

**Short Report**

**ZP 52-5-19.53.1-1347/10**

Subject:

**„INVESTIGATION ON SUITABILITY AND ON CORRELATION TO IN-SERVICE  
FIELD PERFORMANCE AS WELL AS FOR EUROPEAN STANDARDISATION  
WORKS ON TESTING WEATHERING RESISTANCE OF JOINT SEALANTS USED  
IN FACILITIES FOR THE STORAGE, FILLING AND HANDLING OF SUBSTANCES  
HAZARDOUS TO WATER”**

Short title:

**“WEATHERING RESISTANCE OF SEALANTS”**

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Enheim, Mai 31, 2012

## **1 Objective of Research**

Cold applied joint sealants are used in facilities for the storage, filling and handling of substances hazardous to water inside of buildings as well as in outdoor applications. Joint sealants are used to seal moving joints and openings (gaps) between substrates. The main purpose of a sealant is to prevent air, water, and other substances from entering or exiting a structure while permitting a certain amount of movement of the substrates due to shrinkage, temperature (environmental) depending changes in length, or different movement of the substrates.

Joint sealants have to fulfill their function not only short-term but also long-term. In the frame of the European unification of testing sealants up to now a generally accepted testing and assessment concept of sealants durability regarding weathering is missing. According to the approval guidelines of DIBt and to the European standard EN 14188-2 the weathering resistance has to be tested in accelerated artificial weathering tests according to EN ISO 11431. The required duration of artificial weathering of 500 hours permits only a rough estimation of in-service field performance. Preliminary investigations confirmed this statement and showed a significant dependence of the relevant deformation characteristics as a function of time combined with a remarkable surface change (crack formation). The tests were conducted up to a total irradiation of 8 GJ/m<sup>2</sup> at wavelengths from 290 nm to 800 nm, which is equivalent to a natural weathering of about 5 years in Central Europe.

## **2 Objective Target**

The objective of this project was to work out test conditions and test criteria to assess reliable the durability. These criteria are also much-needed for granting national and international technical approvals (CUAP 06.05/11) on joint sealants, based on a minimum service life of 10 years.

## **3 Summary of Results**

The resistance of sealants to weathering is a major factor in their suitability for use in outdoor application. According to the approval guideline "Joint sealant compounds for sealing systems used in facilities for the storage, filling and handling of substances hazardous to water, Part 1 - Joint sealants" the requirements are met if after 500 hours artificial weathering the change in modulus is lower than 20 %.

Within the framework of this research work, the first samples were tested after 1000 hours artificial weathering. One two-component polysulfide sealant (grey, pouring grade and self-leveling) did not meet the requirements of 20 % and showed a decrease of 33.3 % in 100 % modulus. All other sealants showed after 1000 hours modulus changes of lower than 20 %.

Summarized it can be stated that artificial and natural weathering led to gradual differences in surfaces (discolouration, crack formation) and in relevant deformation characteristics.

The measured state of degradation showed no indication for a premature failure of the sealant. The required functional performance under real-time extension and compression movements is also after four years outdoor weathering furthermore ensured for all sealants.

The ageing process within the polymer group of polysulfides and also in polysulfide/polyurethane comparison is distinctly different when storing under normal climate conditions as well as in artificial and outdoor weathering tests. No reliable correlation or even more correlation factors between artificial laboratory and outdoor weathering was attained.

Overall the characteristics of the sealants have changed only slightly between two and four years of outdoor exposure. Further substantiated statements are expected when the continued exposed samples are tested and finally assessed after eight years outdoor exposure.

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Based on these results it is not necessary to modify the test conditions and test criteria of the national (DIBt guideline joint sealants) and international technical approvals (CUAP 06.05/11) procedures on joint sealants. However it must be considered that the duration of artificial weathering of 500 hours only permits to detect absolutely unsuitable sealants, statements on durability could not be derived from these results.