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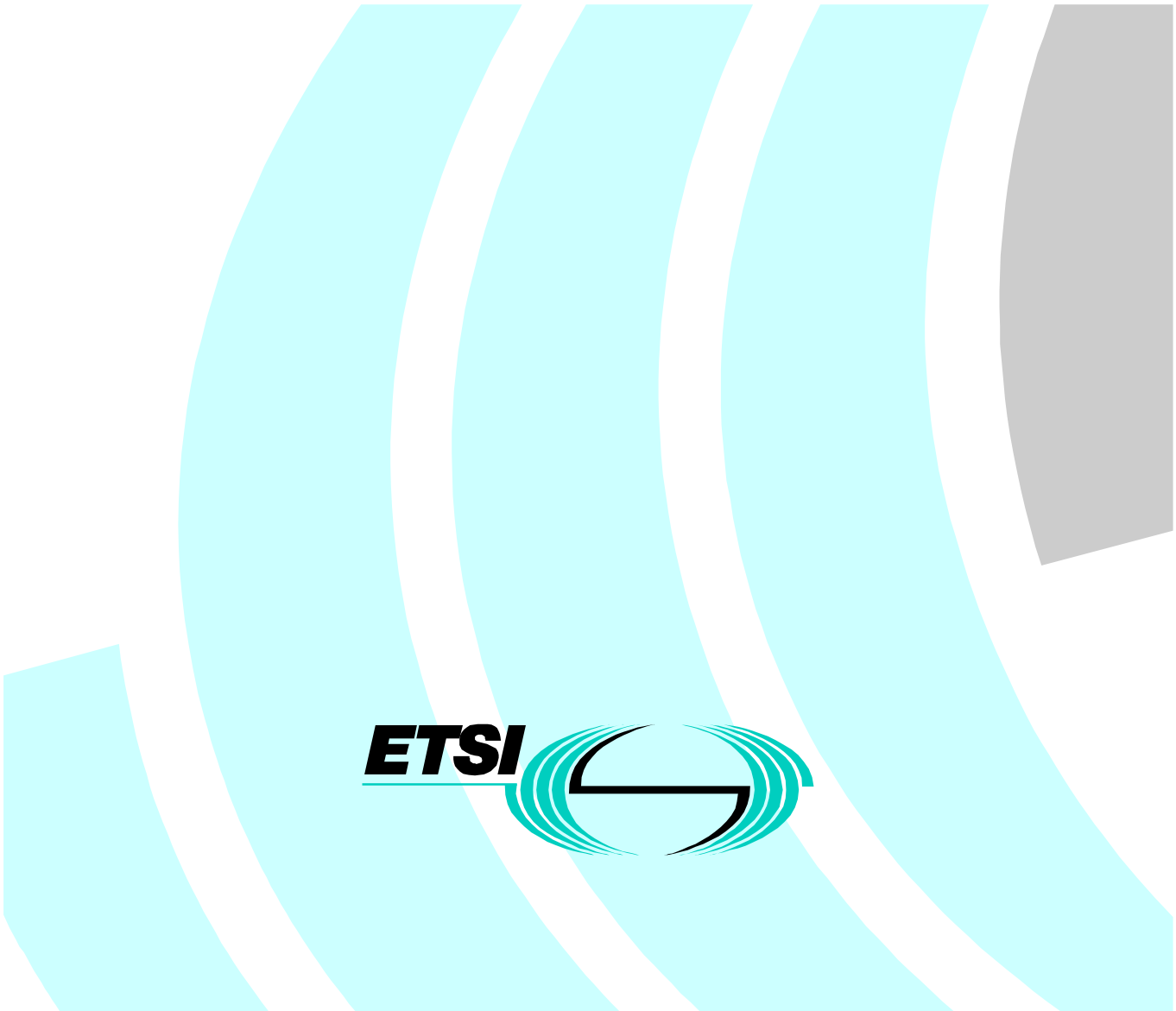
European Standard (Telecommunications series)

Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-7: Specification of environmental tests; Portable and non-stationary use



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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the ETSI standards One-step Approval Procedure.

The present document is part 2, sub-part 7 of a multi-part deliverable covering environmental conditions and environmental tests for telecommunications equipment, as identified below:

Part 1: "Classification of environmental conditions";

Part 2: "Specification of environmental tests";

Sub-part 0: "Introduction";

Sub-part 1: "Storage";

Sub-part 2: "Transportation";

Sub-part 3: "Stationary use at weatherprotected locations";

Sub-part 4: "Stationary use at non-weatherprotected locations";

Sub-part 5: "Ground vehicle installations";

Sub-part 6: "Ship environments";

Sub-part 7: "Portable and non-stationary use";

Sub-part 8: "Stationary use at underground locations".

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

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. The present document deals with portable and non-stationary use.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
pDate of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document specifies test methods and severities for the verification of the required resistibility of telecommunication equipment according to the relevant environmental class.

The tests defined in the present document apply to portable and non-stationary use of equipment, covering the environments stated in ETS 300 019-1-7 [1].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI ETS 300 019-1-7: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-7: Classification of environmental conditions; Portable and non-stationary use".

[2] IEC 60068-2: "Basic environmental testing procedures. Part 2: Tests".

[3] ETSI ETS 300 019-2-0: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-0: Specification of environmental tests; Introduction".

[4] IEC 60721-2-7: "Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Fauna and flora".

3 Environmental test specifications

The detailed descriptions of the environmental conditions are given in clauses 4 and 5 of ETS 300 019-1-7 [1].

ETS 300 019-2-0 [3] forms a general overview of part 2 of the present multipart standard.

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 utilization of the equipment under test. The heat dissipation shall be maximized, except for the steady state, low temperature test, where it shall be minimized.

3.1 Specification T 7.1: Temperature-controlled locations

This specification applies to use at, and direct transfer between, permanently temperature-controlled enclosed locations where humidity is usually not controlled. See tables 1, 5 and 6.

Table 1: Test specification T 7.1: Temperature-controlled locations - climatic tests

Environmental parameter			Environmental Class 7.1	Environmental test specification T7.1: Portable, temperature- controlled location				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	low	(°C)	+5	+5	16 h	IEC 60068-2-1	Ab/Ad: Cold	1
	high	(°C)	+40	+40 or +50	16 h	IEC 60068-2-2	Bb/Bd: Dry heat	2
	change	(°C)	+5/+25	+5/+25	3 cycles t_1 = 3 h	IEC 60068-2-14	Na: Change of temperature	3
Humidity	relative	low (%)	5	none				4
		high (%) (°C)	85 +30	93 +30	96 h	IEC 60068-2-56	Cb: Damp heat steady state	5
		condensation (%) (°C)	yes	90-100 +30	2 cycles	IEC 60068-2-30	Db: Damp heat Cyclic, variant 2	6
	absolute	low (g/m^3)	1	none				4
		high (g/m^3)	25	none				7
Air	pressure	low (kpa)	70	none				8
		high (kpa)	106	none				8
	speed	(m/s)	5,0	none				4
Water	rain	intensity (mm/min)	no					
		low temperature (°C)	no					
	other sources		no					
	icing & frosting		no					
Radiation	solar	(W/m^2)	700	none				11
	heat	(W/m^2)	600	none				11
Chemically active substances	sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	chlorine	salts	Sea and road salt mist	none				12
		Cl_2 (mg/m^3)	0,1/0,3	none				12
		HCl (mg/m^3)	0,1/0,5	none				12
	nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	hydrogen fluoride	HF (mg/m^3)	0,01/0,03	none				12
	ozone	O_3 (mg/m^3)	0,05/0,1	none				12
Mechanically active subtances	dust	sedimentation ($mg/(m^2\ h)$)	1,5	none				13
		suspension (mg/m^3)	0,2	none				13
	sand	(mg/m^3)	30	none				13

Environmental parameter			Environmental Class 7.1	Environmental test specification T7.1: Portable, temperature- controlled location				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Flora and Fauna	micro organisms		no					
	rodents, insects		no					
no: This condition does not occur in this class. none: Verification is required only in special cases. NOTES: Number of note, see clause 3.4.								

3.2 Specification T 7.2: Partly temperature-controlled locations

This specification applies to use at and direct transfer between, enclosed locations having neither temperature nor humidity control but where heating may be used to avoid low temperatures. Building construction avoids extremely high temperatures. See tables 2, 5 and 6.

Table 2: Test specification T 7.2: Partly temperature-controlled locations - climatic tests

Environmental parameter			Environmental Class 7.2	Environmental test specification T7.2: Portable, Partly temperature- controlled locations				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	low	(°C)	-5	-5	16 h	IEC 60068-2-1	Ab/Ad: Cold	1
	high	(°C)	+45	+45 or +55	16 h	IEC 60068-2-2	Bb/Bd: Dry heat	2
	change	(°C)	-5/+25	-5/+25	3 cycles t_1 = 3 h	IEC 60068-2-14	Na: Change of temperature	3
Humidity	relative	low (%)	5	none				4
		high (%) (°C)	95	93 +30	96 h	IEC 60068-2-56	Cb: Damp heat steady state	5
		condensation (%) (°C)	yes	90-100 +30	2 cycles	IEC 60068-2-30	Db: Damp heat Cyclic, variant 2	6
	absolute	low (g/m^3)	1	none				4
		high (g/m^3)	29	none				7
Air	pressure	low (kpa)	70	none				8
		high (kpa)	106	none				8
	speed	(m/s)	5,0	none				4
Water	rain	intensity (mm/min)	no					
		low temperature (°C)	no					
	other sources		dripping water	none				10
	icing & frosting		yes	none				4
Radiation	solar	(W/m^2)	700	none				11
	heat	(W/m^2)	600	none				11

Environmental parameter				Environmental Class 7.2	Environmental test specification T7.2: Portable, Partly temperature- controlled locations				
Type	**Parameter**	**Detail parameter**		**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Chemically active substances	sulphur	SO_2	(mg/m^3)	0,3/1,0	none				12
		H_2S	(mg/m^3)	0,1/0,5	none				12
	chlorine	salts		sea and road salt mist	none				12
		Cl_2	(mg/m^3)	0,1/0,3	none				12
		HCl	(mg/m^3)	0,1/0,5	none				12
	nitrogen	NO_x	(mg/m^3)	0,5/1,0	none				12
		NH_3	(mg/m^3)	1,0/3,0	none				12
	hydrogen fluoride	HF	(mg/m^3)	0,01/0,03	none				12
	ozone	O_3	(mg/m^3)	0,05/0,1	none				12
Mechanically active subtances	dust	sedimentation	($mg/(m^2\ h)$)	20	none				13
		suspension	(mg/m^3)	5,0	none				13
	sand		(mg/m^3)	300	none				13
Flora and Fauna	micro organisms			moulds, fungus, etc.	none				14
	rodents, insects			rodents, etc.	none				14
no: This condition does not occur in this class. none: Verification is required only in special cases. NOTES: Number of note, see clause 3.4.									

3.3 Specification T 7.3: Partly weatherprotected and non-weatherprotected locations

This specification applies to use at totally or partly weatherprotected locations of such construction that extremely low temperatures are avoided and to use at non-weatherprotected locations and to transfer between these locations. During cold seasons non-weatherprotected use and transfer is limited. See tables 3, 5 and 6.

Table 3: Test specification T 7.3: Partly weatherprotected and non-weatherprotected locations - climatic tests

Environmental parameter				Environmental Class 7.3	Environmental test specification T7.3 Portable, Partly weatherprotected and non-weatherprotected locations				
Type	**Parameter**	**Detail parameter**		**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	low		(°C)	-25	-25	16 h	IEC 60068-2-1	Ab/Ad: Cold	1
	high		(°C)	+70	+70 or +85	16 h	IEC 60068-2-2	Bb/Bd: Dry heat	2
	change		(°C)	-25/+30	-25/+30	3 cycles t_1 = 3 h	IEC 60068-2-14	Na: Change of temperature	3

Environmental parameter			Environmental Class 7.3	Environmental test specification T7.3 Portable, Partly weatherprotected and non-weatherprotected locations				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Humidity	relative	low (%)	5	none				4
		high (%) (°C)	100	93 +40	96 h	IEC 60068-2-56	Cb: Damp heat steady state	5
		condensation (%) (°C)	yes	90-100 +40	2 cycles	IEC 60068-2-30	Db: Damp heat Cyclic, variant 2	6
	absolute	low (g/m^3)	0,5	none				4
		high (g/m^3)	48	none				7
Air	pressure	low (kPa)	70	none				8
		high (kPa)	106	none				8
	speed	(m/s)	30	none				4
Water	rain	intensity (mm/min)	6	0,01	1 min/m^2 or 5 min	IEC 60068-2-18	Rb: Impacting water method 2.2	9
		volume (m^3/min) pressure (kPa)		90				
		low temperature (°C)	+5	none				9
	other sources		dripping water	none				10
	icing & frosting		yes	none				4
Radiation	solar	(W/m^2)	1 120	none				11
	heat	(W/m^2)	600	none				11
Chemically active substances	sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	chlorine	salts	Sea and road salt mist	none				12
		Cl_2 (mg/m^3)	0,1/0,3	none				12
		HCl (mg/m^3)	0,1/0,5	none				12
	nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	hydrogen fluoride	HF (mg/m^3)	0,01/0,03	none				12
	ozone	O_3 (mg/m^3)	0,05/0,1	none				12
Mechanically active subtances	dust	sedimentation ($mg/(m^2\ h)$)	20	none				13
		suspension (mg/m^3)	5,0	none				13
	sand	(mg/m^3)	300	none				13
Flora and Fauna	micro organisms		moulds, fungus, etc.	none				14
	rodents, insects		rodents, etc.	none				14

no: This condition does not occur in this class.
none: Verification is required only in special cases.
NOTES: Number of note), see clause 3.4.

3.4 Specification T 7.3E: Partly weatherprotected and non-weatherprotected locations - extended

This specification applies to use at totally or partly weatherprotected locations of any construction (except at Extremely Cold and Cold Climates where extremely low temperatures shall be avoided) and to use at non-weatherprotected locations and to transfer between these locations. During extremely cold seasons non-weatherprotected use and transfer is limited. See tables 4, 5 and 6.

Table 4: Test specification T 7.3E: Partly weatherprotected and non-weatherprotected locations – extended - climatic tests

Environmental parameter			Environmental Class 7.3E	Environmental test specification T7.3E Portable, Partly weatherprotected and non-weatherprotected locations – extended				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	low	(°C)	-40	-40	16 h	IEC 60068-2-1	Ab/Ad: Cold	1
	high	(°C)	+70	+70 or +85	16 h	IEC 60068-2-2	Bb/Bd: Dry heat	2
	change	(°C)	-40/+30	-40/+30	3 cycles t_1 = 3 h	IEC 60068-2-14	Na: Change of temperature	3
Humidity	relative	low (%)	5	none				4
		high (%) (°C)	100	93 +40	21 days	IEC 60068-2-56	Cb: Damp heat steady state	5
		condensation (%) (°C)	yes	90-100 +40	6 cycles	IEC 60068-2-30	Db: Damp heat Cyclic, variant 2	6
	absolute	low (g/m^3)	0,1	none				4
		high (g/m^3)	62	none				7
Air	pressure	low (kpa)	70	none				8
		high (kpa)	106	none				8
	speed	(m/s)	30	none				4
Water	rain	intensity (mm/min)	6	0,01 90	1 min/m^2 or 5 min	IEC 60068-2-18	Rb: Impacting water method 2.2	9
		volume (m^3/min) pressure (kpa)						
		low temperature (°C)	+5	none				9
	other sources		Dripping water	none				10
	icing & frosting		yes	none				4
Radiation	solar	(W/m^2)	1 120	none				11
	heat	(W/m^2)	600	none				11

Environmental parameter			Environmental Class 7.3E	Environmental test specification T7.3E Portable, Partly weatherprotected and non-weatherprotected locations – extended				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Chemically active substances	sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	chlorine	salts	Sea and road salt mist	none				12
		Cl_2 (mg/m^3)	0,1/0,3	none				12
		HCl (mg/m^3)	0,1/0,5	none				12
	nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	hydogen fluoride	HF (mg/m^3)	0,01/0,03	none				12
	ozone	O_3 (mg/m^3)	0,05/0,1	none				12
Mechanically active subtances	dust	Sedimentation ($mg/(m^2\ h)$)	20	none				13
		Suspension (mg/m^3)	5,0	none				13
	sand	(mg/m^3)	300	none				13
Flora and fauna	micro organisms		moulds, fungus, etc.	none				14
	rodents, insects		rodents, etc.	none				14

no: This condition does not occur in this class.
none: Verification is required only in special cases.
NOTES: Number of note, see clause 3.4.

Table 5: Test specification T 7.1 to T 7.3E: Mechanical tests

Environmental parameter			Environmental Class 7.1 to 7.3E	Environmental test specification T 7.1 to 7.3E: Portable. (IEC 721 class 7M2)				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Vibration	sinusoidal	displacement acceleration frequency range	3,5 10 2-9 9-200	15 200-500	none				15
	random	ASD frequency range number of vibration axes	1,0 10-200	0,3 200-2 000	1 -3 10-12 12-150 3	3×30 minutes	IEC 60068-2-64	Fdb: Random vibration (wideband)	16
Shocks	shocks	shock spectrum pulse shape acceleration duration number of shocks/direction number of shock directions	Type I 100 11	Type II 300 6	 half sine 300 6 6	3	IEC 60068-2-27	Ea: Shock	17
	bump	acceleration duration number of shocks/direction number of shocks directions	no		150 6 6	100	IEC 60068-2-29	Eb: Bump	18
Fall	free fall	height mass number of falls/direction number of fall directions	0,25 ≤ 1	0,1 ≤ 10 0,05 ≤ 50	0,25 ≤ 1 6	0,1 ≤ 10	2	IEC 60068-2-32	Ed: Free fall procedure 1	19a
	drop and topple	height number of drops/direction number of drop directions (bottom edges and corners)	no		0,1 4 edges+4 corners	1	IEC 60068-2-31	Ec: Drop and topple	19b
Acceleration, steady state					none				
Load, static load					none				

no: This condition does not occur in this class.
none: Verification is required only in special cases.
NOTES: Number of note, see clause 3.4.

Table 6: Test specifications T 7.1 to T 7.3E: Mechanical tests

Environmental parameter			Environmental Class 7.1 to 7.3E	Environmental test specification T 7.1 to 7.3E: Portable. (IEC 721 class 7M3)				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Vibration	sinusoidal	displacement acceleration frequency range	7,5 20 2-8 8-200 40 200-500	none				15
	random	ASD frequency range number of vibration axes	3,0 1,0 10-200 200-2 000	2 -3 10-12 12-150 3	3×30 minutes	IEC 60068-2-64	Fdb: Random vibration (wideband)	16
Shocks	shocks	shock spectrum pulse shape duration acceleration number of shocks/direction number of shock directions	Type I Type II 11 6 300 1 000	half sine 6 1000 6	3	IEC 60068-2-27	Ea: Shock	17
	bump	acceleration duration number of shocks/direction number of shock directions	no	250 6 6	100	IEC 60068-2-29	Eb: Bump	18
Fall	free fall	height mass number of falls/direction number of directions	1,0 0,5 0,25 ≤ 1 ≤ 10 ≤ 50	1,0 0,5 0,25 ≤ 1 ≤ 10 ≤ 50 6	2	IEC 60068-2-32	Ed: Free fall procedure 1	19a
	drop and topple	height number of drops/direction number of drop directions (bottom edges and corners)	no	0,1 4 edges + 4 corners	1	IEC 60068-2-31	Ec: Drop and topple	19b
Acceleration, steady state			none					
Load, static load			none					

no: This condition does not occur in this class.
none: Verification is required only in special cases.
NOTES: Number of note, see clause 3.4.

4 Notes to tables

4.1 General Note

The present document applies to use of equipment installed permanently or temporally in portable and non-stationary use and the environmental conditions stated in ETS 300 019 -1-7 [1]. The notes have been added to explain the main reasons for recommended tests or to explain why no test has been recommended even if there is a characteristic severity given.

The relevant specification should specify when, during the environmental test programme, the equipment is in its operational state, and which performance requirements should be measured before, during and after the test, together with the appropriate pass/fail criteria.

4.2 Notes to Tables 1 to 6

NOTE 1: (Air temperature, low).

The characteristic severity can be used as a cold start-up temperature, but it may be modified by the product specification. The equipment under test shall remain operational throughout this test, except for the cold start-up temperature, which shall commence once high temperate stability is achieved.

NOTE 2: (Air temperature high).

If two temperatures are given, the higher test temperature includes heat trap effect of direct solar radiation on equipment. The equipment under test shall remain operational throughout this test, except for the start-up at high temperature, which shall commence once high temperature stability is achieved.

NOTE 3: (Air temperature, change).

The change of temperature test is normally used to check design tolerancing. IEC test Na is recommended with severities equal to characteristic severities. Whenever possible, the equipment function shall be monitored throughout the test.

NOTE 4: No suitable test method for this parameter in IEC 60068-2 [2].

NOTE 5: (Humidity, relative, high).

These severities are the nearest preferred values in IEC 60068-2-56 [2] test Cb. The minor differences both in temperature and in humidity conditions are considered to be insignificant.

NOTE 6: (Humidity, relative, condensation).

IEC 60068-2-30 [2] test Db is recommended with test severities not higher than climatogram limits for this class.

NOTE 7: (Humidity, absolute, high).

This effect is considered to be partly included in the damp heat test IEC 60068-2-56 [2] test Cb.

NOTE 8: (Air pressure, low and high).

No test is recommended for normal applications, because the effect of air pressure is evaluated at the component level.

NOTE 9: (Water, rain).

IEC 60068-2-18 [2] test Rb method 2.2 has been chosen even though it does not imitate normal rain. It is a simple hand held shower test, which is easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The greater of the two given durations should be used. The cooling effect of the low temperature of the rain is included in test Na.

NOTE 10:(Water, other sources).

No test is recommended because the effect is already included in IEC 60068-2-30 test Db or IEC 60068-2-18 [2] Test Rb.

NOTE 11:(Radiation, solar, heat).

The effect of direct solar radiation is included in the higher test value in IEC 60068-2-2 [2] Test Bb/Bd described in note 2. Photochemical tests can be made separately for components and materials.

NOTE 12:(Chemically active substances).

The characteristic severities are maximum values. For chemically active substances the characteristic severities should be considered when choosing components and materials. No test is recommended in the present document.

NOTE 13:(Mechanically active substances).

The characteristic severities are much lower than lowest severity in IEC 60068-2-68 [2] Test Lb and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing components and materials.

NOTE 14:(Flora, fauna).

The characteristic severities should be considered when choosing components and materials.

NOTE 15:(Vibration, sinusoidal).

Random vibration is considered to be a more realistic test for this condition, therefore no sinusoidal test is recommended. The severities are given as peak values.

NOTE 16:(Vibration, random).

The most energy is in low frequencies and therefore the most realistic test has been described with a -3 dB/s slope from 12 Hz to 150 Hz. If the vibration in some direction is known to be insignificant, tests need not be performed in those directions.

ASD = Acceleration Spectral Density

NOTE 17:(Shocks, shocks).

IEC test Ea half sine test method has been chosen and a non-IEC recommended test severity has been defined in order to avoid exceeding the characteristic severity. The duration of shock pulses has been changed to 6 ms to facilitate the use of standard testing equipment. Three pulses in all six directions are considered sufficient to demonstrate that the specimen design is adequately toleranced to survive this condition. If the normal attitude is specified, then the number of directions is reduced to 3.

The severities are given as peak values.

NOTE 18:(Shocks, bump).

Bump test is recommended in addition to shocks as the number of expected shocks is high. Standard test severities of IEC test Eb has been chosen and are given as peak values.

NOTE 19:(Fall, drop and topple).

19a) (free fall)

IEC test doesn't provide mass differences for falling heights. ISO severities are chosen because they are considered to be more flexible given different falling heights for different masses.

NOTE: For low masses ISO severities are higher than those given in IEC 60721-2 [4].

19b) (drop and topple)

IEC 60068-2-31 [2] test Ec : Drop and topple test is recommended in addition to the free fall test as the exact attitude of falling equipment under test can not be specified.

Annex A (informative): Bibliography

- ETR 035: "Equipment Engineering (EE); Environmental engineering; Guidance and terminology".
- IEC 60068-1: "Environmental testing. Part 1: General and guidance".

History

Document history		
Edition 1	May 1994	Publication as ETS 300 019-2-5
V2.1.0	May 2001	One-step Approval Procedure OAP 20010914: 2001-05-16 to 2001-09-14