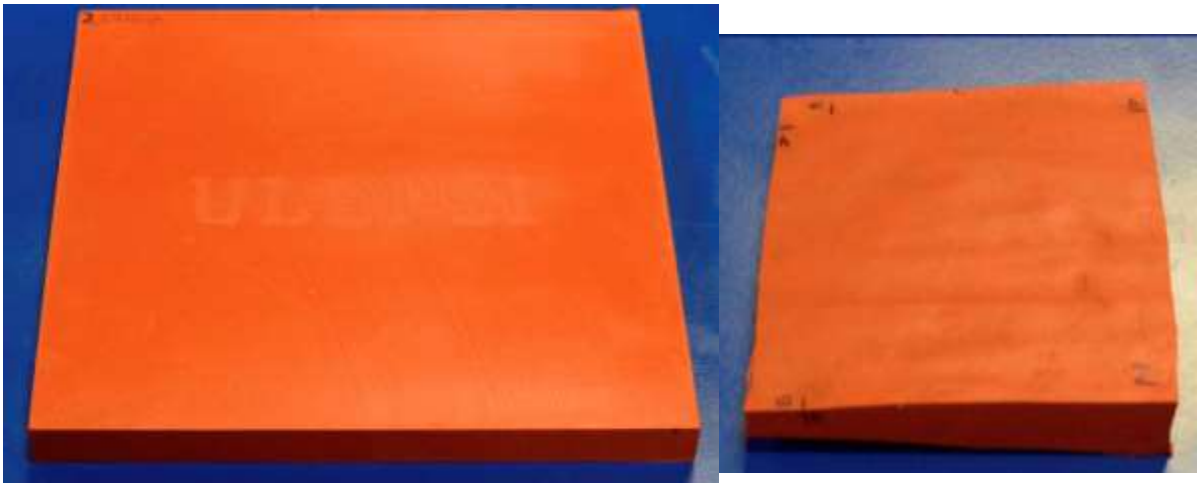
- Change of appearance (visual)
- Evidence of surface effects after exposure (visual)
- Change of hardness in Shore A according to ISO 7619-1
- Change of weight (balance)
- Change of dimensions (calliper)

2 Test results

The results are summarized in table 1.

Table 1. Test results of 24 h exposure to neutral salt spray (NSS)

Property	NOFIRNO rubber		NOFIRNO sealant	
	Specimen 1	Specimen 2	Specimen 1	Specimen 2
Appearance				
- Before exposure	Smooth surface, red colour	Smooth surface, red colour	Smooth surface, red colour	Smooth surface, red colour
- After exposure	No change	No change	No change	No change
Surface effects				
- Before exposure	No cracks, no blisters, etc.	No cracks, no blisters, etc.	No cracks, no blisters, etc.	No cracks, no blisters, etc.
- After exposure	No cracks, no blisters, no discolouration	No cracks, no blisters, no discolouration	No cracks, no blisters, no discolouration	No cracks, no blisters, no discolouration
Hardness [Shore A]				
- Before exposure	79	77	52	52
- After exposure	79	77	52	52
- Change [Shore A]	0	0	0	0
Weight [g]				
- Before exposure	972	970	237	271
- After exposure	972	970	237	271
- Change [%]	0	0	0	0
Dimensions [mm]				
- Before exposure	199,2x199,6x15,1	199,3x198,7x15,1	84,8x92,1	103,4x106,4
- After exposure	199,3x199,5x15,1	199,4x199,3x15,1	84,7x92,1	103,4x106,8
- Change [%]	0	0	0	0



Picture 2. Exposed specimens NOFIRNO sheet (left) and NOFIRNO sealant (right)

3 Conclusions

NOFIRNO rubber and NOFIRNO sealant is resistant to neutral salt spray test (NSS) according to EN-ISO 9227, using an exposure period of 24 hours.
After exposure NOFIRNO rubber and NOFIRNO sealant showed no change in appearance, no change of surface conditions, no change in hardness, weight and dimensions.

Note:
NOFIRNO rubber and NOFIRNO sealant are silicone materials.
In Annex A the properties of silicone materials with respect to weathering conditions are shortly described.

4 Signature

Rijswijk, January 2015

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Senior Consultant Rubber

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Annex A Resistance of NOFIRNO materials to offshore climate conditions

NOFIRNO rubber is a high temperature cured silicone rubber compound, consisting of cross-linked silicone rubber (polysiloxane) and fillers.
NOFIRNO sealant is a room temperature cured silicone sealant compound, consisting of cross-linked silicone (polysiloxane) and fillers.

It is generally known that silicone materials (polysiloxanes) are very good resistant to weathering with respect to UV-radiation, oxygen and ozone.
It is also generally known that silicone materials are very good resistant to sea water.

Silicone materials can be applied within a very large temperature range, from artic conditions (as low as about – 50 ºC) to very hot desert conditions (+ 80 ºC and much higher).

It is therefore to be expected that NOFIRNO products will be very good resistant to offshore climatic conditions during decades.