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**Subject: Investigation of corrosion durability of dowels and tie bars in salt-spray test according to EN ISO 9227:2012**

By mandate of company *OTTO BRENTZEL – Stahlverarbeitung e.K.*, Germany, corrosion durability of dowels and tie bars was investigated by NSS-test (neutral salt-spray test) according to EN ISO 9227:2012.

According to recent draft of EN 13877-3 (prEN 13877-3, dated April 2017), each three new samples of dowels and tie bars we placed in neutral salt spray for duration of 240 hours. Conditions in salt-spray cabinet were as follows:

- Natrium-Chloride concentration: 5%
- Temperature in cabinet: +35°C
- Temperature of salt spray: +50°C

The dowels of plain steel are completely plastic coated except one face end, which is covered with anti-corrosive paint (due to manufacturing process). The dowels show a length of  $l = 500$  mm and a diameter of  $\varnothing = 25$  mm.

The tie bars of ripped steel are plastic coated in centre area at a length of  $l_{\text{coating}} = 250$  mm. The tie bars show a total length of  $l = 800$  mm and a diameter of  $\varnothing = 20$  mm.

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Coating thickness was determined with a magnetic layer thickness meter (Minitest F100) on regarded dowels and tie bars (in area of the ribs) at each three positions. See table 1 for measurement results.

Table 1: Thickness of coating on dowels and tie bars.

Sample	Thickness of plastic coating [ $\mu\text{m}$ ]		
	Pos. "above"	Pos. "centrically"	Pos. "down"
Dowels #1	418	474	532
Dowels #2	410	478	524
Dowels #4	415	460	480
Tie bar #1	612	665	700
Tie bar #2	786	584	606
Tie bar #3	484	514	503

According to table 1, requirement of a coating thickness not less than 0.2 mm and not more than 0.8 mm is met.

According to recent draft of EN 13877-3, investigation of durability of coating in corrosion test regards coating on lateral surface in the middle of specimen on a length 50 mm shorter than coated length of specimen. (25 mm at both endings of coated surface are not relevant.

Before starting investigation, no rust was observed on sample surfaces. After duration of 240 hours at defined neutral salt-spray conditions, the samples were removed from test cabinet and visually inspected.

After 240 hours of salt-spray, plastic coating of **dowels** show an effective protection against corrosion. No rust spots were observed at the total regarded area of plastic coating on lateral surface. See pictures 1 and 2 for view of dowels before testing and pictures 3 and 4 for conditions after corrosion test.



**Picture 1: Plastic coated surface of investigated dowels before corrosion testing.**



**Picture 2: Opposite surface of investigated dowels before corrosion testing.**



**Picture 3: Plastic coated surface of dowels does not show any rust in regarded area of lateral surface after 240 hours at neural salt-spray.**

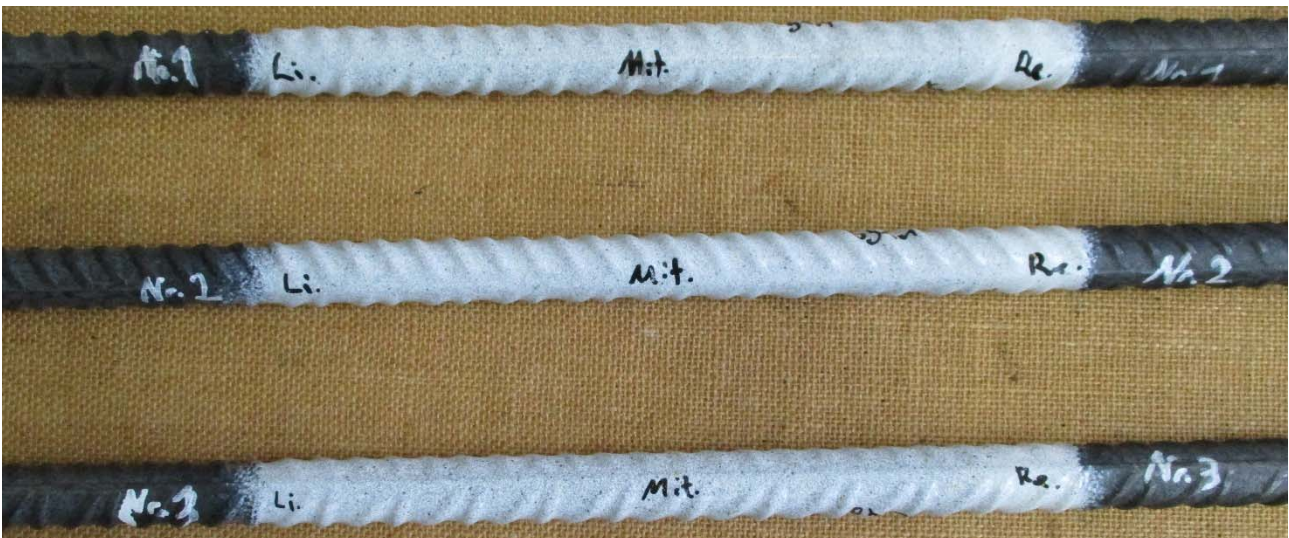




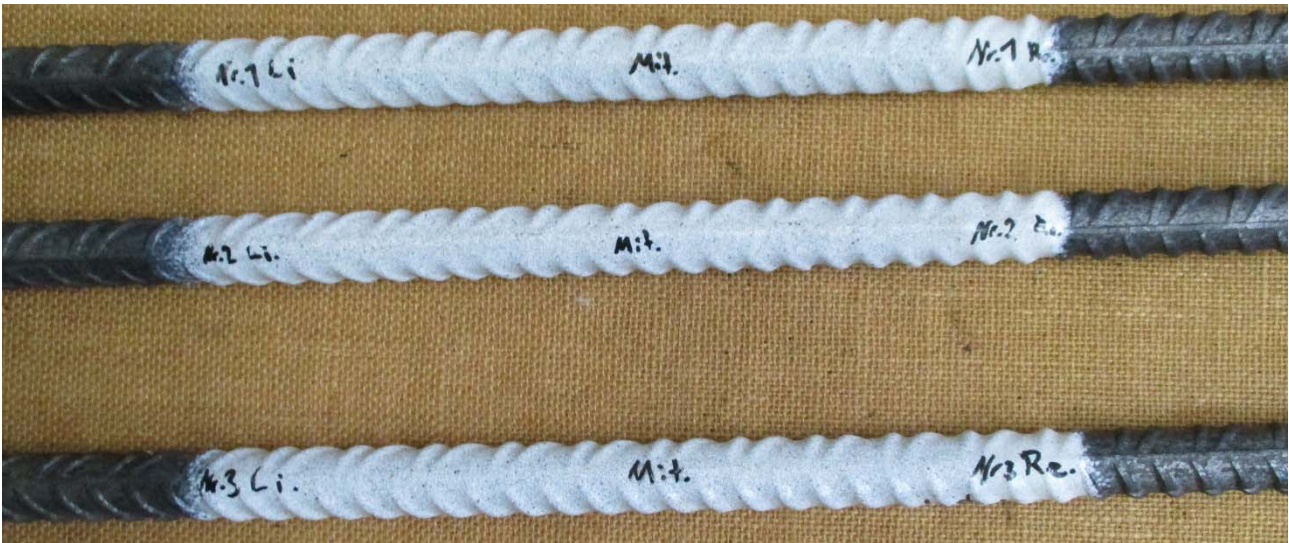
**Picture 4: Opposite plastic coated surface of dowels without any rust in regarded area of lateral surface after 240 hours at neutral salt-spray.**

**Tie bars** are plastic coated on a length of  $l_{\text{coating}} = 250$  mm in centre area. In this area, load transfer transversal to steel bar direction occurs and water may penetrate through the joint.

On all three investigated tie bars no rust was observed after 240 hours of neutral salt-spray in regarded area of lateral surface (200 mm length in centre of tie bar). See pictures 5 and 6 for view of tie bars before testing and pictures 7 and 8 for condition of tie bars after corrosion test.



**Picture 5: View of plastic coated area of tie bars before corrosion testing.**

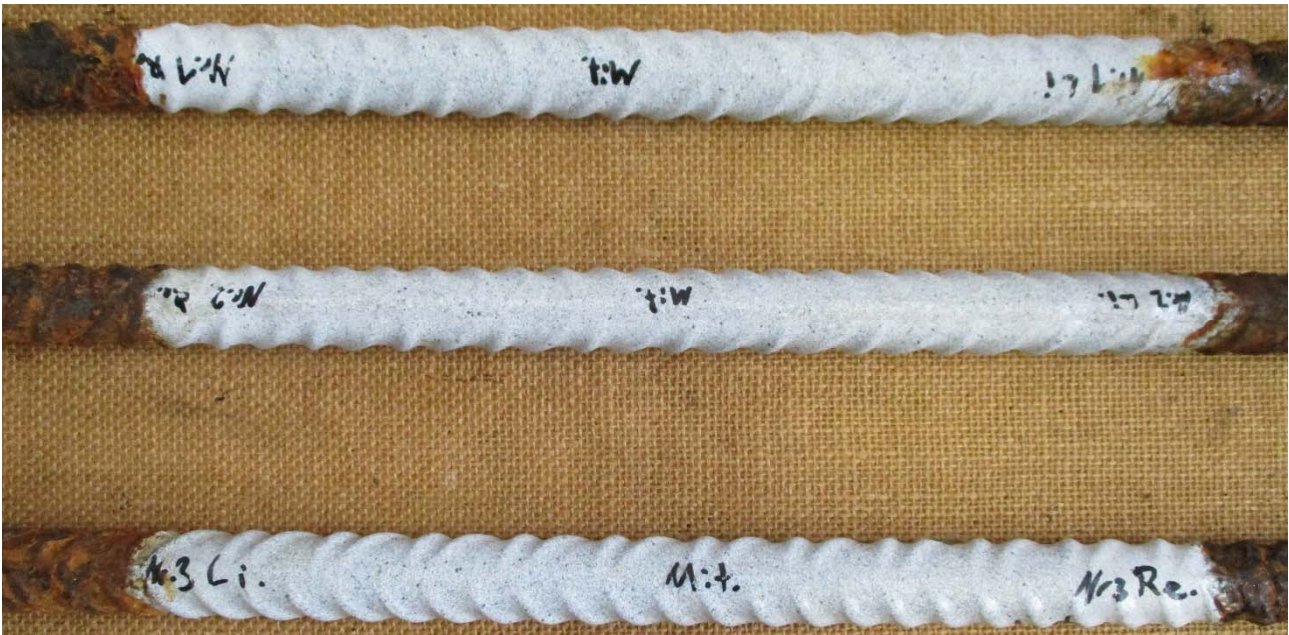


Picture 6: View of opposite side lateral surface of plastic coated area of tie bars before corrosion testing.



Picture 7: View of plastic coated area of tie bars after 240 hours salt-spray. No rust was observed in regarded area of lateral surface (200 mm in centre of tie bar).





**Picture 8: Opposite view of plastic coated area of tie bars after 240 hours salt-spray. As well, no rust was observed in regarded area of coated lateral surface.**

### Summary

By mandate of company *OTTO BRENTZEL - Stahlverarbeitung e.K.*, Germany, corrosion tests according to EN ISO 9227:2012 were executed on samples of dowels and tie bars, as demanded by recent draft of EN 13877-3 (Release: April 2017). Tests were executed in November 2017.

After 240 hours of neural salt-spray, no rust was observed on relevant area of coated lateral surface. Thus, requirements respect to durability against corrosion are met. Requirements respect to thickness of coating are met, as well.

For execution of tests and reporting,

Dr.-Ing. C. Simon