



TECHNICAL REPORT

EUROPEAN ORGANISATION FOR TECHNICAL APPROVALS

Characterisation, Aspects of Durability and Factory Production Control for Reactive Materials, Components and Products

Extract from TR 024
Edition November 2006
Amended July 2009

4 Durability

4.1 General Stipulations

The durability of reactive materials may change significantly when exposed to specific conditions. This change may result in a product not achieving the expected performance. This indicates that the product probably does not meet the required resistance to the intended application conditions.

Where a product is not subject to further processing (e.g. external protection or encapsulation) to achieve its final form, it shall be tested for durability in accordance with the guidance in this document.

Where a product is subject to further processing, such as encapsulation in waterproof casings, the durability tests should be conducted in accordance with the product specification.⁹

The following types of final intended use conditions¹⁰ are considered to be relevant for reactive materials, components and products and should be tested correspondingly:

⁸ Batch: The unit or quantity of production in a single complete production operation.

⁹ This means that the product should be tested in its final form or alternatively the performance of the protective layer, foil, encapsulation etc should be separately assessed in an appropriate test.

¹⁰ The designation of the use categories may change by specification writers according to their needs.

Type X: intended for use at conditions exposed to weathering

Type Y₁: intended for use at temperatures below 0°C with exposure to UV but no exposure to rain¹¹

Type Y₂: intended for use at temperatures below 0°C, but with no exposure to rain nor UV¹¹

Type Z₁: intended for use at internal conditions with high humidity, excluding temperatures below 0°C¹²

Type Z₂: intended for use at internal conditions with humidity classes other than Z₁, excluding temperatures below 0°C.

NOTE 5

Materials that meet requirements for type X, meet the requirements for all other types. Materials that meet requirements for type Y₁ also meet the requirements for type Y₂, Z₁ and Z₂. Materials that meet the requirements for type Y₂ also meet the requirements for type Z₁ and Z₂. Materials that meet the requirements for type Z₁, also meet the requirements for type Z₂.

4.2 Testing and Assessing of durability

4.2.1 General

The principle of the durability tests is to select essential physical and/or chemical properties of the product and to check whether these properties will change during exposure to defined exposure conditions.

For the ETA, the applicant and the approval body shall agree the appropriate selection of the relevant properties (relevant for the performance of the product) from table 3-1 to verify the durability.

If this Technical Report is used for preparing harmonised product standards, the specification writer should define which properties shall be considered being essential.

The test results for the unexposed and for the exposed specimens shall be compared. This stipulates that the samples for the exposure tests shall be of the same quality as for the tests of unexposed specimens. So it would be an advantage, if all specimens are taken from the same sample but also the results for unexposed specimens from approval testing may be used for this purpose.

The evaluation "no essential change in performance" shall be given if the mean value of the tested property of the exposed specimen does not deviate more than $\pm 15\%$ of the mean value of the initial test (unexposed specimens). No single result of exposed specimens shall be less than 80% of the mean value of the initial test.

If the result falls outside these criteria, additional 4 specimens of the same sample should be exposed, tested and assessed. All four additional specimens shall fulfil the pass criteria.

4.2.2 Preparation and conditioning of specimens

All samples shall be prepared as the manufacturer recommended and as intended in practice (curing and curing period, exposure with protection as intended etc). It is in the responsibility of the applicant and the Approval Body to agree the best method for testing complex shaped materials or products. The type of protection, if any, shall be recorded in the test report.

The samples shall be supported on racks or special devices (made of an inert material) to put them into the test chamber preferably in a vertical position, 20 mm separated from each other. The size of the sample shall be sufficient for at least 3 specimens for every verification test and every option model (e.g. thinnest/thickest variation of thickness) and product variation.

Before and after environmental exposure the samples and specimens shall be conditioned at a temperature of (23 ± 3) °C and a relative humidity (rh) of (50 ± 5) %.

Before and after exposure the specimen shall be weighed. The change of weight, if any, shall be recorded.

After exposure and before the post environmental testing the specimens shall be maintained in

¹¹ Products applicable to Y₁ and Y₂ but not at temperatures below 0°C see chapter 4.2.4.

¹² These uses apply for internal humidity class 5 in accordance with EN ISO 13788.

conditions of a temperature of (23 ± 3) °C and a relative humidity of (50 ± 5) % rh.

4.2.3 Testing reactive materials intended for type X applications

Reactive materials, components and products intended for outdoor use are usually exposed to weathering – rain, UV, high temperatures in summer, frost and frost-thaw in winter. To be able to assess the fitness of the reactive material for outdoor use the following tests shall be carried out:

UV Chamber

The sample shall be exposed in a UV chamber to the conditions according to EN ISO 4892-3:2006, with a Type A lamp combination A.2 (table 1) according to cycle N°3 (table 4).

Air, humidified and temperature-controlled, shall be blown into the test bench. The specimens shall be sprayed with distilled or demineralised water.

A sample for at least 3 specimens as required for the verification tests¹³ shall be stored preferably in a vertical position for 28 days in the UV chamber conducting the following procedure:

Continuous UV-irradiation for 28 days,

1 cycle takes 6 h divided as follows:

- 5 h dry phase at (50 ± 3) °C and relative humidity below 15 % rh and
- 1 h exposed to water spray¹⁴, at (25 ± 3) °C without controlled humidity

This cycle shall be repeated 112 times without interruption. After testing the specimens shall be visually assessed and the observations shall be recorded.

Environmental Chamber

After the UV chamber test the same sample shall be exposed for further two weeks to the procedure according to table 4-1 in a controlled environmental chamber without interruption¹⁵:

¹³ *At least 3 specimens are required for each verification test. If more than one test is intended (e.g. expansion ratio and expansion pressure) the number of specimens will grow. So the exposed sample/s should be of sufficient size.*

¹⁴ Advice: Use water of approximately (20 ± 5) °C.

¹⁵ The cycle of exposure according to table 4-1 or 4-2 shall be repeated twice

Table 4-1 Exposure condition cycle for reactive materials without temperature restriction

period/ day	6 hour phase			
	1 st (6 hours)	2 nd (6 hours)	3 rd (6 hours)	4 th (6 hours)
1. + 2.	(20 ± 3) °C, saturated rh	(70 ± 3) °C, (20 ± 5) % rh	(20 ± 3) °C, saturated rh	(70 ± 3) °C, (20 ± 5) % rh
3. + 4.	(20 ± 3) °C, saturated rh	(30 ± 3) °C, (40 ± 5) % rh	(40 ± 3) °C, saturated rh	(30 ± 3) °C, (40 ± 5) % rh
5. + 6 + 7	(- 20 ± 3) °C	(40 ± 3) °C, saturated rh	(- 20 ± 3) °C	(40 ± 3) °C, saturated rh

NOTE 6

The chamber temperature change shall be at a rate of (1.5 ± 0,5) K/min. During the period of temperature change the change of humidity is not controlled, but condensation should be avoided. The duration of temperature change is included in the duration of an exposure phase.

After the exposure the specimens shall be cut from the sample and shall be tested according to the verification test¹⁶.

¹⁶ Specific deviations and modifications concerning the conditioning, the shape and size of the specimen, the exposure conditions and the verification test/s shall be recorded.