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**Equipment Engineering (EE);
Environmental conditions and environmental tests for
telecommunications equipment
Part 2-3: Specification of environmental tests
Stationary use at weatherprotected locations**

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Foreword

This multi-part European Telecommunication Standard (ETS) has been produced by the Equipment Engineering (EE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETS 300 019 is concerned with environmental conditions and environmental tests for telecommunications equipment and comprises two main parts, each with subdivisions:

- ETS 300 019-1: "Classification of environmental conditions".

Part 1 specifies different standardised environmental classes covering climatic and biological conditions, chemically and mechanically active substances and mechanical conditions during storage, transportation and in use.

- ETS 300 019-2: "Specification of environmental tests".

Part 2 specifies the recommended test severities and test methods for the different environmental classes.

Part 2-0 forms a general overview of Part 2. This part, (Part 2-3), deals with stationary use at weatherprotected locations.

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1 Scope

This European Telecommunication Standard (ETS) specifies test severities and methods for the verification of the required resistibility of equipment according to the relevant environmental class.

The tests in Part 2-3 of this multi-part standard apply to stationary use of equipment at weatherprotected locations covering the environmental conditions stated in ETS 300 019-1-3 [1].

2 Normative references

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

- [1] ETS 300 019-1-3: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".
- [2] IEC 68-2: "Environmental testing. Part 2: Tests".
- [3] ETS 300 019-2-0: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 2-0: Specification of environmental tests; Introduction".

3 Environmental test specifications

The detailed descriptions of the environmental conditions are in Clauses 4 and 5 of ETS 300 019-1-3 [1].

ETS 300 019-2-0 [3] forms a general overview of Part 2 of this ETS.

The equipment under test is assumed to be in its operational state throughout the test conditions described in this Part unless otherwise stated. The required performance before, during and after the test needs to be specified in the product specification. Input and load conditions of the equipment shall be chosen to obtain full utilisation of the equipment under test. The heat dissipation shall be maximised, except for the steady state, low temperature test, where it shall be minimised.

3.1 Specifications T 3.1 and T 3.1 E: Temperature-controlled locations

Specification T 3.1: Temperature-controlled locations, - normal operating conditions.

This specification applies to permanently temperature-controlled enclosed locations where humidity is usually not controlled. See tables 1 and 2.

Table 1: Test specification T 3.1: Temperature-controlled locations - climatic tests

Environmental parameter			Environmental Class 3.1	Environmental test specification T 3.1: In-use, 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) (11)	
	high	(°C)	+40	+40 (2) or +50 (16)	16 h	IEC 68-2-2	Bb/Bd: Dry heat (11)	
	change	(°C) (°C/min)	0,5	+25/+40 (4) 0,5 (7) (16)	half cycle t ₁ = 3 h	IEC 68-2-14	Nb: Change of temperature (11)	
Humidity	relative	low	(%)	5	none (5)		(11)	
		high	(%) (°C)	85	85 +30	4 d	IEC 68-2-56	Cb: Damp heat steady state (11)
		condensation		no				
	absolute	low	(g/m ³)	1	none (5) (10)			
		high	(g/m ³)	25	(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		no					
Radiation	solar	(W/m ²)	700	(21)				
	heat	(W/m ²)	600	(3)				

(continued)

Table 1 (concluded): Test specification T 3.1: Temperature-controlled locations - climatic tests

Environmental parameter			Environmental Class 3.1	Environmental test specification T 3.1: In-use, Temperature-controlled locations			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Chemically active sub- stances	sulphur	SO ₂ (mg/m ³)	0,3/1,0 (1)	none (6)			
		H ₂ S (mg/m ³)	0,1/0,5 (1)	none (6)			
	chlorine	salt mist	sea and road salt	none (6)			
		Cl ₂ (mg/m ³)	0,1/0,3 (1)	none (6)			
		HCl (mg/m ³)	0,1/0,5 (1)	none (6)			
	nitrogen	NO _x (mg/m ³)	0,5/1,0 (1)	none (6)			
		NH ₃ (mg/m ³)	1,0/3,0 (1)	none (6)			
	hydrogen fluoride HF	(mg/m ³)	0,01/0,03 (1)	none (6)			
ozone O ₃	(mg/m ³)	0,05/0,1 (1)	none (6)				
Mechanically active substances	dust	sedimentation (mg/(m ² h))	1,5	none (5)			
		suspension (mg/m ³)	0,2	none (5)			
	sand	(mg/m ³)	30	none (5)			
Flora and Fauna	micro organisms		negligible				
	rodents, insects		negligible				
no = this condition does not occur in this class. none = verification is required only in special cases.							
(n) = NOTE (n = number of note), see subclause 3.6.							

Table 2: Test specification T 3.1: Temperature-controlled locations - mechanical tests

Environmental parameter			Environmental Class 3.1	Environmental test specification T 3.1: In-use, Temperature-controlled locations.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s ²) frequency range (Hz) axes of vibration	0,3 2-9 1,0 9-200	none			
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s ²) number of shocks directions of shocks	Type L 22 40	half sine 6 (16) 50 6 (14)	3 in each direction	IEC 68-2-27	Ea: Shock (15)
no = this condition does not occur in this class.			(n) = NOTE (n = number of note), see subclause 3.6.				
none = verification is required only in special cases.							

Specification T 3.1 E: Temperature-controlled locations - exceptional operating conditions.

This specification applies to permanently temperature-controlled locations where humidity is usually not controlled. The reference class is the same as for T 3.1, but the test specification relates to reduced performance requirements. See table 3.

Table 3: Test specification T 3.1 E : Temperature-controlled locations, exceptional operating conditions - climatic tests

Environmental parameter			Environmental Class 3.1E	Environmental test specification T 3.1E: In-use, Temperature-controlled locations - Exceptional.			
Type	Parameter	Detail parameter	Characteristic severity (17)	Test severity	Duration	Reference	Method
Air temperature	low	(°C)	-5	-5	16 h	IEC 68-2-1	Ab/Ad: Cold (8) (9) (11)
	high	(°C)	+45	+45 (2) or +55	16 h	IEC 68-2-2	Bb/Bd: Dry heat (11)
	change	(°C) (°C/min)	0,5	+25/+45 0,5 (4) (7) (16)	half cycle t ₁ = 3 h	IEC 68-2-14	Nb: Change of temperature (11)
Humidity	relative	low (%)	5	none (5)			(11)
		high (%) (°C)	90	93 +30	4 d	IEC 68-2-56	Cb: Damp heat steady state (11)
		condensation	no				
	absolute	low (g/m ³)	1	none (5) (10)			
		high (g/m ³)	25	(5) (10) (12)			
Radiation	solar	(W/m ²)	700	(21)			
	heat	(W/m ²)	600	(3)			
no = this condition does not occur in this class. none = verification is required only in special cases.			(n) = NOTE (n = number of note), see subclause 3.6.				

3.2 Specification T 3.2: Partly temperature-controlled locations

This specification applies to enclosed locations having neither temperature nor humidity control, but where heating may be used to avoid low temperatures. The building construction avoids extremely high temperatures. See tables 4 and 5.

Table 4: Test specification T 3.2: Partly temperature-controlled locations - climatic tests

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)
	high	(°C)	+45	+45 (2) (18) or +55	16 h	IEC 68-2-2	Bb/Bd: Dry heat
	change	temp range (°C)		+25/+55 or +25/+45 (2) or +25/+40 (18)	half cycle t ₁ = 3 h	IEC 68-2-14	Nb: Change of temperature
		rate (°C/min)	0,5	0,5 (4) (7) (16)			
Humidity		low (%)	5	none (5)			
	relative	high (%)	95	93 +30	4 d	IEC 68-2-56	Cb: Damp heat steady state
		condensation (°C) (%)	yes	+30° 90-100 (22) (19)	1 cycle	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	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)

Table 4 (concluded): Test specification T 3.2: Partly temperature-controlled locations - climatic tests

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
Chemically active sub- stances	sulphur	SO ₂ (mg/m ³)	0,3/1,0 (1)	none (6)			
		H ₂ S (mg/m ³)	0,1/0,5 (1)	none (6)			
	chlorine	salt mist	sea and road salt	none (6)			
		Cl ₂ (mg/m ³)	0,1/0,3 (1)	none (6)			
		HCl (mg/m ³)	0,1/0,5 (1)	none (6)			
	nitrogen	NO _x (mg/m ³)	0,5/5,0 (1)	none (6)			
		NH ₃ (mg/m ³)	1,0/3,0 (1)	none (6)			
	hydrogen fluoride HF	(mg/m ³)	0,01/0,03 (1)	none (6)			
ozone O ₃	(mg/m ³)	0,05/0,1 (1)	none (6)				
Mechanically active substances	dust	sedimentation (mg/(m ² h))	15	(5)			
		suspension (mg/m ³)	0,4	(5)			
	sand	(mg/m ³)	300	(5)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (6)			
	rodents, insects		rodents, etc.	none (6)			
no = this condition does not occur in this class. (n) = NOTE (n = number of note), see subclause 3.6.							
none = verification is required only in special cases.							

Table 5: Test specification T 3.2 : Partly temperature-controlled locations - mechanical tests

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
Vibration	sinusoidal	velocity (13) (mm/s)	1,5	5		IEC 68-2-6 (16)	Fc: Vibration (sinusoidal)
		displacement (13) (mm)					
		acceleration (13) (m/s ²)	5	2			
		frequency range (Hz)	2-9	5-62	62-200		
		axes of vibration	9-200	3 axes (14)	3 x 5 sweep cycles		
Shocks	shocks	shock spectrum	Type L	half sine		IEC 68-2-27	Ea: Shock
		duration (ms)	22	11	6		
		acceleration (13) (m/s ²)	40	100	50		
		mass (kg)		≤100	>100		
		number of shocks			3 in each direction		
		directions of shocks		6 (14)			
no = this condition does not occur in this class. none = verification is required only in special cases.			(n) = NOTE (n = number of note), see subclause 3.6.				

3.3 Specification T 3.3: Not temperature-controlled locations

This specification applies to weatherprotected or partially weatherprotected locations having neither temperature nor humidity control. See tables 6 and 7.

Table 6: Test specification T 3.3: Not temperature-controlled locations - climatic tests

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)
	high	(°C)	+55	+55 (2) or +70	16 h	IEC 68-2-2	Bb/Bd: Dry heat
	change	(°C) (°C/min)	0,5	-5/+45 (4) 0,5 (7) (16)	1 cycle t ₁ = 3 h	IEC 68-2-14	Nb: Change of temperature
Humidity	relative	low	(%) 10	none (5)			
		high	(%) (°C)	93 +30	4 d	IEC 68-2-56	Cb: Damp heat steady state
		condensation	(%) (°C)	yes	2 cycles	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	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)

Table 6 (concluded): Test specification T 3.3: Not temperature-controlled locations - climatic tests

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
Chemically active sub- stances	sulphur	SO ₂ (mg/m ³)	0,3/1,0 (1)	none (6)			
		H ₂ S (mg/m ³)	0,1/0,5 (1)	none (6)			
	chlorine	salt mist	sea and road salt	none (6)			
		Cl ₂ (mg/m ³)	0,1/0,3 (1)	none (6)			
		HCl (mg/m ³)	0,1/0,5 (1)	none (6)			
	nitrogen	NO _x (mg/m ³)	0,5/1,0 (1)	none (6)			
		NH ₃ (mg/m ³)	1,0/3,0 (1)	none (6)			
	hydrogen fluoride HF	(mg/m ³)	0,01/0,03 (1)	none (6)			
	ozone O ₃	(mg/m ³)	0,05/0,1 (1)	none (6)			
Mechanically active substances	dust	sedimentation (mg/(m ² h))	15	(5)			
		suspension (mg/m ³)	0,4	(5)			
	sand	(mg/m ³)	300	(5)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (6)			
	rodents, insects		rodents, etc.	none (6)			

no = this condition does not occur in this class.
none = verification is required only in special cases.

(n) = NOTE (n = number of note), see subclause 3.6.

Table 7: Test specification T 3.3: Not temperature-controlled locations - mechanical tests

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
Vibration	sinusoidal	velocity (13) (mm/s) displacement (13) (mm) acceleration (13) (m/s ²) frequency range (Hz) axes of vibration	1,5 5 2-9 9-200	5 5-62 62-200 3 axes (14)	2 3 x 5 sweep cycles	IEC 68-2-6 (16)	Fc: Vibration (sinusoidal)
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s ²) mass (kg) number of shocks directions of shocks	Type L 22 40	half sine 11 100 ≤100 6 (14)	6 50 >100 3 in each direction	IEC 68-2-27	Ea: Shock
no = this condition does not occur in this class. none = verification is required only in special cases.			(n) = NOTE (n = number of note), see subclause 3.6.				

3.4 Specification T 3.4: Sites with heat-trap

This specification applies to weatherprotected or partially weatherprotected locations having neither temperature nor humidity control. Solar radiation and heat-trap conditions may cause high temperatures. See tables 8 and 9.

Table 8: Test specification T 3.4: Sites with heat-trap - climatic tests

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)
	high	(°C)	+70	+70 (2) or +85	16 h	IEC 68-2-2	Bb/Bd: Dry heat
	change	(°C) (°C/min)	0,5	-5/+45 0,5 (4) (7) (16)	2 cycles t ₁ = 3 h	IEC 68-2-14	Nb: Change of temperature
Humidity	relative	low (%)	10	none (5)			
		high (%) (°C)	100	93 +35 (16)	4 d	IEC 68-2-56	Cb: Damp heat steady state
		condensation (%) (°C)	yes	90-100 +30 (16)	2 cycles	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	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)

Table 8 (concluded): Test specification T 3.4: Sites with heat-trap - climatic tests

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
Chemically active sub- stances	sulphur	SO ₂ (mg/m ³)	0,3/1,0 (1)	none (6)			
		H ₂ S (mg/m ³)	0,1/0,5 (1)	none (6)			
	chlorine	salt mist	sea and road salt	none (6)			
		Cl ₂ (mg/m ³)	0,1/0,3 (1)	none (6)			
		HCl (mg/m ³)	0,1/0,5 (1)	none (6)			
	nitrogen	NO _x (mg/m ³)	0,5/1,0 (1)	none (6)			
		NH ₃ (mg/m ³)	1,0/3,0 (1)	none (6)			
	hydrogen fluoride HF	(mg/m ³)	0,01/0,03 (1)	none (6)			
	ozone O ₃	(mg/m ³)	0,05/0,1 (1)	none (6)			
Mechanically active substances	dust	sedimentation (mg/(m ² h))	15	(5)			
		suspension (mg/m ³)	0,4	(5)			
	sand	(mg/m ³)	300	(5)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (6)			
	rodents, insects		rodents, etc.	none (6)			
no = this condition does not occur in this class. none = verification is required only in special cases.							
(n) = NOTE (n = number of note), see subclause 3.6.							

Table 9: Test specification T 3.4: Sites with heat-trap - mechanical tests

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
Vibration IEC Class 3M5 (24)	sinusoidal	displacement (13) (mm) acceleration (13) (m/s ²) frequency range (Hz) axes of vibration	3,0 10 2-9 9-200	3,5 10 5-9 9-200 3 axes (14)	3 x 5 sweep cycles	IEC 68-2-6	Fc: Vibration (sinusoidal)
Shocks IEC Class 3M5 (24)	shocks	shock spectrum duration (ms) acceleration (13) (m/s ²) mass (kg) number of shocks directions of shocks	Type II 6 250	6 250 ≤100 (14)(4) 6 (14)(23)	500 bumps in each direction	IEC 68-2-29	Eb: Bump
Vibration IEC Class 3M3 (24)	sinusoidal	velocity (13) (mm/s) displacement (13) (mm) acceleration (13) (m/s ²) frequency range (Hz) axes of vibration	1,5 5 2-9 9-200	5 (16) 2 (16) 5-62 62-200 3 axes (14)	3 x 5 sweep cycles	IEC 68-2-6	Fc: Vibration (sinusoidal)
Shocks IEC Class 3M3 (24)	shocks	shock spectrum duration (ms) acceleration (13) (m/s ²) mass (kg) number of shocks directions of shocks	Type L 22 70	11 100 ≤100 6 (14)	3 in each direction	IEC 68-2-27	Ea: Shock (half sine)
no = this condition does not occur in this class. none = verification is required only in special cases.			(n) = NOTE (n = number of note), see subclause 3.6.				

3.5 Specification T 3.5: Sheltered locations

This specification applies to sheltered locations where direct solar radiation and heat-trap conditions do not exist. See tables 10 and 11.

Table 10: Test specification T 3.5: Sheltered locations - climatic tests

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)
	high	(°C)	+40	+40	16 h	IEC 68-2-2	Bb/Bd: Dry heat
	change	(°C) (°C/min)	1,0	-40/+40 1,0 (4)	2 cycles t ₁ = 3 h	IEC 68-2-14	Nb: Change of temperature
Humidity	relative	low	(%) 10	none (5)			
		high	(%) (°C)	93 +35 (16)	4 d	IEC 68-2-56	Cb: Damp heat steady state
		condensation	(%) (°C)	yes	2 cycles	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	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)

Table 10 (concluded): Test specification T 3.5: Sheltered locations - climatic tests

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
Chemically active sub- stances	sulphur	SO ₂ (mg/m ³)	0,3/1,0 (1)	none (6)			
		H ₂ S (mg/m ³)	0,1/0,5 (1)	none (6)			
	chlorine	salt mist	sea and road salt	none (6)			
		Cl ₂ (mg/m ³)	0,1/0,3 (1)	none (6)			
		HCl (mg/m ³)	0,1/0,5 (1)	none (6)			
	nitrogen	NO _x (mg/m ³)	0,5/1,0 (1)	none (6)			
		NH ₃ (mg/m ³)	1,0/3,0 (1)	none (6)			
	hydrogen fluoride HF	(mg/m ³)	0,01/0,03 (1)	none (6)			
ozone O ₃	(mg/m ³)	0,05/0,1 (1)	none (6)				
Mechanically active substances	dust	sedimentation (mg/(m ² h))	15	(5)			
		suspension (mg/m ³)	0,4	(5)			
	sand	(mg/m ³)	300	(5)			
Flora and	micro organisms		mould, fungus, etc.	none (6)			
Fauna	rodents, insects		rodents, etc.	none (6)			

no = this condition does not occur in this class.
none = verification is required only in special cases.

(n) = NOTE (n = number of note), see subclause 3.6.

Table 11: Test specification T 3.5: Sheltered locations - mechanical tests

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
Vibration IEC Class 3M5 (24)	sinusoidal	displacement (13) (mm) acceleration (13) (m/s ²) frequency range (Hz) axes of vibration	3,0 10 2-9 9-200	3,5 10 5-9 9-200 3 axes (14)	3 x 5 sweep cycles	IEC 68-2-6	Fc: Vibration (sinusoidal)
Shocks IEC Class 3M5 (24)	shocks	shock spectrum duration (ms) acceleration (13) (m/s ²) mass (kg) number of shocks directions of shocks	Type II 6 250	6 250 ≤100 6 (14)(23)	6 100 >100 500 bumps in each direction	IEC 68-2-29	Eb: Bump
Vibration IEC Class 3M3 (24)	sinusoidal	velocity (13) (mm/s) displacement (13) (mm) acceleration (13) (m/s ²) frequency range (Hz) axes of vibration	1,5 5 2-9 9-200	5 (16) 2 (16) 5-62 62-200 3 axes (14)	3 x 5 sweep cycles	IEC 68-2-6	Fc: Vibration (sinusoidal)
Shocks IEC Class 3M3 (24)	shocks	shock spectrum duration (ms) acceleration (13) (m/s ²) mass (kg) number of shocks directions of shocks	Type L 22 40	11 100 ≤100 6 (14)(23)	6 50 >100 3 in each direction	IEC 68-2-27	Ea: Shock (half sine)
no = this condition does not occur in this class. none = verification is required only in special cases.			(n) = NOTE (n = number of note), see subclause 3.6.				

3.6 Notes to tables 1 to 11

- NOTE 1: Mean/maximum value.
- NOTE 2: If protected against solar and heat radiation or if the equipment is ventilated (natural or forced).
- NOTE 3: The heating effect on equipment is covered by test Bb/Bd.
- NOTE 4: The equipment function shall be monitored throughout the test.
- NOTE 5: No suitable tests exist in IEC 68-2 [2].
- NOTE 6: The characteristic severities should be considered when choosing components and materials. Therefore no tests are required at the equipment level.
- NOTE 7: The cooling gradient may be reduced to 0,2°C/min where test chamber restrictions preclude a gradient of 0,5°C/min.
- NOTE 8: The equipment under test shall remain operational throughout this test except for the cold start-up test which shall commence once low temperature stability is achieved.
- NOTE 9: The cold start-up temperature may be modified by the product specification. The cold start-up temperature shall be declared whenever reference is made to conformance with any in-use class from ETS 300 019.
- NOTE 10: Relevant parameter. Equipment should be designed with this requirement in mind.
- NOTE 11: The alternative test method given in Annex B may be used.
- NOTE 12: This is covered by test Cb: Damp heat, steady state.
- NOTE 13: Peak value.
- NOTE 14: Equipment under test mounted in the "in-use" position.
- NOTE 15: This test simulates the effects of transients on the equipment.
- NOTE 16: Value not specified in IEC 68-2 [2].
- NOTE 17: The characteristic severity values shown are taken from the exceptional operating conditions given in ETS 300 019-1-3 [1].
- NOTE 18: +40°C for manholes.
- NOTE 19: This test is required for equipment mounted in underground locations, e.g. manholes.
- NOTE 20: The wetting effect is included in test Db.
- NOTE 21: The heating effect on equipment is covered by test Bb/Bd. Photochemical tests for materials can be made separately.
- NOTE 22: 30°C is not an IEC test value. However, this figure is chosen in order to test within the prescribed limits of the climetogram.
- NOTE 23: If the shocks in some directions are known to be insignificant, then tests need not be performed in those directions.
- NOTE 24: Where the consequences of mechanical failure are small, or the probability of high mechanical stresses are rare (e.g. when not for public use) the conditions of 3M3 may be chosen.

Annex A (informative): Bibliography

The following references can be used for informative purposes.

ETR 035: "Equipment Engineering (EE); Environmental engineering; Guidance and terminology".

IEC 68-1: "Environmental testing Part 1: General and guidance".

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 humidity tests, but not the Cold start test, given in this ETS 300 019-2-3. It uses a sequence test which scans the characteristic conditions of a climatogram 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.

NOTE: This test method is restricted to class 3.1 as experience of this type of test is limited to this class.

B.2 Objectives

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

The climatogram test takes into account boundary climatic conditions which can affect equipment throughout Europe, up to an altitude of 3 000 metres. Its aim 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 stabilisation 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 IEC 68-2 [2] tests, (i.e. cold, dry heat, change of temperature, and steady state damp heat), the severities of which are chosen to simulate the effects of the 'extreme' climatic conditions of the class.

This annex describes an alternative approach. It uses a sequence test which scans the characteristic conditions of a climatogram (see figure 1) constructed from characteristic severities specified in ETS 300-019-1, modified, as necessary, to take the effects of solar radiation into account. This verifies an equipment's resistibility to its "extreme" climatic environment.

B.5 Pre-conditioning

Pre-conditioning is required. The duration shall be at least one hour under the initial condition 23 °C / 50 % R.H. (i.e. point S₁ 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 utilisation of the equipment under test. The dissipation shall be maximised, except for the low-temperature test, where it shall be minimised.

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.

B.6.3 Test severities

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 climatic limits			Normal climatic limits				Exceptional climatic limits			Normal climatic limits		
Point	Temp (°C)	RH (%)	Point	Temp (°C)	RH (%)		Point	Temp (°C)	RH (%)	Point	Temp (°C)	RH (%)
S ₁	+23 (4)	50 (7)	-	-	-		S ₁	+23 (4)	50 (7)	-	-	-
A _e	-5 (3)	Any (1)	An	+5 (3)	Any (1)		A _e	-5 (3)	Any (1)	An	+5 (3)	Any (1)
B	+5 (3)	90 (7)	Bn	+5 (3)	85 (7)		B	+5 (3)	90 (7)	Bn	+5 (3)	85 (7)
C _e	+28 (4)	37 (7)	Cn	+29 (4)	85 (5)		C _e	+28 (4)	37 (7)	Cn	+29 (4)	85 (5)
D _e	+45 (4)	37 (7)	Dn	+40 (4)	47 (7)		D _e	+45 (4)	37 (7)	Dn	+40 (4)	47 (7)
E _e	+45 (4)	5 (6)	En	+40 (4)	5 (6)		E _e	+45 (4)	5 (6)	En	+40 (4)	5 (6)
F	+23 (4)	5 (6)	-	-	-		F	+23 (4)	5 (6)	-	-	-
G	+5 (3)	15 (6)	-	-	-		G	+5 (3)	15 (6)	-	-	-
S ₂	+23 (4)	Any (2)	-	-	-		S ₂	+23 (4)	Any (2)	-	-	-
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: Within 10 - 85 % RH.												
NOTE 3: +/- 3°C according to IEC 68-2-1.												
NOTE 4: +/- 2°C according to IEC 68-2-2 and IEC 68-2-56.												
NOTE 5: +/- 3°C is acceptable for certain chamber sizes, as indicated in IEC 68-2-2.												
NOTE 6: Low relative humidity to be +/- 5%.												
NOTE 7: +/- 3 % RH.												

B.6.4 Scanning the climatogram

The sequence of scanning the climatogram is shown in figure B.1. Scanning begins at point S_1 and ends at point S_2 .

The points S_1 , S_2 and A to G correspond with test severities specified in table B.1. When the test plan allows reduced performance at the exceptional climatic limits, the test shall include an excursion to the equivalent normal test severity in order to demonstrate that the equipment will recover and achieve normal performance. However, if normal performance is achieved at any exceptional test severity then the test may continue without an excursion to the equivalent normal test severity.

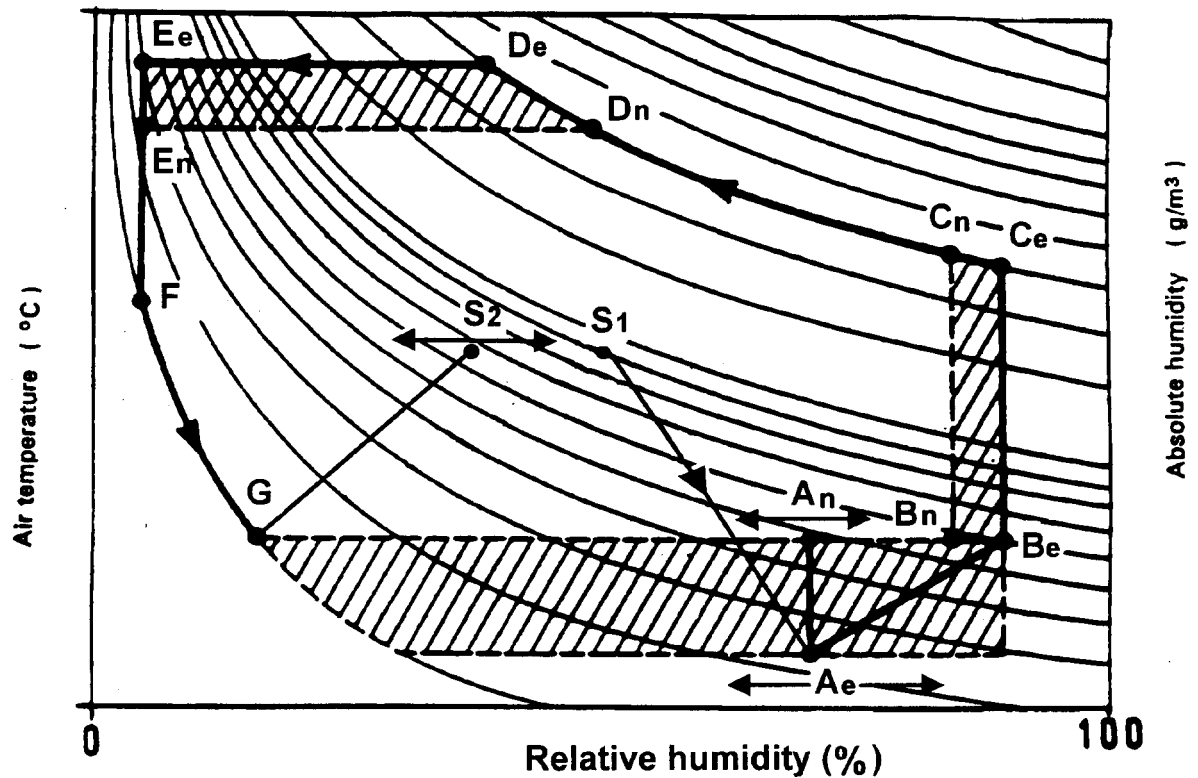


Figure B.1: Climatogram showing scanning sequence

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 with no requirement for humidity control for the final step from point G to point S₂. This final step is used to verify the equipment's performance under maximum rate of change of temperature.

B.6.6 Functional requirements and verification

Where practicable, the equipment's performance should be monitored throughout the test, the details being fully described in the equipment's test programme.

At points "S₁" and "S₂" on the test climatogram, figure B.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 B.1, as described in subclause B.6.4, after a minimum period of one hour has elapsed since temperature stabilisation within the equipment. The test program shall detail which functions are to be checked at each point on the test climatogram.

History

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