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**Environmental Engineering (EE);
Environmental conditions and environmental tests
for telecommunications equipment;
Part 2-4: Specification of environmental tests;
Stationary use at non-weatherprotected locations**

Reference

REN/EE-017002

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Environmental Engineering (EE).

The present document is part 2, sub-part 4 of a multi-part deliverable. Full details of the entire series can be found in part 2, sub-part 0 [i.1].

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Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

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

The tests defined in the present document apply to stationary use of equipment at non-weatherprotected locations covering the environmental conditions stated in ETSI EN 300 019-1-4 [1].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] ETSI EN 300 019-1-4 (04-2014): "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".
- [2] IEC 60068-2-1 (03-2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".
- [3] Void.
- [4] Void.
- [5] ATIS T1.0600329 (2014): "Network Equipment - Earthquake Resistance".
- [6] Void.
- [7] IEC 60068-2-2 (07-2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".
- [8] IEC 60068-2-14 (01-2009): "Environmental testing - Part 2-14: Tests - Test N: Change of temperature".
- [9] IEC 60068-2-30 (08-2005): "Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)".
- [10] IEC 60068-2-64 (04-2008): "Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance".
- [11] IEC 60068-2-27 (02-2008): "Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock".
- [12] IEC 60068-2-6 (12-2007): "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)".
- [13] IEC 60068-2-57 (04-2013): "Environmental testing - Part 2-57: Tests - Test Ff: Vibration - Time-history and sine-beat method".
- [14] Void.
- [15] IEC 60068-2-18 (03-2017): "Environmental testing - Part 2-18: Tests - Test R and guidance: Water".

- [16] IEC 60068-2-78 (10-2012): "Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state".
- [17] IEC 60068-2-11 (01-1981): "Basic environmental testing procedures - Part 2-11: Tests - Test Ka: Salt mist".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI EN 300 019-2-0: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-0: Specification of environmental tests; Introduction".
- [i.2] IEC 60068-2-68 (08-1994): "Environmental testing - Part 2-68: Tests - Test L: Dust and sand".
- [i.3] IEC 60068-2 (all parts): "Environmental testing - Part 2: Tests".
- [i.4] ETSI EN 300 019-1-0: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-0: Classification of environmental conditions; Introduction".

3 Definitions

For the purposes of the present document, the terms and definitions given in ETSI EN 300 019-1-0 [i.4] apply.

4 Environmental test specifications

4.0 General

The equipment shall be tested in its operational state throughout the test conditions described in the present document. The detailed descriptions of the environmental conditions are given in clauses 4 and 5 of ETSI EN 300 019-1-4 [1].

ETSI EN 300 019-2-0 [i.1] forms a general overview of part 2 of this multi-part deliverable.

4.1 Equipment setup and configuration

The equipment shall be tested in its operational state throughout the test conditions described in the present document unless otherwise stated. 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.

4.2 Performance criteria

The following performance criteria shall apply in the tests defined by the present document.

Performance criterion A:

The equipment shall function according to the manufacturer specifications before, during and after the tests. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer when the apparatus is used as intended. If the minimum performance level is not specified by the manufacturer, then this may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B:

The equipment shall function according to the manufacturer specifications before and after the tests. During the test it is not required to monitor the equipment functionality. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer when the apparatus is used as intended. If the minimum performance level is not specified by the manufacturer, then this may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C:

The equipment shall function according to the manufacturer specifications before and after the tests. No degradation of performance or loss of function is allowed below the performance level specified by the manufacturer when the apparatus is used as intended. If the minimum performance level is not specified by the manufacturer, then this may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

During the application of the test, temporary loss of function is allowed but after the test the equipment shall restore to the normal functionality without replacement of components, manual rebooting or human intervention.

The equipment shall sustain the test without permanent structural or mechanical damage.

Performance criterion D:

This performance criterion applies to the enclosure of the equipment. No corrosion traces (e.g. rust) or deterioration of the enclosure shall occur at the end of the test.

4.3 Specification T 4.1: non-weatherprotected locations, climatic tests

The specification in table 1 shall apply to non-weatherprotected locations described in ETSI EN 300 019-1-4 [1].

Table 1: Test specification T 4.1: Stationary use at non-weatherprotected locations - climatic tests

Environmental parameter			Environmental Class 4.1	Environmental test specification T 4.1: Stationary use, Non-weatherprotected locations					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
Air temperature	Low	(°C)	-33	-33 or -45	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	A	1
	High	(°C)	+40	+40 or +55	16 h	IEC 60068-2-2 [7]	Bb/Bd/Be: Dry heat	A	2
	Change	(°C) (°C/min)	0,5	-10 to +40 0,5	2 cycles t ₁ = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	A	3
Humidity	Relative	Low (%)	15	None					8
		High (%)	100	93	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	A	4
		Condensation (°C)	Yes	+30					
	Absolute	Low (g/m ³)	0,26	90 to 100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat, cyclic Variant 1	A	
High (g/m ³)		25	None					6	
Air	Pressure	Low (kPa)	70	None					7
		High (kPa)	106	None					7
	Speed	(m/s)	50	None					8
Water	Rain	Intensity	6 mm/min	0,01 m ³ /min 90 kPa	3 min/m ² or 15 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1.2 "spray nozzle"	B	9
		Low temperature (°C)	+5	None					
	Other sources		Splashing water	None					10
	Icing & frosting		Yes	None					8
Radiation	Solar	(W/m ²)	1 120	None					11
	Heat	(W/m ²)	Negligible	None					
Chemically active substances	Sulphur	SO ₂ (mg/m ³)	0,3 to 1,0	None					12
		H ₂ S (mg/m ³)	0,1 to 0,5	None					12
	Chlorine	Salt mist	Sea and road salt	35 °C, 5 % NaCl solution	10 d	IEC 60068-2-11 [17]	Ka: Salt mist	D	12
		Cl (mg/m ³)	0,1 to 0,3	None					12
		HCl (mg/m ³)	0,1 to 0,5	None					12
	Nitrogen	NO _x (mg/m ³)	0,5 to 1,0	None					12

Environmental parameter			Environmental Class 4.1	Environmental test specification T 4.1: Stationary use, Non-weatherprotected locations					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
		NH ₃ (mg/m ³)	1,0 to 3,0	None					12
	Hydrogen fluoride HF	(mg/m ³)	0,01 to 0,03	None					12
	Ozone O ₃	(mg/m ³)	0,05 to 0,1	None					12
Mechanically active substances	Dust	Sedimentation (mg/(m ² h))	20	None					13
		Suspension (mg/m ³)	5	None					13
	Sand	(mg/m ³)	300	None					13
Flora and fauna	Micro organisms		Mould, fungus, etc.	None					14
	Rodents, insects		Rodents, etc.	None					14
<p>NOTE 1: (Air temperature, low). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. The temperature cold start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.</p> <p>NOTE 2: (Air temperature, high). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. The temperature start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.</p> <p>NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5 °C/min can be applied.</p> <p>NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.</p> <p>NOTE 7: (Air pressure, low and high). No test is required for normal applications, because the effect of air pressure is evaluated at the component level.</p> <p>NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.</p> <p>NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1.2 "Spay nozzle" has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately tolerated to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.</p> <p>NOTE 10: (Water, other sources). No test is required because the effect is already included in IEC 60068-2-18 [15] Test Rb.</p> <p>NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be performed separately for component and materials.</p> <p>NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is required in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.</p> <p>NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is required. This condition should be considered when designing the equipment and choosing components and materials.</p> <p>NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.</p>									

4.4 Specification T 4.1E: non-weatherprotected locations - extended, climatic tests

The specification in table 2 shall apply to non-weatherprotected locations - extended as described in ETSI EN 300 019-1-4 [1].

Table 2: Test specification T 4.1E: Stationary use at non-weatherprotected locations, extended - climatic tests

Environmental parameter			Environmental Class 4.1E	Environmental test specification T 4.1E: Stationary use Non-weatherprotected locations - extended						
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes	
Air temperature	Low	(°C)	-45	-45 or -55	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	A	1	
	High	(°C)	+45	+45 or +60	16 h	IEC 60068-2-2 [7]	Bb/Bd/Be: Dry heat	A	2	
	Change	(°C) (°C/min)	0,5	-10 to +45 0,5	2 cycles t1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	A	3	
Humidity	Relative	Low	(%)	8	None				8	
		High	(%)	100	93	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	A	4
		Condensation	(°C)	Yes	+30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	A	5
	Absolute	Low	(g/m ³)	0,03	90 to 100 +30					6
		High	(g/m ³)	30	None					
Air	Pressure	Low	(kPa)	70	None				7	
		High	(kPa)	106	None				7	
	Speed	(m/s)	50	None					8	
Water	Rain	Intensity		15 mm/min	0,01 m ³ /min 90 kPa	6 min/m ² or 30 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1.2 "spray nozzle"	B	9
		Low temperature	(°C)	+5	None					
	Other sources		Splashing water	None					10	
	Icing & frosting		Yes	None					8	
Radiation	Solar	(W/m ²)	1 120	None					11	
	Heat	(W/m ²)	Negligible	None						
Chemically active substances	Sulphur	SO ₂	(mg/m ³)	0,3 to 1,0	None				12	
		H ₂ S	(mg/m ³)	0,1 to 0,5	None				12	
	Chlorine	Salt mist		Sea and road salt	35 °C, 5 % NaCl solution	10 d	IEC 60068-2-11 [17]	Ka: Salt mist	D	12
		Cl	(mg/m ³)	0,1 to 0,3	None					12
		HCl	(mg/m ³)	0,1 to 0,5	None					12
	Nitrogen	NO _x	(mg/m ³)	0,5 to 1,0	None					12
		NH ₃	(mg/m ³)	1,0 to 3,0	None					12

Environmental parameter			Environmental Class 4.1E	Environmental test specification T 4.1E: Stationary use Non-weatherprotected locations - extended					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
	Hydrogen fluoride HF	(mg/m ³)	0,01 to 0,03	None					12
	Ozone O ₃	(mg/m ³)	0,05 to 0,1	None					12
Mechanically active substances	Dust	Sedimentation (mg/(m ² h))	20	None					13
		Suspension (mg/m ³)	5	None					13
	Sand	(mg/m ³)	300	None					13
Flora and fauna	Micro organisms		Mould, fungus, etc.	None					14
	Rodents, insects		Rodents, etc.	None					14
<p>NOTE 1: (Air temperature, low). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. The temperature cold start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.</p> <p>NOTE 2: (Air temperature, high). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. The temperature start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.</p> <p>NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5 °C/min can be applied.</p> <p>NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab is shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.</p> <p>NOTE 7: (Air pressure, low and high). No test is required for normal applications, because the effect of air pressure is evaluated at the component level.</p> <p>NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.</p> <p>NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1.2 "Spray nozzle" has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.</p> <p>NOTE 10: (Water, other sources). No test is required because the effect is already included in IEC 60068-2-18 [15] Test Rb.</p> <p>NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be performed separately for component and materials.</p> <p>NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is required in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.</p> <p>NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is required. This condition should be considered when designing the equipment and choosing components and materials.</p> <p>NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.</p>									

4.5 Specification T 4.2L: non-weatherprotected locations - extremely cold, climatic tests

The specification in table 3 shall apply to non-weatherprotected locations - extremely cold as described in ETSI EN 300 019-1-4 [1] (see table 3).

Table 3: Test specification T 4.2L: Stationary use at non-weatherprotected locations, extremely cold - climatic tests

Environmental parameter			Environmental Class 4.2L	Environmental test specification T 4.2L: Stationary use Non-weatherprotected locations - extremely cold						
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes	
Air temperature	Low	(°C)	-65	-65 or -75	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	A	1	
	High	(°C)	+35	+35 or +50	16 h	IEC 60068-2-2 [7]	Bb/Bd/Be: Dry heat	A	2	
	Change	(°C) (°C/min)	0,5	-10 to +45 0,5	2 cycles t1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	A	3	
Humidity	Relative	Low	(%)	20	none				8	
		High	(%) (°C)	100	93 +30	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	A	4
		Condensation	(%) (°C)	Yes	90 to 100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	A	5
	Absolute	Low	(g/m ³)	0,003	None				6	
		High	(g/m ³)	22	None					
Air	Pressure	Low	(kPa)	70	None				7	
		High	(kPa)	106	None				7	
	Speed	(m/s)	50	None					8	
Water	Rain	Intensity		15 mm/min	0,01 m ³ /min 90 kPa	6 min/m ² or 30 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1.2 "spray nozzle"	B	9
		Low temperature (°C)		+5	None					
	Other sources		splashing water	None					10	
	Icing & frosting		Yes	None					8	
Radiation	Solar	(W/m ²)	1 120	None					11	
	Heat	(W/m ²)	Negligible	None						
Chemically active substances	Sulphur	SO ₂	(mg/m ³)	0,3 to 1,0	None				12	
		H ₂ S	(mg/m ³)	0,1 to 0,5	None				12	
	Chlorine	Salt mist		Sea and road salt	35 °C, 5 % NaCl solution	10 d	IEC 60068-2-11 [17]	Ka: Salt mist	D	12
		Cl	(mg/m ³)	0,1 to 0,3	None					12
		HCl	(mg/m ³)	0,1 to 0,5	None					12
	Nitrogen	NO _x	(mg/m ³)	0,5 to 1,0	None					12
NH ₃		(mg/m ³)	1,0 to 3,0	None					12	

Environmental parameter			Environmental Class 4.2L	Environmental test specification T 4.2L: Stationary use Non-weatherprotected locations - extremely cold					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
	Hydrogen fluoride HF	(mg/m ³)	0,01 to 0,03	None					12
	Ozone O ₃	(mg/m ³)	0,05 to 0,1	None					12
Mechanically active substances	Dust	Sedimentation (mg/(m ² h))	20	None					13
		Suspension (mg/m ³)	5	None					13
	Sand	(mg/m ³)	300	None					13
Flora and fauna	Micro organisms		Mould, fungus, etc.	None					14
	Rodents, insects		Rodents, etc.	None					14
<p>NOTE 1: (Air temperature, low). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. The temperature cold start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.</p> <p>NOTE 2: (Air temperature, high). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. The temperature start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.</p> <p>NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5 °C/min can be applied.</p> <p>NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.</p> <p>NOTE 7: (Air pressure, low and high). No test is required for normal applications, because the effect of air pressure is evaluated at the component level.</p> <p>NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.</p> <p>NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1.2 "Spray nozzle" has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately tolerated to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.</p> <p>NOTE 10: (Water, other sources). No test is required because the effect is already included in IEC 60068-2-18 [15] Test Rb.</p> <p>NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be performed separately for component and materials.</p> <p>NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is required in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.</p> <p>NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is required. This condition should be considered when designing the equipment and choosing components and materials.</p> <p>NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.</p>									

4.6 Specification T 4.2H: non-weatherprotected locations - extremely warm dry, climatic tests

The specification in table 4 shall apply to non-weatherprotected locations - extremely warm dry described in ETSI EN 300 019-1-4 [1].

Table 4: Test specification T 4.2H: Stationary use at non-weatherprotected locations, extremely warm dry - climatic tests

Environmental parameter			Environmental Class 4.2H	Environmental test specification T 4.2H: Stationary use Non-weatherprotected locations - extremely warm dry						
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes	
Air temperature	Low	(°C)	-20	-20 or -30	16 h	IEC 60068-2-1 [2]	Ab/Ad: Cold	A	1	
	High	(°C)	+55	+55 or +70	16 h	IEC 60068-2-2 [7]	Bb/Bd: Dry heat	A	2	
	Change	(°C) (°C/min)	0,5	-10 to +45 0,5	2 cycles t1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	A	3	
Humidity	Relative	Low	(%)	4	None				8	
		High	(%)	100	93	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	A	4
		Condensation	(°C)	Yes		2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	A	5
	Absolute	Low	(g/m ³)	0,9	None					6
		High	(g/m ³)	36	None					
Air	Pressure	Low	(kPa)	70	None				7	
		High	(kPa)	106	None				7	
	Speed	(m/s)	50	None					8	
Water	Rain	Intensity		15 mm/min	0,01 m ³ /min 90 kPa	6 min/m ² or 30 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1.2 "spray nozzle"	B	9
		Low temperature (°C)		+5	None					
	Other sources		splashing water	None						10
	Icing & frosting		Yes	None					8	
Radiation	Solar	(W/m ²)	1 120	None					11	
	Heat	(W/m ²)	Negligible	None						
Chemically active substances	Sulphur	SO ₂	(mg/m ³)	0,3 to 1,0	None				12	
		H ₂ S	(mg/m ³)	0,1 to 0,5	None				12	
	Chlorine	Salt mist		Sea and road salt	35 °C, 5 % NaCl solution	10 d	IEC 60068-2-11 [17]	Ka: Salt mist	D	12
		Cl	(mg/m ³)	0,1 to 0,3	None					12
		HCl	(mg/m ³)	0,1 to 0,5	None					12
	Nitrogen	NO _x	(mg/m ³)	0,5 to 1,0	None					12
NH ₃		(mg/m ³)	1,0 to 3,0	None					12	

Environmental parameter			Environmental Class 4.2H	Environmental test specification T 4.2H: Stationary use Non-weatherprotected locations - extremely warm dry					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
	Hydrogen fluoride HF	(mg/m ³)	0,01 to 0,03	None					12
	Ozone O ₃	(mg/m ³)	0,05 to 0,1	None					12
Mechanically active substances	Dust	Sedimentation (mg/(m ² h))	20	None					13
		Suspension (mg/m ³)	5	None					13
	Sand	(mg/m ³)	300	None					13
Flora and fauna	Micro organisms		Mould, fungus, etc.	None					14
	Rodents, insects		Rodents, etc.	None					14
<p>NOTE 1: (Air temperature, low). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. The temperature cold start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.</p> <p>NOTE 2: (Air temperature, high). Two test temperatures are given, the lower test temperature shall apply if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. The temperature start up test shall be performed according to the characteristic severity temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.</p> <p>NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5°C/min can be applied.</p> <p>NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.</p> <p>NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.</p> <p>NOTE 7: (Air pressure, low and high). No test is required for normal applications, because the effect of air pressure is evaluated at the component level.</p> <p>NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.</p> <p>NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1.2 "Spray nozzle" has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.</p> <p>NOTE 10: (Water, other sources). No test is required because the effect is already included in IEC 60068-2-18 [15] Test Rb.</p> <p>NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be performed separately for component and materials.</p> <p>NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is required in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.</p> <p>NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is required. This condition should be considered when designing the equipment and choosing components and materials.</p> <p>NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.</p>									

4.7 Specification T 4.1, 4.1E, 4.2L and 4.2H: non-weatherprotected locations - mechanical tests

The specification of mechanical tests in table 5 shall apply to the following locations: Non weatherprotected locations; Non weatherprotected locations, extended; Non weatherprotected locations, extremely cold; non weatherprotected locations, extremely warm dry.

Table 5: Mechanical tests

Test specification T 4.1: Non-weatherprotected locations; Test specification T 4.1E: Non-weatherprotected locations, extended; Test specification T 4.2L: Non-weatherprotected locations, extremely cold; Test specification T 4.2H: Non-weatherprotected locations, extremely warm dry

Environmental parameter			Environmental Class 4.X	Environmental test specification T 4.X: Stationary use, Non-weatherprotected locations						
Type	Parameter	Detail parameter	Characteristic severity	Test severity		Duration	Reference	Method	Performance criterion	Notes
Vibration Severity class 1	Sinusoidal	Displacement (mm)	3,0	1,2			IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	A	1; 2
		Acceleration (m/s ²)	10	4						
		Frequency range (Hz)	2-9 9-200	5-9 9-200		3 x 5 sweep cycles				
		Axes of vibration		3						
	Random	ASD (m ² /s ³) (dB/oct)	No	0,04			IEC 60068-2-64 [10]	Fh: Vibration, broad-band (digital control)	A	1; 3
		Frequency range (Hz)		+12 -12						
		Frequency range (Hz)		5-10 10-50 50-100		3 x 30 minutes				
		Axes of vibration		3						
Shocks Severity class 1	Shocks	Shock spectrum	Type II	Half sine			IEC 60068-2-27 [11]	Ea: Shock	A	1; 4
		Duration (ms)	6	11						
		Acceleration (m/s ²)	250	50						
		Number of shocks				100 in each direction				
		Directions of shocks		6						
Vibration Severity class 2	Sinusoidal	Velocity (mm/s)		5			IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	A	1; 2
		Displacement (mm)	1,5							
		Acceleration (m/s ²)	5	2						
		Frequency range (Hz)	2-9 9-200	5-62 62-200		3 x 5 sweep cycles				
		Axes of vibration		3						
	Random	ASD (m ² /s ³) (dB/oct)	No	0,02			IEC 60068-2-64 [10]	Fh: Vibration, broad-band (digital control)	A	1; 3
		Frequency range (Hz)		+12 -12						
		Frequency range (Hz)		5-10 10-50 50-100		3 x 30 minutes				
		Axes of vibration		3						
Shocks Severity class 2	Shocks	Shock spectrum	Type L	Half sine			IEC 60068-2-27 [11]	Ea: Shock	A	1; 4
		Duration (ms)	22	11						
		Acceleration (m/s ²)	70	30						
		Number of shocks				3 in each direction				
		Directions of shocks		6						

NOTE 1: In this table two tests severity classes are given. Test severity class 2 may be chosen for equipment that, according to the product manufacturer specifications, are intended to be installed in locations where the mechanical conditions are equivalent to those given for partly- and not-temperature controlled locations or where the probability of high mechanical stresses are rare. In all other cases the test severity class 1 shall be applied.

NOTE 2: (Vibration, sinusoidal). The severities are given as peak values. These test severity values are not specified in IEC 60068-2 [i.3] series. The test severity is lower than the characteristic severity which is considered to be too severe for this class. Equipment under test shall be mounted in the "in-use" position.

Environmental parameter			Environmental Class 4.X	Environmental test specification T 4.X: Stationary use, Non-weatherprotected locations					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
NOTE 3: (Vibration, random). ASD (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. These test severity values are not specified in IEC 60068-2 [i.3] series. The maximum test frequency has been reduced to 100 Hz because between 100 Hz and 200 Hz the contribution is insignificant. Also at low and high frequency ends the ASD is reduced by 12 dB/oct. Equipment under test shall be mounted in the "in-use" position.									
NOTE 4: (Shocks). The severities are given as peak values. The Energy content and the SRS of the shock given as test severity have been considered more appropriate than that given by the characteristic severity. Equipment under test shall be mounted in the "in-use" position.									

5 Earthquake test specification

5.0 General

If the equipment is declared by the manufacturer to be designed to withstand earthquake conditions, the test requirements stated below shall be applied.

The test specification is applicable to classes 4.1, 4.1E, 4.2L and 4.2H.

5.1 Vibration response investigation

A preliminary vibration response investigation shall be carried out to determine the lowest resonant frequency of the mounted test specimen.

The vibration response investigation can be carried out by means of *sine sweep testing* or *random testing*.

When using the *sine sweep testing*, the vibration response investigation shall be carried out in a manner based on that of IEC 60068-2-6 [12] (test Fc), with the following parameter severities:

Frequency range:	1 Hz to 35 Hz
Vibration amplitude:	2 m/s ²
Sweep rate:	≤ 1 octave/min

NOTE 1: The vibration amplitude may be reduced to 1 m/s² or less in case of sharp resonances.

If a *random test* is used this shall be performed in accordance with the requirements of IEC 60068-2-64 [10], using the following severities:

Frequency range:	1 Hz to 20 Hz	20 Hz to 35 Hz
ASD:	0,5 m ² /s ³	-3 dB/octave
Duration:	3 minutes	

NOTE 2: The Acceleration Spectral Density (ASD) value may be reduced to 0,3 m²/s³ or less in case of sharp resonances.

- The time-history stated in table 6 can be omitted if, after the vibration response investigation, the equipment does not exhibit any resonance below 5 Hz and has passed the sinusoidal vibration test reported in table 5 for the test severity class 1. This test is sufficient to prove compliance with the earthquake conditions given in ETSI EN 300 019-1-4 [1].

5.2 Test conditioning

The tests shall be performed according to the tests conditions defined in table 6.

Table 6: Test specification T 4.X: Earthquake test

Environmental parameter			Environmental Class 4.X	Environmental test specification T 4.X: Earthquake test					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Performance criterion	Notes
Earthquake	Time-history	RRS	Fig.1, tab.7	Fig.1, tab.7		IEC 60068-2-57 [13]	Ff: time-history method	C	(see note)
		Frequency range (Hz)	0,3 - 50	1 - 35					
		ZPA (m/s ²)	5	5					
		Axes		3	30 s				
		Damping ratio (%)		2					
<p>NOTE: (Earthquake). Time history signal Verreq II specified in ATIS T1.0600329 [5] shall be used. RRS (Required Response Spectrum). ZPA (Zero Period Acceleration). The equipment under test mounted in the "in use" position. The testing configuration shall be worst case in terms of weight and stiffness. The influence of connections, piping, cables, etc. shall be taken into account when mounting the specimen. The normal "in service" mounting structure of the specimen shall be included in the test. Single-axis excitation shall be used; simultaneous multi-axis excitation is also acceptable, but it is not recommended since, in general, multi-axis testing gives less reproducible test results. The three testing axes can be reduced to two horizontal axes if the equipment, after the vibration response investigation in the vertical axis, does not exhibit any resonance below 20 Hz. The strong part of the time-history should be at least 15 s. The duration of each time-history signal shall be 30 s. One time-history shall be applied along each axis.</p>									

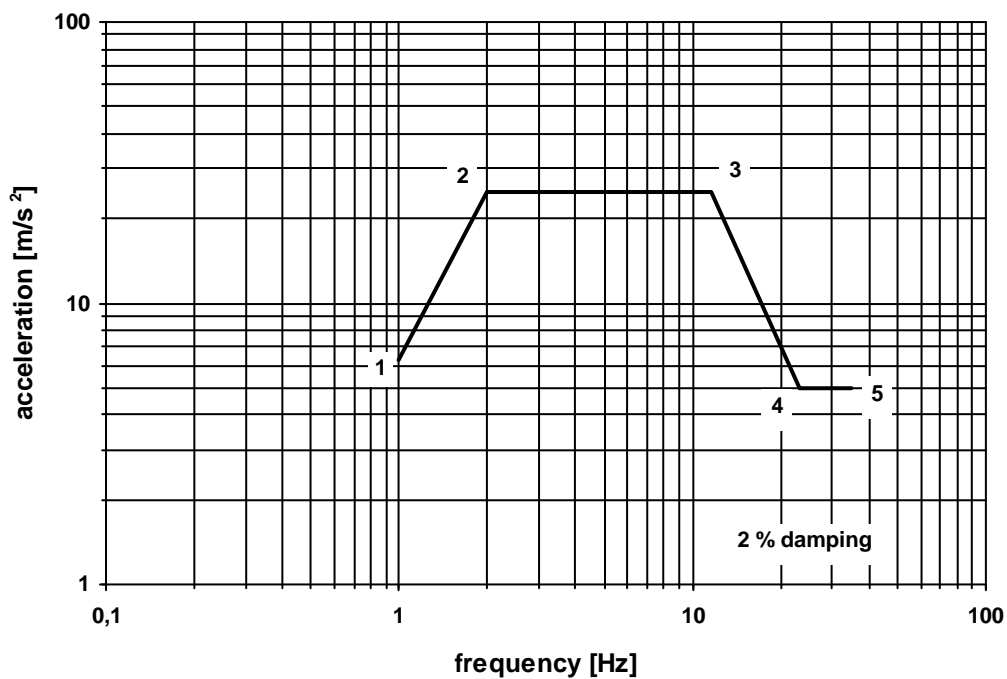


Figure 1: Earthquake Required Response Spectrum

Table 7: Acceleration co-ordinates for the Required Response Spectrum in figure 1

Co-ordinate point	Frequency [Hz]	Ground acceleration [m/s ²]
1	1,0	6,3
2	2,0	25
3	11,6	25
4	23,0	5
5	35,0	5

Annex A (informative): Bibliography

IEC 60068-1: "Environmental testing - Part 1: General and guidance".

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

History

Document history		
Edition 1	May 1994	Publication as ETSI ETS 300 019-2-4
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