

Sulfur dioxide corrosion testing in a saturated atmosphere

DIN
50018

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Descriptors: Corrosion testing, saturated atmosphere, sulfur dioxide.

Prüfung im Kondenswasser-Wechselklima mit schwefeldioxidhaltiger Atmosphäre

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Foreword

This standard has been prepared by Technical Committee *Materialprüfung* of the *Normenausschuß Materialprüfung* (Materials Testing Standards Committee). It is based on the requirements for corrosion testing laid down in DIN EN ISO 6988, March 1997 edition, and was issued as an amended version to cover further exposure conditions which are relevant to the German market.

Amendments

In comparison with the June 1988 and March 1997 editions of DIN 50018, the present standard exclusively specifies requirements for sulfur dioxide corrosion tests which have not been dealt with in the March 1997 edition of DIN EN ISO 6988. Furthermore, a printing error in the table has been corrected.

Previous editions

DIN 50018: 1963-12, 1978-05, 1988-06, 1997-03.

1 Scope and field of application

This standard mainly covers performance checks carried out on test arrangements used to assess anti-corrosion systems.

As far as corrosion testing itself is concerned, it refers to the March 1997 edition of DIN EN ISO 6988 unless the exposure conditions differ.

Users of this standard are also requested to consult other relevant standards and regulations and are advised that individual test conditions may be also agreed upon on a case by case basis.

The methods illustrated in table 1 are accelerated corrosion tests as specified in DIN 50900-3, which rapidly detect deficiencies in corrosion resistance.

It should be noted that the instructions given in DIN 50905-1 to DIN 50905-3 should be observed when

carrying out the tests covered by this standard. For further instructions, also refer to the foreword of DIN EN ISO 6988. As it cannot be ruled out that specimens, on which different anti-corrosion systems have been applied, may interact, it is recommended that different anti-corrosion systems be tested separately.

If various anti-corrosion systems applied to different test materials are to be tested together, it should be taken into account that the sulfur dioxide tends to have diverse effects on the materials under test and that results are, therefore, not always reproducible.

Unless the anti-corrosion systems compared are similar to one another, it may be difficult to draw reliable conclusions with regard to their effectiveness under service conditions. In the same way that corrosive test conditions differ considerably from those occurring in service, so do the levels of protection afforded by anti-corrosion systems.

Continued on pages 2 and 3.

2 Normative references

This standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the titles of the publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- DIN 50900-1
Corrosion of metals – General concepts
- DIN 50900-2
Corrosion of metals – Electrochemical concepts
- DIN 50900-3
Corrosion of metals – Concepts associated with corrosion testing
- DIN 50905-1
Corrosion testing – Principles
- DIN 50905-2
Corrosion testing – Corrosion characteristics under uniform corrosion attack
- DIN 50905-3
Corrosion testing – Corrosion characteristics under non-uniform and localized corrosion attack without mechanical stress
- DIN EN 10130
Cold rolled flat steel products for cold forming – Technical delivery conditions
- DIN EN ISO 6988
Metallic and other non-organic coatings – Sulfur dioxide test with general condensation of moisture
- ISO 8407:1991
Corrosion of metals and alloys – Removal of corrosion products from corrosion test specimens

3 Concepts

See DIN 50900-1 to DIN 50900-3.

4 Test arrangement and materials

See clause 3 of DIN EN ISO 6988.

5 Designation

The standard designations for the anti-corrosion tests covered by this standard shall read:

Test DIN 50018 – KFW 1,0 S

and

Test DIN 50018 – KFW 2,0 S

Also refer to table 1.

6 Specimens

See clause 4 of DIN EN ISO 6988.

7 Exposure of specimens

The specimens shall be exposed to corrosion as specified in clause 5 of DIN EN ISO 6988.

8 General test conditions

The test conditions specified in table 1 of the present standard partly differ from those in DIN EN ISO 6988. However, when carrying out the test, instructions given in subclauses 6.1, 6.2 and 6.4 of DIN EN ISO 6988 should also be taken into account.

NOTE: Much of the sulfur dioxide added at the beginning of the first test phase quickly dissolves into the water at the bottom of the test chamber. Thus, the effective sulfur dioxide concentration is approxi-

mately $\frac{1}{7}$ of the theoretical amount. Also, the initial concentration does not remain constant during the first test phase, dropping rapidly at first and then more slowly.

During the second test phase the heating shall be switched off and the test chamber opened or vented until, after about 1,5 hours, the exposure conditions given in table 1 are achieved.

Test duration

Unless the test duration has been specified otherwise in relevant test standards referred to, 1, 2, 5, 10, 15 or 20 cycles of 24 hours each shall be carried out. The test may be terminated if an unacceptable degree of corrosion has been reached, or if the appearance or function of specimens has otherwise been impaired.

If, as usual, several cycles are carried out, note that both the water and sulfur dioxide must be replaced at the end of each cycle as specified in subclause 6.5.1 of DIN EN ISO 6988.

9 Performance checks

In order to ensure the reproducibility and repeatability of test results obtained either with one or several test apparatuses, performance checks shall be carried out.

The specifications laid down in subclauses 9.1 to 9.6 are based on a nominal test chamber capacity of 300 l.

9.1 Specimens used for performance checks

9.1.1 Five specimens, made of FeP04B sheet in compliance with DIN EN 10130, with a width of 50 mm, a length of 100 mm and a thickness of 0,6 to 1,5 mm shall be selected for each test.

9.1.2 In order to increase the total specimen surface¹⁾ to a width of 200 mm, a length of 400 mm and a thickness of 1 mm, two blanks, made of FeP04B in compliance with DIN EN 10130, shall be arranged horizontally on either side of the specimens.

9.2 Preparation of specimens for performance check

Before the performance check is carried out, the specimens and blanks shall be degreased with white spirit or some other suitable solvent using a soft, non-fibrous cloth or brush and the specimens weighed to an accuracy of 1 mg. If the test specimens cannot be weighed immediately after degreasing, they are to be kept in a desiccator until weighing may be carried out.

9.3 Procedure

The five specimens shall be placed vertically in the test chamber and the two blanks positioned vertically on either side of them. Five test cycles shall be carried out in accordance with test conditions specified in DIN EN ISO 6988.

9.4 Removal of corrosion products

Once the required five test cycles have been performed, the corrosion products shall be removed from the specimens by pickling carried out at a temperature of 18 to 28 °C. Hydrochloric acid with a density of 1,10 g/ml (prepared, for example, by making up 500 ml of chemically pure HCl with a density of 1,19 g/ml to 1 l with deionized water), inhibited with 3,5 g of hexamethylenetetramine per litre may be used for this purpose.

Other solutions as specified in ISO 8407 may also be used. The corrosion products having been removed, the specimens are to be thoroughly rinsed in water, dried and then kept in a desiccator at a temperature of 18 to 28 °C until weighing may be carried out.

¹⁾ For further specifications, see subclause 5.4 of DIN EN ISO 6988.

Table 1: Test conditions

Test parameters		Theoretical concentration of SO ₂ at the beginning of each test cycle, as a percentage by volume	
		0,33 ¹⁾	0,67 ¹⁾
Standard designation		Test DIN 50018 – 1,0 S	Test DIN 50018 – 2,0 S
Test cycle	1st test phase	8 hours, including preheating.	
	2nd test phase	16 hours, including cooling in opened or ventilated test chamber.	
	Total	24 hours	
Exposure conditions	1st test phase	Temperature	(40 ± 3) °C
		Relative humidity	About 100 % (with formation of condensate on the specimen)
	2nd test phase	Temperature	18 to 28 °C
		Relative humidity	75 % maximum
Water at bottom of test chamber		0,67 % ²⁾ maximum	
<p>¹⁾ Given a test chamber capacity of 300 l, the theoretical SO₂ concentration is equivalent to 1 l to 2 l per cycle. ²⁾ The concentration is based on a test chamber capacity of 300 l and a water volume of 2 l.</p>			

9.5 Weighing of specimens

The specimens shall be weighed to an accuracy of 1 mg.

9.6 Expression of results

The loss in mass determined shall be expressed as a function of the total area exposed to corrosion, in g/m². The mean value shall be (125 ± 25) g/m², individual values not deviating from the mean by more than 20 %.

10 Test report

The test report shall refer to this standard and include the following details:

- a) the type and designation of specimens;
- b) the designation of the test carried out;
- c) the duration of the test;
- d) any interruptions occurring during the test;
- e) the nominal test chamber capacity;
- f) any deviations from this standard;
- g) the date of the test.