# AMENDMENT

**ETS 300 019-2-3**
**A2**

**May 1998**

Source: EE

Reference: RE/EE-01026-2-3

ICS: 33.020

**Key words:** Environment

**This amendment A2, modifies**
**the European Telecommunication Standard ETS 300 019-2-3 (1994)**

# Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests T 3.1 to T 3.5; Stationary use at weatherprotected location


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## Foreword

This amendment two to ETS 300 019-2-3 (1994) has been produced by the Equipment and Engineering (EE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

| **Transposition dates** | |
|---|---|
| Date of adoption of this amendment: | 1 May 1998 |
| Date of latest announcement of this amendment (doa): | 31 August 1998 |
| Date of latest publication or endorsement of this amendment (dop/e): | 28 February 1999 |
| Date of withdrawal of any conflicting National Standard (dow): | 28 February 1999 |

## Amendments

### Page 12, subclause 3.2

Replace table 3.2 with the following:

| Environmental parameter | | | Environmental Class 3.2 | Environmental test specification T 3.2: In-use, Partly temperature-controlled locations | | | |
|---|---|---|---|---|---|---|---|
| Type | Parameter | Detail parameter | Characteristic severity | Test severity | Duration | Reference | Method |
| Air temperature | low | (°C) | -5 | -5 | 16 h | IEC 68-2-1 | Ab/Ad: Cold (8) (9) (25) |
| | high | (°C) | +45 | +45 (2) (18) or +55 | 16 h | IEC 68-2-2 | Bb/Bd: Dry heat (25) |
| | change | temp range (°C)<br>rate (°C/min) | <br>0,5 | +25/+55<br>or +25/+45 (2)<br>or +25/+40 (18)<br>0,5 (4) (7) (16) | half cycle<br>$t_1$ = 3 h | IEC 68-2-14 | Nb: Change of temperature (25) |
| Humidity | relative | low (%) | 5 | none (5) | | | |
| | | high (%)<br>(°C) | 95 | 93<br>+30 | 4 d | IEC 68-2-56 | Cb: Damp heat steady state (25) |
| | | condensation<br>(°C)<br>(%) | yes | <br>+30°<br>90-100 (22) (19) | 1 cycle | IEC 68-2-30 | Db: Damp heat cyclic Variant 1 (25) |
| | absolute | low ($g/m^3$) | 1 | none (5) (10) | | | |
| | | high ($g/m^3$) | 29 | (12) | | | |
| Air | pressure | low (kPa) | 70 | none | | | |
| | | high (kPa) | 106 | none | | | |
| | speed | (m/s) | 5,0 | none | | | |
| Water | rain | intensity | no | | | | |
| | | low temperature | no | | | | |
| | other sources | | no | | | | |
| | icing & frosting | | yes | (5) | | | |
| Radiation | solar | ($W/m^2$) | 700 | (21) | | | |
| | heat | ($W/m^2$) | 600 | (3) | | | |

(continued)

**Page 15, subclause 3.3**

Replace table T 3.3 with the following:

| Environmental parameter | | | Environmental Class 3.3 | Environmental test specification T 3.3: In-use, Not temperature-controlled locations | | | |
|---|---|---|---|---|---|---|---|
| Type | Parameter | Detail parameter | Characteristic severity | Test severity | Duration | Reference | Method |
| Air temperature | low | (°C) | -25 | -25 | 16 h | IEC 68-2-1 | Ab/Ad: Cold (8) (9) (26) |
| | high | (°C) | +55 | +55 (2) or +70 | 16 h | IEC 68-2-2 | Bb/Bd: Dry heat (26) |
| | change | (°C)<br>(°C/min) | <br>0,5 | -5/+45 (4)<br>0,5 (7) (16) | 1 cycle<br>$t_1$ = 3 h | IEC 68-2-14 | Nb: Change of temperature (26) |
| Humidity | relative | low (%) | 10 | none (5) | | | |
| | | high (%)<br>(°C) | 100 | 93<br>+30 | 4 d | IEC 68-2-56 | Cb: Damp heat steady state (26) |
| | | condensation<br>(%)<br>(°C) | yes | <br>90-100<br>+30 (22) | 2 cycles | IEC 68-2-30 | Db: Damp heat cyclic Variant 1 (26) |
| | absolute | low ($g/m^3$) | 0,5 | none (5) (10) | | | |
| | | high ($g/m^3$) | 29 | (12) | | | |
| Air | pressure | low (kPa) | 70 | none | | | |
| | | high (kPa) | 106 | none | | | |
| | speed | (m/s) | 5,0 | none | | | |
| Water | rain | intensity | wind driven | (20) | | | |
| | | low temperature | no | | | | |
| | other sources | | dripping water | (20) | | | |
| | icing & frosting | | yes | (5) | | | |
| Radiation | solar | ($W/m^2$) | 1200 | (21) | | | |
| | heat | ($W/m^2$) | 600 | (3) | | | |

(continued)

**Page 21, subclause 3.4**

Replace table T 3.4 with the following:

| Environmental parameter | | | Environmental Class 3.4 | Environmental test specification T 3.4: In-use, Sites with heat trap. | | | |
|---|---|---|---|---|---|---|---|
| Type | Parameter | Detail parameter | Characteristic severity | Test severity | Duration | Reference | Method |
| Air temperature | low | (°C) | -40 | -40 | 16 h | IEC 68-2-1 | Ab/Ad: Cold (8) (9) (27) |
| | high | (°C) | +70 | +70 (2) or +85 | 16 h | IEC 68-2-2 | Bb/Bd: Dry heat (27) |
| | change | (°C)<br>(°C/min) | <br>0,5 | -5/+45<br>0,5 (4) (7) (16) | 2 cycles<br>$t_1$ = 3 h | IEC 68-2-14 | Nb: Change of temperature (27) |
| Humidity | relative | low (%) | 10 | none (5) | | | |
| | | high (%)<br>(°C) | 100 | 93<br>+35 (16) | 4 d | IEC 68-2-56 | Cb: Damp heat steady state (27) |
| | | condensation<br>(%)<br>(°C) | yes | <br>90-100<br>+30 (16) | 2 cycles | IEC 68-2-30 | Db: Damp heat cyclic Variant 1 (27) |
| | absolute | low ($g/m^3$) | 0,1 | none (5) (10) | | | |
| | | high ($g/m^3$) | 35 | (12) | | | |
| Air | pressure | low (kPa) | 70 | none | | | |
| | | high (kPa) | 106 | none | | | |
| | speed | (m/s) | 5,0 | none | | | |
| Water | rain | intensity | wind driven | (20) | | | |
| | | low temperature | no | | | | |
| | other sources | | dripping and spraying water | (20) | | | |
| | icing & frosting | | yes | (5) | | | |
| Radiation | solar | ($W/m^2$) | 1200 | (21) | | | |
| | heat | ($W/m^2$) | 600 | (3) | | | |

(continued)

**Page 18, subclause 3.5**

Replace table T 3.5 with the following:

| Environmental parameter | | | | Environmental Class 3.5 | Environmental test specification T 3.5: In-use, Sheltered locations. | | | |
|---|---|---|---|---|---|---|---|---|
| Type | Parameter | Detail parameter | | Characteristic severity | Test severity | Duration | Reference | Method |
| Air temperature | low | | (°C) | -40 | -40 | 16 h | IEC 68-2-1 | Ab/Ad: Cold (8) (9) (28) |
| | high | | (°C) | +40 | +40 | 16 h | IEC 68-2-2 | Bb/Bd: Dry heat (28) |
| | change | | (°C)<br>(°C/min) | 1,0 | -40/+40<br>1,0 (4) | 2 cycles<br>$t_1$ = 3 h | IEC 68-2-14 | Nb: Change of temperature (28) |
| Humidity | relative | low | (%) | 10 | none (5) | | | |
| | | high | (%)<br>(°C) | 100 | 93<br>+35 (16) | 4 d | IEC 68-2-56 | Cb: Damp heat steady state (28) |
| | | condensation | | yes | | | | |
| | | | (%)<br>(°C) | | 90-100<br>+35 (16) | 2 cycles | IEC 68-2-30 | Db: Damp heat cyclic Variant 1 (28) |
| | absolute | low | ($g/m^3$) | 0,1 | none (5) (10) | | | |
| | | high | ($g/m^3$) | 35 | (12) | | | |
| Air | pressure | low | (kPa) | 70 | none | | | |
| | | high | (kPa) | 106 | none | | | |
| | speed | | (m/s) | 30 | none | | | |
| Water | rain | intensity | | wind driven | (20) | | | |
| | | low temperature | | no | | | | |
| | other sources | | | dripping and spraying water | (20) | | | |
| | icing & frosting | | | yes | (5) | | | |
| Radiation | solar | | ($W/m^2$) | no | | | | |
| | heat | | ($W/m^2$) | 600 | none | | | |

(continued)

**Page 24, subclause 3.6**

Add notes 25 to 28.

NOTE 25: The alternative test method given in annex C may be used.

NOTE 26: The alternative test method given in annex D may be used.

NOTE 27: The alternative test method given in annex E may be used.

NOTE 28: The alternative test method given in annex F may be used.

**Page 26, annex B**

**Replace by the following:**

# Annex B (normative): Alternative climatic test method for class 3.1

## B.1 Description

This test method is an alternative to IEC 68 [2] temperature and most humidity tests. It can also contain the cold start test given in this ETS 300 019-2-3. The test uses a sequence which scans the characteristic conditions of the climatogram which is constructed from test severities specified in ETS 300 019-2-3. It may be applied to all equipment being tested for climatic conformance with class 3.1 in ETS 300 019-1.

## B.2 Objectives

To provide a standard test method for determining the functionality of an equipment when it is tested in a variable climatic environment consisting of a simultaneous change in combined values of temperature and humidity.

The climatogram test takes into account the boundary climatic conditions which can affect equipment throughout Europe up to an altitude of 3000 metres. The objective of the test is the evaluation of equipment resistibility performance and no attempt is made to assess its reliability. This is why repairs are authorized during tests, provided that failures observed do not systematically recur in the same climatic conditions.

## B.3 Test apparatus

The test apparatus shall consist of a single test chamber that is able to reproduce the conditions described in this annex.

The dimensions of the chamber shall be in accordance with the criteria described in IEC 68-2-56 [2].

NOTE: When climatic stabilization is specified, the time required will vary depending on the thermal mass of the equipment under test, its heat dissipation and the relative size of the test chamber.

For naturally ventilated equipment it is important that the air flow in the test chamber is controlled (less than 1 m/s) near the equipment under test in order to prevent undue influence on its ventilation system. This will allow components inside the equipment to reach their working temperature in relation to the ambient conditions of the chamber.

The test chamber is required to control the rate of change of temperature to a maximum of 0,5°C per minute and the rate of change of relative humidity to a maximum of 10 % per hour with the equipment in its operational state.

## B.4 Methodology

The traditional method used for climatic testing of equipment in order to demonstrate its resistibility is to use the IEC 68-2 [2] tests (i.e. cold, dry heat, change of temperature and steady state damp heat). The severities of the tests are chosen to simulate the effects of the extreme climatic conditions of the class.

This annex describes an alternative test method which uses a sequence test following the characteristic conditions of the climatogram figure B.1.

## B.5 Pre-conditioning

Pre-conditioning is required for a minimum period of one hour after temperature stabilization within the equipment under the initial condition 23°C / 50 % R.H. (i.e. point S on the climatogram of figure B.1).

## B.6 Testing

### B.6.1 Equipment operation

The equipment under test shall be in its operational state throughout the tests.

Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The dissipation shall be maximized, except for the low temperature test, where it shall be minimized.

### B.6.2 Equipment failures

If a failure occurs, the whole test cycle shall be started again, after the failure has been recorded and rectified.

**Table B.1: Test severities for class 3.1**

| Protected from solar and heat radiation or equipment is ventilated | | | | | | Exposed to solar and heat radiation and equipment is not ventilated | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Exceptional operating conditions (8) | | | Normal operating conditions | | | Exceptional operating conditions (8) | | | Normal operating conditions | | |
| Point | Temp (°C) | RH (%) | Point | Temp (°C) | RH (%) | Point | Temp (°C) | RH (%) | Point | Temp (°C) | RH (%) |
| S | + 23 (3) | 50 (6) | S | +23 (3) | 50 (6) | S | + 23 (3) | 50 (6) | S | +23 (3) | 50 (6) |
| $A_e$ | + 45 (3) | 37 (6) | A via S | + 40 (3) | 47 (6) | $A_e$ | + 55 (3) | 23 (6) | A via S | + 50 (3) | 30 (6) |
| $B_e$ | + 45 (3) | 5 (5) | B | + 40 (3) | 5 (5) | $B_e$ | + 55 (3) | 5 (5) | B | + 50 (3) | 5 (5) |
| C | + 23 (3) | 5 (5) | C | +23 (3) | 5 (5) | C | + 23 (3) | 5 (5) | C | +23 (3) | 5 (5)- |
| D | + 5 (2) | 15 (5) | D | +5 (2) | 15 (5) | D | + 5 (2) | 15 (5) | D | +5 (2) | 15 (5) |
| $E_e$ | - 5 (2), (7) | Any (1) | E | + 5 (2), (7) | Any (1) | $E_e$ | - 5 (2), (7) | Any (1) | E | + 5 (2), (7) | Any (1) |
| $F_e$ | + 5 (2) | 90 (6) | F | + 5 (2) | 85 (6) | $F_e$ | + 5 (2) | 90 (6) | F | + 5 (2) | 85 (6) |
| $G_e$ | + 28 (3) | 90 (4) | G | + 29 (3) | 85 (4) | $G_e$ | + 28 (3) | 90 (4) | G | + 29 (3) | 85 (4) |
| A | + 40 (3) | 47 (6) | A | +40 (3) | 47 (6) | A | + 50 (3) | 30 (6) | A | +50 (3) | 30 (6) |
| S | + 23 (3) | 50 (6) | S | +23 (3) | 50 (6) | S | + 23 (3) | 50 (6) | S | +23 (3) | 50 (6) |

NOTE 1: It is acceptable to perform tests without controlling the humidity when testing below 5°C (as detailed in IEC 68-2-1 test Ad).
NOTE 2: ± 3°C according to IEC 68-2-1.
NOTE3: ± 2°C according to IEC 68-2-2 and IEC 68-2-56.
± 3°C is acceptable for certain chamber sizes, as indicated in IEC 68-2-2.
NOTE 4: ± 3% RH according to IEC 68-2-56.
NOTE 5: Low relative humidity to be ± 5%
NOTE 6: ± 3% RH.
NOTE 7: If the cold start test is required in the product specification, when arriving at the point E the equipment shall be switched off; after temperature stabilization is reached within the equipment, it shall be switched on and the test continued.
NOTE 8: Exceptional operating conditions relate to reduced performance requirements.

### B.6.4 Scanning the climatogram

The sequence of scanning the climatogram is shown in figure B.1. Scanning begins at point S and ends at point S.

The various points of the climatogram correspond with test severities specified in table B.1.

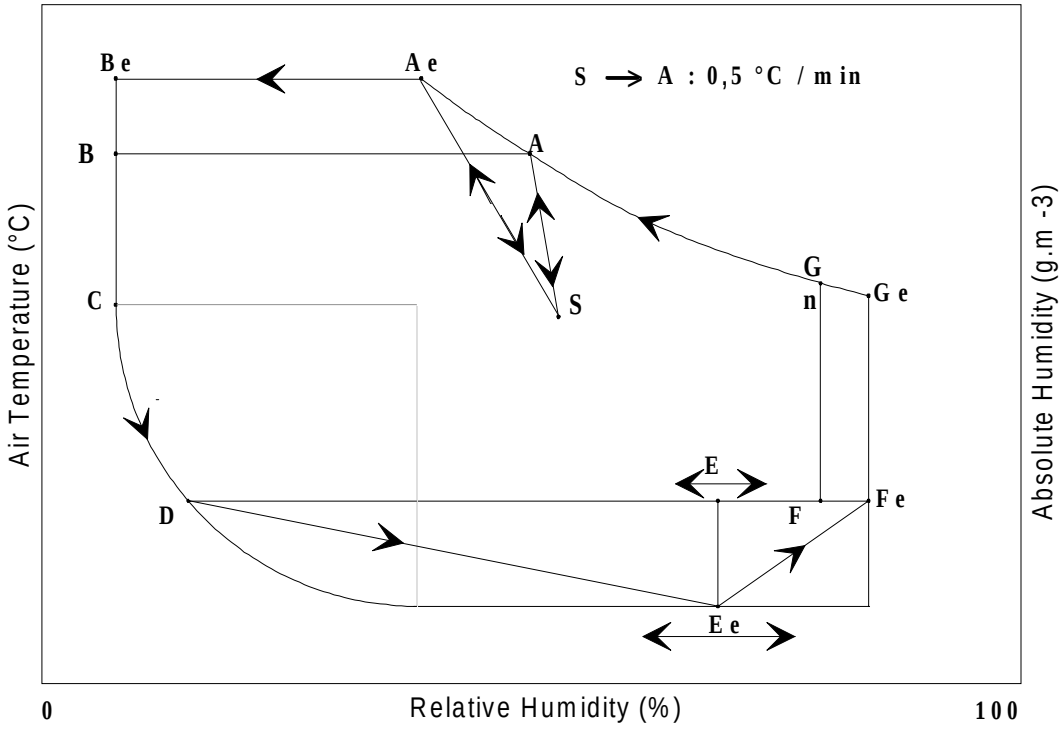


**Figure B.1: Climatogram showing scanning sequence**

### B.6.5 Rates of change

The rates of change for temperature and humidity are:

a) 5° C/h during constant relative or absolute humidity;
b) 10% RH/h during constant temperature;
c) 0,5°C/min between point S to point A and $A_e$. This step is used to verify the performance of the equipment under maximum rate of change of temperature.

NOTE: The cooling gradient may be reduced to 0,2°C/min where test chamber restrictions preclude a gradient of 0,5°C/min.

### B.6.6 Functional requirements and verification

Where practicable, the performance of the equipment should be monitored throughout the test. The parameters shall be fully described in the relevant test specification.

At the beginning and the end of scanning (Point "S" on the test climatogram, figure B.1) the equipment shall be visually examined and functional checks shall be made as prescribed by the test specification.

Functional checks shall also be performed at relevant points on figure B.1 as described in subclauses B.6.3 and B.6.4, after a minimum period of one hour has elapsed since temperature stabilization within the equipment. The test specification shall detail which functions are to be checked at each point on the test climatogram.

**Add annexes C, D, E, F**

# Annex C (normative): Alternative climatic test method for class 3.2

## C.1 Description

This test method is an alternative to IEC 68 [2] temperature and most humidity tests. It can also contain the cold start test given in this ETS 300 019-2-3. The test uses a sequence which scans the characteristic conditions of the climatogram which is constructed from test severities specified in ETS 300 019-2-3. It may be applied to all equipment being tested for climatic conformance with class 3.2 in ETS 300 019-1.

NOTE: This test method is made complete with the condensation test (see table 4: Test specification T 3.2 - Test Db) and should be carried out on the same test specimen.

## C.2 Objectives

To provide a standard test method for determining the functionality of an equipment when it is tested in a variable climatic environment consisting of a simultaneous change in combined values of temperature and humidity.

The climatogram test takes into account the boundary climatic conditions which can affect equipment throughout Europe up to an altitude of 3000 metres. The objective of the test is the evaluation of equipment resistibility performance and no attempt is made to assess its reliability. This is why repairs are authorized during tests, provided that failures observed do not systematically recur in the same climatic conditions.

## C.3 Test apparatus

The test apparatus shall consist of a single test chamber that is able to reproduce the conditions described in this annex.

The dimensions of the chamber shall be in accordance with the criteria described in IEC 68-2-56 [2].

NOTE: When climatic stabilization is specified, the time required will vary depending on the thermal mass of the equipment under test, its heat dissipation and the relative size of the test chamber.

For naturally ventilated equipment it is important that the air flow in the test chamber is controlled (less than 1 m/s) near the equipment under test in order to prevent undue influence on its ventilation system. This will allow components inside the equipment to reach their working temperature in relation to the ambient conditions of the chamber.

The test chamber is required to control the rate of change of temperature to a maximum of 0,5°C per minute and the rate of change of relative humidity to a maximum of 10 % per hour with the equipment in its operational state.

## C.4 Methodology

The traditional method used for climatic testing of equipment in order to demonstrate its resistibility is to use the IEC 68-2 [2] tests (i.e. cold, dry heat, change of temperature and steady state damp heat). The severities of the tests are chosen to simulate the effects of the extreme climatic conditions of the class.

This annex describes an alternative test method which uses a sequence test following the characteristic conditions of the climatogram figure C.1.

## C.5 Pre-conditioning

Pre-conditioning is required for a minimum period of one hour after temperature stabilization within the equipment under the initial condition 23°C / 50 % R.H. (i.e. point S on the climatogram of figure C.1).

## C.6 Testing

### C.6.1 Equipment operation

The equipment under test shall be in its operational state throughout the tests.

Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The dissipation shall be maximized, except for the low temperature test, where it shall be minimized.

### C.6.2 Equipment failures

If a failure occurs, the whole test cycle shall be started again, after the failure has been recorded and rectified.

### C.6.3 Test severities

**Table C.1: Test severities for class 3.2**

| Protected from solar and heat radiation or equipment is ventilated | | | | Exposed to solar and heat radiation and equipment is not ventilated | | |
|---|---|---|---|---|---|---|
| Climatic limits | | | | Climatic limits | | |
| Point | Temp (°C) | RH (%) | | Point | Temp (°C) | RH (%) |
| S | + 23 (3) | 50 (6) | | S | + 23 (3) | 50 (6) |
| A | + 45 (3) | 45 (6) | | A | + 55 (3) | 28 (6) |
| B | + 45 (3) | 5 (5) | | B | + 55 (3) | 5 (5) |
| C | + 23 (3) | 5 (5) | | C | + 23 (3) | 5 (5) |
| D | + 5 (2) | 15 (5) | | D | + 5 (2) | 15 (5) |
| E | - 5 (2), (7) | Any (1) | | E | - 5 (2), (7) | Any (1) |
| F | + 5 (2) | 95 (6) | | F | + 5 (2) | 95 (6) |
| G | + 30 (3) | 95 (4) | | G | + 30 (3) | 95 (4) |
| A | + 45 (3) | 45 (6) | | A | + 55 (3) | 45 (6) |
| S | + 23 (3) | 50 (6) | | S | + 23 (3) | 50 (6) |

NOTE 1: It is acceptable to perform tests without controlling the humidity when testing below 5°C (as detailed in IEC 68-2-1 test Ad).
NOTE 2: ± 3°C according to IEC 68-2-1.
NOTE 3: ± 2°C according to IEC 68-2-2 and IEC 68-2-56.
± 3°C is acceptable for certain chamber sizes, as indicated in IEC 68-2-2.
NOTE 4: ± 3% RH according to IEC 68-2-56.
NOTE 5: Low relative humidity to be ± 5%.
NOTE 6: ± 3% RH.
NOTE 7: If the cold start test is required in the product specification, when arriving at the point E the equipment shall be switched off; after temperature stabilization is reached within the equipment, it shall be switched on and the test continued.

### C.6.4 Scanning the climatogram

The sequence of scanning the climatogram is shown in figure C.1. Scanning begins at point S and ends at point S.

The various points of the climatogram correspond with test severities specified in table C.1.

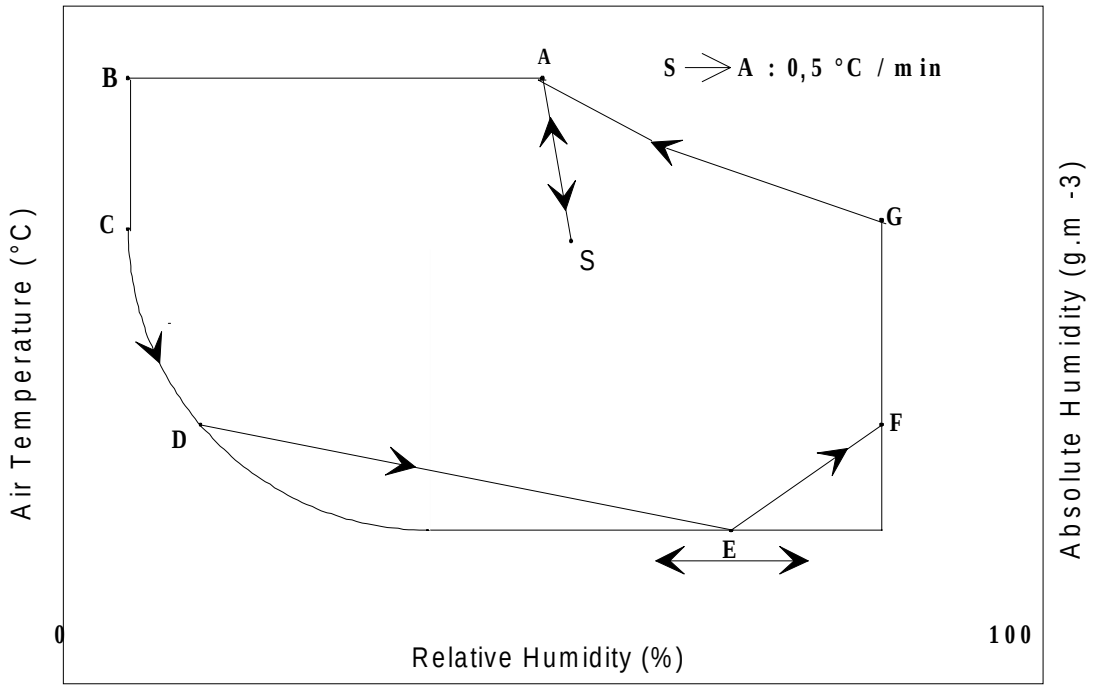


**Figure C.1: Climatogram showing scanning sequence**

### C.6.5 Rates of change

The rates of change for temperature and humidity are:

a) 5°C/h during constant relative or absolute humidity;
b) 10% RH/h during constant temperature;
c) 0,5°C/min between point S to point A. This step is used to verify the performance of the equipment under maximum rate of change of temperature.

NOTE: The cooling gradient may be reduced to 0,2°C/min where test clamber restrictions preclude a gradient of 0,5°C/min.

### C.6.6 Functional requirements and verification

Where practicable, the equipment's performance should be monitored throughout the test. The parameters shall be fully described in the relevant test specification.

At the beginning and the end of scanning (Point S on the test climatogram, figure C.1), the equipment shall be visually examined, and functional checks shall be made as prescribed by the test specification.

Functional checks shall also be performed at relevant points on figure C.1, as described in subclause C.6.4, after a minimum period of one hour has elapsed since temperature stabilization within the equipment. The test specification shall detail which functions are to be checked at each point on the test climatogram.

# Annex D (normative): Alternative climatic test method for class 3.3

## D.1 Description

This test method is an alternative to IEC 68 [2] temperature and most humidity tests. It can contain also the cold start test given in this ETS 300 019-2-3. The test uses a sequence which scans the characteristic conditions of the climatogram which is constructed from test severities specified in ETS 300 019-2-3. It may be applied to all equipment being tested for climatic conformance with class 3.3 in ETS 300 019-1.

NOTE: This test method is made complete with the condensation test (see table 6: Test specification T 3.3 - Test Db) and should be carried out on the same test specimen.

## D.2 Objectives

To provide a standard test method for determining the functionality of an equipment when it is tested in a variable climatic environment consisting of a simultaneous change in combined values of temperature and humidity.

The climatogram test takes into account the boundary climatic conditions which can affect equipment throughout Europe up to an altitude of 3000 metres. The objective of the test is the evaluation of equipment resistibility performance and no attempt is made to assess its reliability. This is why repairs are authorized during tests, provided that failures observed do not systematically recur in the same climatic conditions.

## D.3 Test apparatus

The test apparatus shall consist of a single test chamber that is able to reproduce the conditions described in this annex.

The dimensions of the chamber shall be in accordance with the criteria described in IEC 68-2-56 [2].

NOTE: When climatic stabilization is specified, the time required will vary depending on the thermal mass of the equipment under test, its heat dissipation and the relative size of the test chamber.

For naturally ventilated equipment it is important that the air flow in the test chamber is controlled (less than 1 m/s) near the equipment under test in order to prevent undue influence on its ventilation system. This will allow components inside the equipment to reach their working temperature in relation to the ambient conditions of the chamber.

The test chamber is required to control the rate of change of temperature to a maximum of 0,5°C per minute and the rate of change of relative humidity to a maximum of 10 % per hour with the equipment in its operational state.

## D.4 Methodology

The traditional method used for climatic testing of equipment in order to demonstrate its resistibility is to use the IEC 68-2 [2] tests (i.e. cold, dry heat, change of temperature and steady state damp heat). The severities of the tests are chosen to simulate the effects of the extreme climatic conditions of the class.

This annex describes an alternative test method which uses a sequence test following the characteristic conditions of the climatogram figure D.1.

## D.5 Pre-conditioning

Pre-conditioning is required for a minimum period of one hour after temperature stabilization within the equipment under the initial condition 23°C / 50 % R.H. (i.e. point S on the climatogram of figure D.1).

## D.6 Testing

### D.6.1 Equipment operation

The equipment under test shall be in its operational state throughout the tests.

Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The dissipation shall be maximized, except for the low temperature test, where it shall be minimized.

### D.6.2 Equipment failures

If a failure occurs, the whole test cycle shall be started again, after the failure has been recorded and rectified.

### D.6.3 Test severities

**Table D.1: Test severities for class 3.3**

| Protected from solar and heat radiation or equipment is ventilated | | | | Exposed to solar and heat radiation and equipment is not ventilated | | |
|---|---|---|---|---|---|---|
| Climatic limits | | | | Climatic limits | | |
| Point | Temp (°C) | RH (%) | | Point | Temp (°C) | RH (%) |
| S | + 23 (3) | 50 (6) | | S | + 23 (3) | 50 (6) |
| A | + 55 (3) | 28 (6) | | A | + 70 (3) | 15 (6) |
| B | + 55 (3) | 10 (5) | | B | + 70 (3) | 10 (5) |
| C,D | + 5 (2) | 10 (5) | | C,D | + 5 (2) | 10 (5) |
| E | - 25 (2), (7) | Any (1) | | E | -25 (2), (7) | Any (1) |
| F | + 5 (2) | 100 (6) | | F | + 5 (2) | 100 (6) |
| G | + 29 (3) | 100 (4) | | G | + 29 (3) | 100 (4) |
| A | + 55 (3) | 28 (6) | | A | + 70 (3) | 15 (6) |
| S | + 23 (3) | 50 (6) | | S | + 23 (3) | 50 (6) |

NOTE 1: It is acceptable to perform tests without controlling the humidity when testing below 5°C (as detailed in IEC 68-2-1 test Ad).
NOTE 2: ± 3°C according to IEC 68-2-1.
NOTE 3: ± 2°C according to IEC 68-2-2 and IEC 68-2-56.
± 3°C is acceptable for certain chamber sizes, as indicated in IEC 68-2-2.
NOTE 4 : ± 3% RH according to IEC 68-2-56.
NOTE 5: Low relative humidity to be ± 5%
NOTE 6: ±3% RH.
NOTE 7: If the cold start test is required in the product specification, when arriving at the point E the equipment shall be switched off; after temperature stabilization is reached within the equipment, it shall be switched on and the test continued.

### D.6.4 Scanning the climatogram

The sequence of scanning the climatogram is shown in figure D.1. Scanning begins at point S and ends at point S.

The various points of the climatogram correspond with test severities specified in table D.1.

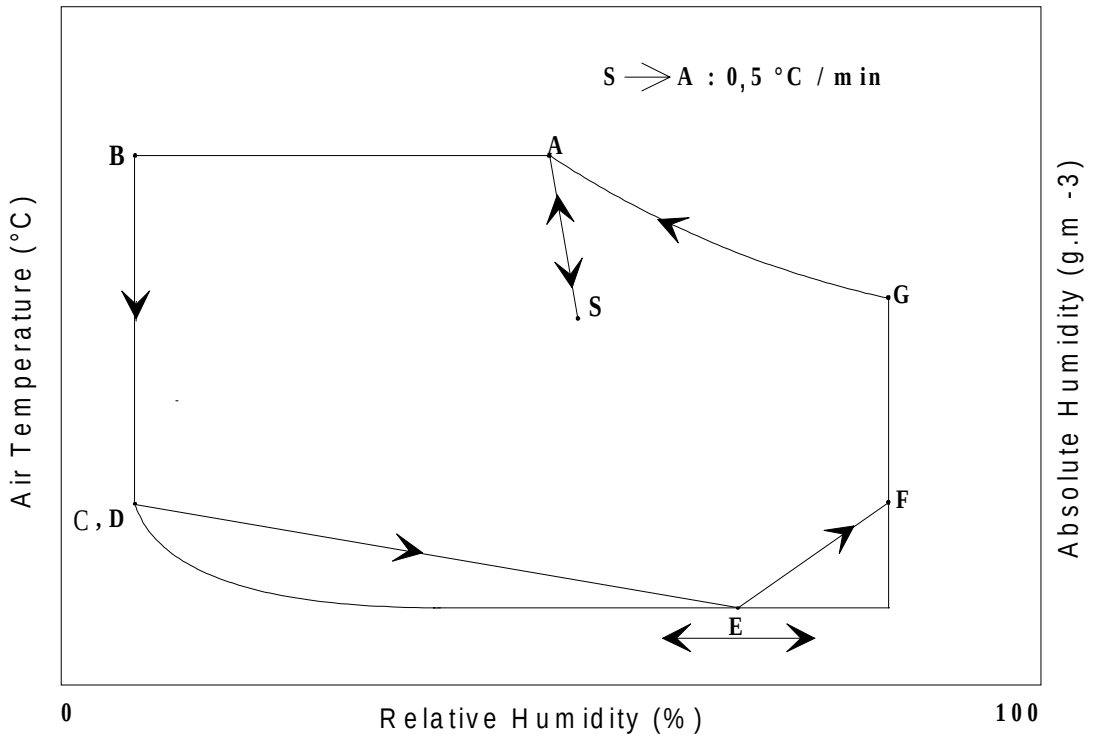


**Figure D.1: Climatogram showing scanning sequence**

### D.6.5 Rates of change

The rates of change for temperature and humidity are:

a) 5°C/h during constant relative or absolute humidity;
b) 10% RH/h during constant temperature;
c) 0,5°C/min between point S to point A. This step is used to verify the performance of the equipment under maximum rate of change of temperature.

NOTE: The cooling gradient may be reduced to 0,2°C/min where test chamber restrictions preclude a gradient of 0,5°C/min.

### D.6.6 Functional requirements and verification

Where practicable, the performance of the equipment should be monitored throughout the test. The parameters shall be fully described in the relevant test specification.

At the beginning and the end of scanning (Point S on the test climatogram, figure D.1), the equipment shall be visually examined, and functional checks shall be made as prescribed by the test specification.

Functional checks shall also be performed at relevant points on figure D.1, as described in subclause D.6.4, after a minimum period of one hour has elapsed since temperature stabilization within the equipment. The test specification shall detail which functions are to be checked at each point on the test climatogram.

# Annex E (normative): Alternative climatic test method for class 3.4

## E.1 Description

This test method is an alternative to IEC 68 [2] temperature and most humidity tests. It can also contain the cold start test given in this ETS 300 019-2-3. The test uses a sequence which scans the characteristic conditions of the climatogram which is constructed from test severities specified in ETS 300 019-2-3. It may be applied to all equipment being tested for climatic conformance with class 3.4 in ETS 300 019-1.

NOTE: This test method is made complete with the condensation test (see table 8 Test specification T 3.4 - Test Db) and should be carried out on the same test specimen.

## E.2 Objectives

To provide a standard test method for determining the functionality of an equipment when it is tested in a variable climatic environment consisting of a simultaneous change in combined values of temperature and humidity.

The climatogram test takes into account the boundary climatic conditions which can affect equipment throughout Europe up to an altitude of 3000 metres. The objective of the test is the evaluation of equipment resistibility performance and no attempt is made to assess its reliability. This is why repairs are authorized during tests, provided that failures observed do not systematically recur in the same climatic conditions.

## E.3 Test apparatus

The test apparatus shall consist of a single test chamber that is able to reproduce the conditions described in this annex.

The dimensions of the chamber shall be in accordance with the criteria described in IEC 68-2-56 [2].

NOTE: When climatic stabilization is specified, the time required will vary depending on the thermal mass of the equipment under test, its heat dissipation and the relative size of the test chamber.

For naturally ventilated equipment it is important that the air flow in the test chamber is controlled (less than 1m/s) near the equipment under test in order to prevent undue influence on its ventilation system. This will allow components inside the equipment to reach their working temperature in relation to the ambient conditions of the chamber.

The test chamber is required to control the rate of change of temperature to a maximum of 0,5°C per minute and the rate of change of relative humidity to a maximum of 10 % per hour with the equipment in its operational state.

## E.4 Methodology

The traditional method used for climatic testing of equipment in order to demonstrate its resistibility is to use the IEC 68-2 [2] tests (i.e. cold, dry heat, change of temperature and steady state damp heat). The severities of the tests are chosen to simulate the effects of the extreme climatic conditions of the class.

This annex describes an alternative test method which uses a sequence test following the characteristic conditions of the climatogram figure E.1.

## E.5 Pre-conditioning

Pre-conditioning is required for a minimum period of one hour after temperature stabilization within the equipment under the initial condition 23°C / 50 % R.H. (i.e. point S on the climatogram of figure E.1).

## E.6 Testing

### E.6.1 Equipment operation

The equipment under test shall be in its operational state throughout the tests.

Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The dissipation shall be maximized, except for the low temperature test, where it shall be minimized.

### E.6.2 Equipment failures

If a failure occurs, the whole test cycle shall be started again, after the failure has been recorded and rectified.

### E.6.3 Test severities

**Table E.1: Test severities for class 3.4**

| Protected from solar and heat radiation or equipment is ventilated | | |
|---|---|---|
| Climatic limits | | |
| Point | Temp (°C) | RH (%) |
| S | + 23 (3) | 50 (6) |
| A | + 70 (3) | 18 (6) |
| B | + 70 (3) | 10 (5) |
| C,D | + 5 (2) | 10 (5) |
| E | - 40 (2), (7) | Any (1) |
| F | + 5 (2) | 100 (6) |
| G | + 33 (3) | 100 (4) |
| A | + 70 (3) | 28 (6) |
| S | + 23 (3) | 50 (6) |

NOTE 1: It is acceptable to perform tests without controlling the humidity when testing below 5°C (as detailed in IEC 68-2-1 test Ad).
NOTE 2: ± 3°C according to IEC 68-2-1.
NOTE 3: ± 2°C according to IEC 68-2-2 and IEC 68-2-56.
± 3°C is acceptable for certain chamber sizes, as indicated in IEC 68-2-2.
NOTE 4: ± 3% RH according to IEC 68-2-56.
NOTE 5: Low relative humidity to be ± 5%.
NOTE 6: ± 3% RH.
NOTE 7: If the cold start test is required in the product specification, when arriving at the point E the equipment shall be switched off; after temperature stabilization is reached within the equipment, it shall be switched on and the test continued.

### E.6.4 Scanning the climatogram

The sequence of scanning the climatogram is shown in figure E.1. Scanning begins at point S and ends at point S.

The various points of the climatogram correspond with test severities specified in table E.1.

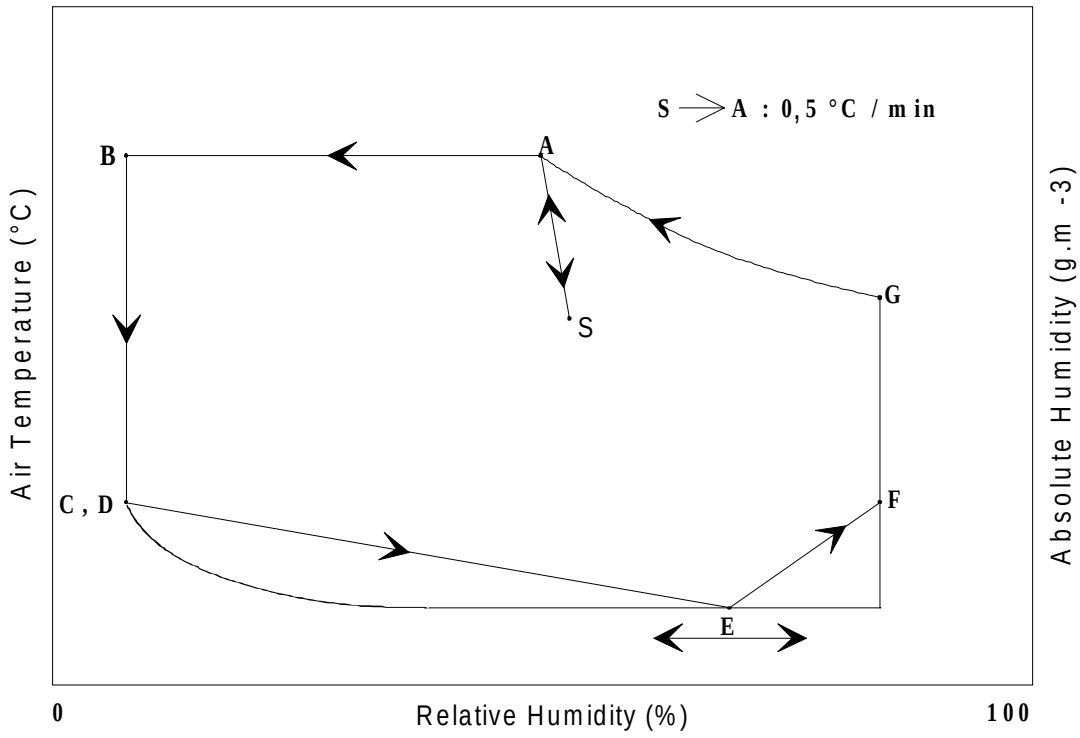


**Figure E.1: Climatogram showing scanning sequence**

### E.6.5 Rates of change

The rates of change for temperature and humidity are:

a) 5° C/h during constant relative or absolute humidity;
b) 10% RH/h during constant temperature;
c) 0,5°C/min between point S to point A. This step is used to verify the performance of the equipment under maximum rate of change of temperature.

NOTE: The cooling gradient may be reduced to 0,2°C/min where test chamber restrictions preclude a gradient of 0,5°C/min.

### E.6.6 Functional requirements and verification

Where practicable, the performance of the equipment should be monitored throughout the test. The parameters shall be fully described in the relevant test specification.

At the beginning and the end of scanning (Point S on the test climatogram, figure E.1), the equipment shall be visually examined, and functional checks shall be made as prescribed by the test program.

Functional checks shall also be performed at relevant points on figure E.1, as described in subclause E.6.4, after a minimum period of one hour has elapsed since temperature stabilization within the equipment. The test specification shall detail which functions are to be checked at each point on the test climatogram.

# Annex F (normative): Alternative climatic test method for class 3.5

## F.1 Description

This test method is an alternative to IEC 68 [2] temperature and most humidity tests. It can also contain the cold start test, given in this ETS 300 019-2-3. The test uses a sequence test which scans the characteristic conditions of the climatogram which is constructed from test severities specified in ETS 300 019-2-3. It may be applied to all equipment being tested for climatic conformance with class 3.5 in ETS 300 019-1.

NOTE: This test method is made complete with the condensation test (see table 10 Test specification T 3.5) and should be carried out on the same test specimen..

## F.2 Objectives

To provide a standard test method for determining the functionality of an equipment when it is tested in a variable climatic environment consisting of a simultaneous change in combined values of temperature and humidity.

The climatogram test takes into account the boundary climatic conditions which can affect equipment throughout Europe up to an altitude of 3000 metres. The objective of the test is the evaluation of equipment resistibility performance and no attempt is made to assess its reliability. This is why repairs are authorized during tests, provided that failures observed do not systematically recur in the same climatic conditions.

## F.3 Test apparatus

The test apparatus shall consist of a single test chamber that is able to reproduce the conditions described in this annex.

The dimensions of the chamber shall be in accordance with the criteria described in IEC 68-2-56 [2].

NOTE: When climatic stabilization is specified, the time required will vary depending on the thermal mass of the equipment under test, its heat dissipation and the relative size of the test chamber.

For naturally ventilated equipment it is important that the air flow in the test chamber is controlled (less than 1 m/s) near the equipment under test in order to prevent undue influence on its ventilation system. This will allow components inside the equipment to reach their working temperature in relation to the ambient conditions of the chamber.

The test chamber is required to control the rate of change of temperature to a maximum of 0,5°C per minute and the rate of change of relative humidity to a maximum of 10 % per hour with the equipment in its operational state.

## F.4 Methodology

The traditional method used for climatic testing of equipment in order to demonstrate its resistibility is to use the IEC 68-2 [2] tests (i.e. cold, dry heat, change of temperature and steady state damp heat). The severities of the tests are chosen to simulate the effects of the extreme climatic conditions of the class.

This annex describes an alternative test method which uses a sequence test following the characteristic conditions of the climatogram figure F.1.

## F.5 Pre-conditioning

Pre-conditioning is required for a minimum period of one hour after temperature stabilization within the equipment under the initial condition 23°C / 50 % R.H. (i.e. point S on the climatogram of figure F.1).

## F.6 Testing

### F.6.1 Equipment operation

The equipment under test shall be in its operational state throughout the tests.

Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The dissipation shall be maximized, except for the low temperature test, where it shall be minimized.

### F.6.2 Equipment failures

If a failure occurs, the whole test cycle shall be started again, after the failure has been recorded and rectified.

### F.6.3 Test severities

**Table F.1: Test severities for class 3.5**

| Protected from solar and heat radiation or equipment is ventilated | | |
|---|---|---|
| Climatic limits | | |
| Point | Temp (°C) | RH (%) |
| S | + 23 (3) | 50 (6) |
| A | + 40 (3) | 69 (6) |
| B | + 40 (3) | 10 (5) |
| C,D | + 5 (2) | 10 (5) |
| E | - 40 (2), (7) | Any (1) |
| F | + 5 (2) | 100 (6) |
| G | + 33 (3) | 100 (4) |
| A | + 40 (3) | 69 (6) |
| S | + 23 (3) | 50 (6) |

NOTE 1: It is acceptable to perform tests without controlling the humidity when testing below 5°C (as detailed in IEC 68-2-1 test Ad).
NOTE 2: ± 3°C according to IEC 68-2-1.
NOTE 3: ± 2°C according to IEC 68-2-2 and IEC 68-2-56. ± 3°C is acceptable for certain chamber sizes, as indicated in IEC 68-2-2.
NOTE 4: ± 3% RH according to IEC 68-2-56.
NOTE 5: Low relative humidity to be ± 5%.
NOTE 6: ± 3% RH.
NOTE 7: If the cold start test is required in the product specification, when arriving at the point E the equipment shall be switched off; after temperature stabilization is reached within the equipment, it shall be switched on and the test continued.

### F.6.4 Scanning the climatogram

The sequence of scanning the climatogram is shown in figure F.1. Scanning begins at point S and ends at point S.

The various points of the climatogram correspond with test severities specified in table F.1.

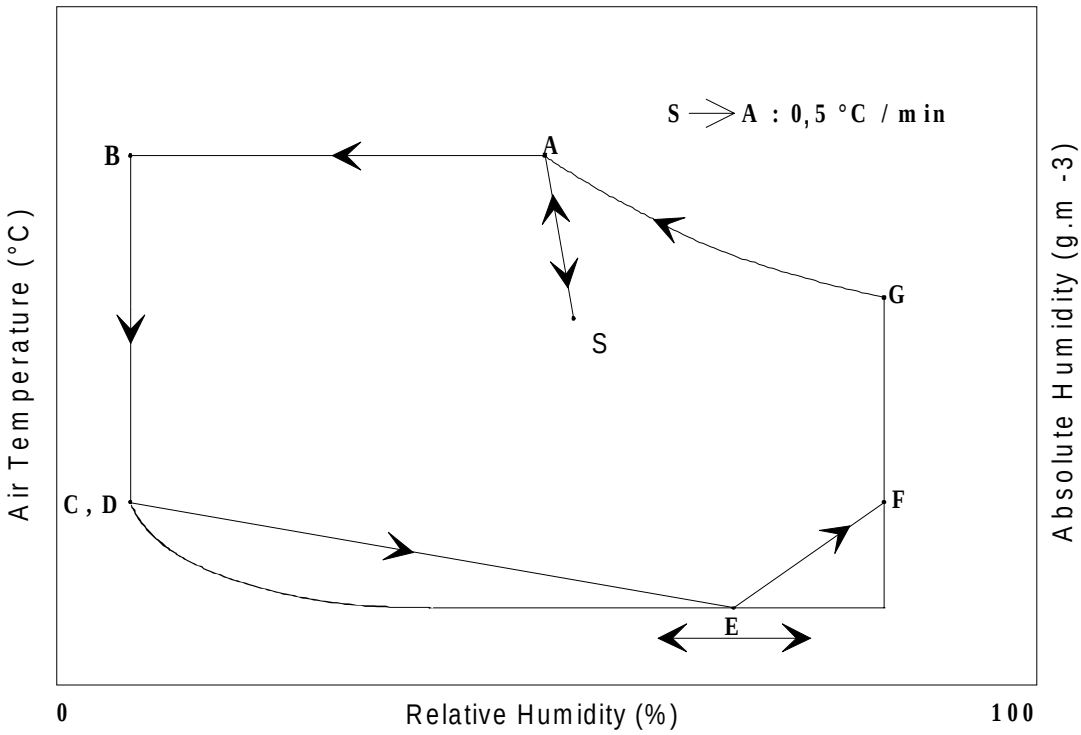


**Figure F.1: Climatogram showing scanning sequence**

### F.6.5 Rates of change

The rates of change for temperature and humidity are:

a) 5°C/h during constant relative or absolute humidity;
b) 10% RH/h during constant temperature;
c) 1°C/min between point S to point A. This step is used to verify the performance of the equipment performance under maximum rate of change of temperature.

### F.6.6 Functional requirements and verification

Where practicable, the performance of the equipment should be monitored throughout the test. The parameters shall be fully described in the relevant test specification.

At the beginning and the end of scanning (Point S on the test climatogram, figure F.1), the equipment shall be visually examined and functional checks shall be made as prescribed by the test specification.

Functional checks shall also be performed at relevant points on figure F.1, as described in subclause F.6.4, after a minimum period of one hour has elapsed since temperature stabilization within the equipment. The test specification shall detail which functions are to be checked at each point on the test climatogram.

## History

| Document history | | | |
|---|---|---|---|
| May 1994 | First Edition | | |
| June 1997 | Amendment 1 to First Edition | | |
| December 1997 | One-step Approval Procedure | OAP 9817: | 1997-12-26 to 1998-04-24 |
| May 1998 | Amendment 2 to First Edition | | |
| | | | |

ISBN 2-7437-2184-7
Dépôt légal : Mai 1998