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Atmospheres and their technical application

# Condensation water test atmospheres

**DIN**  
**50 017**

Klimate und ihre technische Anwendung; Kondenswasser-Prüfklimate

Supersedes December 1963 edition

*As it is current practice in standards published by the International Organization for Standardization (ISO), the comma has been used throughout as a decimal marker.*

## 1 Purpose and field of application

This standard describes the general conditions which have to be observed in respect of the stressing of specimens in condensation water constant atmospheres or in condensation water alternating atmospheres, in order to ensure that the results of tests carried out in different laboratories are reproducible.

The tests are designed to elucidate the behaviour of the specimens in humid ambient atmospheres, and to pinpoint any defects of the protection of the specimens against corrosion. The stressing of the specimens in these test atmospheres does not however enable any positive first-hand assertions to be made in respect of the service life expectation of the components tested under real conditions of use.

During the stressing, the specimens may, if applicable, only be operated in such a way that they do not give off any additional heat.

The shape and the preparation of the specimens, the duration of the test, the evaluation of the test and the assessment of the test results do not form part of the subject matter of this standard. Details relating to these aspects should be obtained from the respective special standards or should be mutually agreed if necessary.

In particular, the recommendations contained in DIN 50 905 Part 1 to Part 3 shall be observed.

## 2 Concepts

See DIN 50 011 Part 11 and DIN 50 900 Part 1 and Part 2.

## 3 Designation

Designation of a condensation water alternating atmosphere in accordance with DIN 50 017 with alternation of atmospheric humidity and temperature (KFW):

Test atmosphere DIN 50 017 — KFW

## 4 Test conditions

Condensation water test atmospheres promote the condensation of atmospheric humidity on the surfaces of specimens, the temperatures of which are lower than the temperature of the saturated air in the test room, due to radiation onto the chamber walls or to the cooling of the specimen.

The atmospheric temperature in the test room during the condensation process of the condensation water test atmospheres of this standard shall be 40 °C.

The condensation water test atmosphere may be either a constant atmosphere (KK) or an alternating atmosphere (KFW, KTW). If, in addition to the action of the condensation water, the change in atmospheric temperature and the change in atmospheric humidity have an important effect on the specimens, an alternating atmosphere should be chosen in lieu of a constant atmosphere.

The quantity of condensation water formed on the surface of the specimen may also exercise an important influence on the action of the condensation water; this quantity will be affected by the ambient temperature in the installation room or by the cooling of the specimen.

The condensate which drips off the specimens consists of condensation water and also in some instances of solid and liquid constituents of the specimens dissolved in the condensation water or mixed in it.

Reproducible results can only be expected on condition that the atmosphere is the same and that the test procedure is the same.

In the case of alternating atmospheres, a cycle time of 24 hours shall be adopted as a general rule. In deviation from this rule, a shorter cycle time (12 or 16 hours) and a correspondingly shortened time of the two test portions may be adopted for the KTW test atmosphere.

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Table.

| Test atmosphere                           |                                                                 | Letter symbol 1)    | Duration of one cycle |                                                                         | Conditions relating to the useful space after attainment of state of equilibrium |                                              |
|-------------------------------------------|-----------------------------------------------------------------|---------------------|-----------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------|
|                                           |                                                                 |                     | Total                 | First test portion                                                      | Atmospheric temperature                                                          | Relative atmospheric humidity                |
| Term                                      |                                                                 | Second test portion |                       |                                                                         |                                                                                  |                                              |
| Condensation water constant atmosphere    |                                                                 | KK                  | —                     | from warming up to end of stressing                                     | (40 ± 3) °C 2)                                                                   | approx. 100 % with bedewing of the specimens |
| Condensation water alternating atmosphere | with change in atmospheric humidity and atmospheric temperature | KFW                 | 24 h                  | 8 hours including warming up                                            | (40 ± 3) °C 2)                                                                   | approx. 100 % with bedewing of the specimens |
|                                           |                                                                 |                     |                       | 16 hours including cooling down (climatic chamber opened or ventilated) | 18 to 28 °C 4)                                                                   | less than 100 %                              |
|                                           | with change in atmospheric temperature                          | KTW                 | 24 h 3)               | 8 hours 3) including warming up                                         | (40 ± 3) °C 2)                                                                   | approx. 100 % with bedewing of the specimens |
|                                           |                                                                 |                     |                       | 16 hours 3) including cooling down (climatic chamber closed)            | 18 to 28 °C 4)                                                                   | approx. 100 %                                |

1) See Explanations

2) The permissible time and space-related deviations of the atmospheric temperature in the useful space in accordance with DIN 50011 Part 11 are greater than in DIN 50013, because reproducible test results are feasible with the testing device proposed here. The permissible deviations of the atmospheric temperature in the installation room are governed by subclause 5.2.

3) See clause 4 re shorter test duration

4) Room temperature in accordance with DIN 50014

## 5 Climatic testing device

### 5.1 Climatic chamber

A vapour-tight climatic chamber is essential for testing in a warm and humid atmosphere. The material of the inner walls must be corrosion-resistant and must not affect the specimens. The climatic chamber shall be usually equipped with a floor trough which acts as the receptacle for the quantity of water prescribed in subclause 6.1. The test room shall be tempered by heating the water in the floor trough.

If the quantity of heat introduced via the water is insufficient to heat up the air in the test room to the required temperature, then this air can be heated up additionally.

**Note:** The heating-up time will depend on the nature and quantity of the specimens, and also on the ratio of the water surface of the floor trough to the wall surface of the test room, and on the water temperature.

The water temperature should not exceed  $60 ^\circ\text{C}$  in order to prevent vapour formation.

The dimensions of the climatic chamber and the arrangement of its temperature measuring and control equipment are optional, provided that the test conditions in accordance with clause 4 and subclause 6.3 are observed and that the temperature of the test atmosphere in the useful space is measured.

The climatic chamber shall be provided with a suitable door or other aperture capable of being closed, which allows the test room to be charged with specimens and to be ventilated.

An example of a condensation water climatic testing device is illustrated.

Climatic testing devices not equipped with water-filled floor troughs must be fitted out in such a way that an adequate formation of condensation water on the specimens is achieved in them.

### 5.2 Installation of the climatic chamber

The climatic chamber shall be installed in a room with an ambient atmosphere not containing any corrosive constituents (e.g. it shall not be installed in a chemical

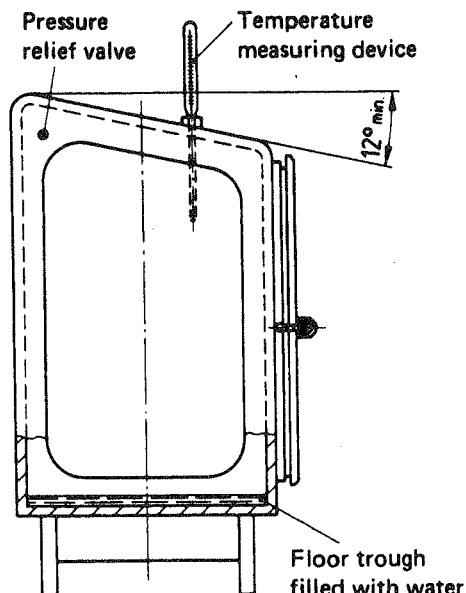


Figure. Example of a condensation water climatic testing device with glass walls

laboratory), at a room temperature situated between 18 and 28 °C in accordance with DIN 50 014 and at a relative atmospheric humidity of 75 % max., in such a way that it is protected against draughts and solar radiation. In the case of comparison tests, the ambient temperature in the installation room should amount to the standard temperature of  $(23 \pm 2) ^\circ\text{C}$  in accordance with DIN 50 013.

Note: A decrease in the ambient temperature will result in an increase in the quantity of condensation water.

### 5.3 Device for the accommodation of the specimens

The device for the accommodation of the specimens shall consist of a corrosion-resistant material and shall not promote the corrosion of the specimens. It shall allow the specimens to be arranged in accordance with the requirements of subclause 6.3.

## 6 Procedure

### 6.1 Filling the floor trough

The floor trough shall be filled with pure water (distilled water or de-ionized water) in such a way that a depth of water of 10 mm at least is present at all times during operation.

### 6.2 Specimens

Only specimens which are not capable of influencing one another mutually shall be tested together at any one time.

If specimens are likely to be affected additionally by the quantity of condensation water formed, then the quantity of condensation water shall be ascertained by way of comparison within one test cycle or within a 24-hour period, with the aid of a suitable device, for the purpose of describing the test conditions (see subclause 6.4).

### 6.3 Arrangement of the specimens

The specimens shall be arranged in the useful space in such a way that they are not in close contact with each

other and that they are able to radiate heat adequately.

The following minimum spacings shall be observed:

- distance from the walls not less than 100 mm
- distance of the bottom edge of the specimen from the surface of the water not less than 200 mm
- spacing between adjoining specimens not less than 20 mm

Steps must be taken to ensure that no condensation water is allowed to drip onto the specimens from the walls of the test room or from other specimens arranged overhead, when the specimens are stored in the useful space.

### 6.4 Device for the determination of the comparison quantity of condensation water

The device described below is suitable for the determination of the comparison quantity of condensation water:

An 18 mm X 180 mm test tube in accordance with DIN 12 395, filled with water, shall be used as standard specimen. The condensate dripping from the test tube shall be collected in a graduated measuring cylinder with a nominal capacity of 10 ml via a glass funnel in accordance with DIN 12 445, with a diameter of 55 mm.

The device shall be arranged in the useful space amongst the other specimens in the same way as described in subclause 6.3 for the arrangement of the specimens, and the bottom of the test tube (which shall itself be suspended from a thread of polyamide for example) shall be situated 50 mm above the rim of the funnel placed in the graduated measuring cylinder.

### 6.5 Test sequence

#### 6.5.1 Start-up

After the specimens have been placed in position and after the climatic chamber has been closed, the heating for the floor trough water or for the climatic testing device shall be switched on, and the useful space shall be heated up to the atmospheric temperature of the first portion of the test, this temperature having to be attained within 1,5 hours. Condensation water must be formed on the specimens.

#### 6.5.2 Condensation water constant atmosphere KK

The temperature prescribed in clause 4, and therefore the condensation process, shall be maintained in the useful space for the entire prescribed or mutually agreed duration of the test.

In order to arrive at an intermediate assessment if necessary, the specimens shall be removed from the climatic chamber without switching off the heating, and replaced immediately after assessment. It shall be mutually agreed whether and in which manner the surface of the specimens may be dried for the intermediate assessment.

#### 6.5.3 Condensation water alternating atmosphere KFW

The test consists of a prescribed or mutually agreed number of climatic cycles, each comprising a first and a second test portion.

8 hours after commencement of the start-up phase (see subclause 6.5.1), the heating shall be switched off and the condensation process terminated (first test

portion). Thereafter the climatic chamber shall be opened or ventilated.

After a further 16 hours, the water level in the floor trough shall be checked, and the water topped up if necessary. Then the climatic chamber shall be closed. The heating shall be switched on again, and a new cycle commences.

For the purpose of an intermediate assessment, if required, the specimens shall be removed briefly from the climatic chamber before the start of a new cycle, and replaced immediately after assessment.

**Note:** In special cases, intermediate assessments can also be carried out immediately after the heating has been switched off and the climatic chamber has been opened. It shall be mutually agreed whether and in which manner the surface of the specimens may be dried for the intermediate assessment.

#### 6.5.4 Condensation water alternating atmosphere KTW

The test consists of a prescribed or mutually agreed number of climatic cycles, each comprising a first and a second test portion.

In the case of a 24 hour cycle, the heating shall be switched off 8 hours after commencement of the start-up phase (see subclause 6.5.1) and the condensation process is terminated (first test portion). The climatic chamber remains closed.

After a further 16 hours have elapsed, the water level in the floor trough shall be checked, and the water topped up if necessary. Then the heating shall be switched on again and a new cycle commences.

For the purpose of an intermediate assessment, if required, the specimens shall be briefly removed from the climatic chamber before the start of a new cycle, and replaced immediately after assessment. It shall be mutually agreed whether and in which manner the surface of the specimens may be dried for the intermediate assessment.

#### 6.6 End of test

The test shall be terminated when a specified impairment of the specimen has occurred, or when the mutually

agreed test duration or number of cycles has been attained.

#### 6.7 Interruptions

Any interruptions of tests which involve stressing with alternating atmospheres shall be bridged by a prolongation of the second test portion, which normally lasts 16 hours. Such bridging storages shall be added to the computation of the interrupted cycle in each case. In every case, they must be recorded accurately in the test report.

#### 7 Evaluation

The number and the moment in time of any intermediate assessments, and the kind of evaluation of the final assessment of the specimens are governed by the respective test standards concerned, or by other agreements. DIN 50905 Part 1 to Part 3 apply to metals.

#### 8 Test report

The following information shall be provided in the test report, quoting this standard as reference:

- exact description of the specimens, including their pretreatment if applicable
- description of the climatic testing device, in cases where the test was carried out in equipment other than that specified in clause 5
- type of test atmosphere (KK or KFW, KTW)
- cycle time and duration of stressing
- reason for terminating the stressing
- number and moment in time of any intermediate assessments performed
- comparison quantity of condensation water in ml/cycle or ml/24 h, if required in accordance with subclause 6.2
- handling of the specimens between the end of the climatic stressing and the beginning of the assessment
- all the information and data required in the test standards used, quoting the relevant standards as reference.

#### Standards referred to

|                   |                                                                                                                                       |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| DIN 12395         | Laboratory apparatus; test tubes                                                                                                      |
| DIN 12445         | Laboratory glassware; short stem funnels                                                                                              |
| DIN 50011 Part 11 | Atmospheres and their technical application; climatic testing devices; general concepts and requirements                              |
| DIN 50013         | Atmospheres and their technical application; preferred temperatures                                                                   |
| DIN 50014         | Atmospheres and their technical application; standard atmospheres                                                                     |
| DIN 50900 Part 1  | Corrosion of metals; concepts, general concepts                                                                                       |
| DIN 50900 Part 2  | Corrosion of metals; concepts, electrochemical concepts                                                                               |
| DIN 50905 Part 1  | Corrosion of metals; chemical corrosion tests, general                                                                                |
| DIN 50905 Part 2  | Corrosion of metals; chemical corrosion tests, corrosion values with uniform corrosion                                                |
| DIN 50905 Part 3  | Corrosion of metals; chemical corrosion tests, corrosion values with non-uniform corrosion in absence of additional mechanical stress |

#### Further standards

|           |                                                                                           |
|-----------|-------------------------------------------------------------------------------------------|
| DIN 50018 | Corrosion tests; testing in alternating condensation atmosphere containing sulfur dioxide |
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## Previous editions

DIN 50 017: 12.63

## Amendments

The following amendments have been made compared with the December 1963 edition:

- device for the determination of the comparison quantity of condensation water introduced into the standard
- title changed
- letter symbols changed
- contents revised editorially

## Explanations

This standard has been prepared by Technical Committee NMP 844 *Prüfverfahren für Klimate*.

The letter symbols featured in this standard draw attention to the condensation process of the humid air by means of the code letter "K". This code letter replaces the previously used code letter "S", which referred to perspiration water, and the objective of the present test method is not the creation of perspiration water.

Until the letter symbols in the standards which still use the symbols in accordance with DIN 50 017, December 1963 edition, have been amended, the following list of comparison is published for information:

| Letter symbol as given in DIN 50 017,<br>December 1963 edition | Letter symbol as given in DIN 50 017,<br>October 1982 edition |
|----------------------------------------------------------------|---------------------------------------------------------------|
| SFW                                                            | KFW                                                           |
| STW                                                            | KTW                                                           |
| SK                                                             | KK                                                            |

## International Patent Classification

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