



**Environmental 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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Reference

REN/EE-0162

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## Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 2, sub-part 3 of a multi-part deliverable. Full details of the entire series can be found in part 2, sub-part 0 [3].

<b>Proposed national transposition dates</b>	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
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Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

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# 1 Scope

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

The tests in the present document apply to stationary use of equipment at weatherprotected locations covering the environmental conditions stated in ETSI EN 300 019-1-3 [1].

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## 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 reference 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 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations".
- [2] IEC 60068-2-1 (03-2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".
- [3] 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".
- [4] IEC 60721-3-3: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weatherprotected locations".
- [5] Void.
- [6] IEC 60068-2-2 (07-2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".
- [7] IEC 60068-2-14 (01-2009): "Environmental testing - Part 2-14: Tests - Test N: Change of temperature".
- [8] IEC 60068-2-78 (10-2012): "Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state".
- [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] IEC 60068-2-68 (08-1994): "Environmental testing - Part 2-68: Tests - Test L: Dust and sand".

## 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 reference document (including any amendments) applies.

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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.

Not applicable.

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## 3 Environmental test specifications

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

ETSI EN 300 019-2-0 [3] forms a general overview of part 2 of this multi-part deliverable.

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

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

The specification in table 1 and table 2 shall apply to permanently temperature-controlled enclosed locations where humidity is usually not controlled.

**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	Notes
Air temperature	Low	(°C)	+5	+5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+40	+40 or +50	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	0,5	+25/+40 0,5	half cycle t <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3
Humidity	Relative	low (%)	5	none				4
		high (%)	85	85	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5
		condensation	no					
	Absolute	low (g/m <sup>2</sup> )	1	none				4
		high (g/m <sup>2</sup> )	25					7
Air	Pressure	low (kPa)	70	none				8
		high (kPa)	106	none				8
	Speed	(m/s)	5,0	none				4
Water	Rain	intensity	no					
		low temperature	no					
	Other sources		no					
	Icing & frosting		no					
Radiation	Solar	(W/m <sup>2</sup> )	700					10
	Heat	(W/m <sup>2</sup> )	600					11

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	Notes	
Chemically active substances	Sulphur	SO <sub>2</sub> (mg/m <sup>3</sup> )	0,3/1,0	none				12	
		H <sub>2</sub> S (mg/m <sup>3</sup> )	0,1/0,5	none				12	
	Chlorine	salt mist	sea and road salt	none					12
		Cl (mg/m <sup>3</sup> )	0,1/0,3	none					12
		HCl (mg/m <sup>3</sup> )	0,1/0,5	none					12
	Nitrogen	NO <sub>x</sub> (mg/m <sup>3</sup> )	0,5/1,0	none					12
		NH <sub>3</sub> (mg/m <sup>3</sup> )	1,0/3,0	none					12
		Hydrogen fluoride HF	(mg/m <sup>3</sup> )	0,01/0,03	none				12
	Ozone O <sub>3</sub>	(mg/m <sup>3</sup> )	0,05/0,1	none				12	
Mechanically active substances	Dust	sedimentation (mg/(m <sup>2</sup> h))	1,5	none				12	
		suspension (mg/m <sup>3</sup> )	0,2	none				13	
	Sand	(mg/m <sup>3</sup> )	30	none				13	
Flora and fauna	Micro organisms		negligible						
	Rodents, insects		negligible						
<p>NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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). The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5 °C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.</p> <p>NOTE 4: (Relative humidity, low). There is no IEC 60068-2 series test method for this parameter.</p> <p>NOTE 5: (Humidity, relative, high). IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.</p> <p>NOTE 6: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test values not higher than climatogram limits for this class.</p> <p>NOTE 7: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [8] Test Cab.</p> <p>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.</p>									



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	Notes
NOTE 9: (Water, rain). The effect of wind driven rain outside to the equipment in the weatherprotected or partly weatherprotected locations is included in IEC 60068-2-30 [9] Test Db. No test is recommended.								
NOTE 10: (Radiation, solar). The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.								
NOTE 11: (Radiation, heat). The higher test temperature as described in note 2 includes the heating effect.								
NOTE 12: (Chemically active substances). The characteristic severities are given as mean/maximum values. These severities should be considered when designing the equipment and 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 test severity in IEC 60068-2-68 [14] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing components and materials.								

**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	Notes
Vibration	Sinusoidal	displacement (mm) acceleration (m/s <sup>2</sup> ) frequency range (Hz) axes of vibration	0,3  1,0 2-9 9-200	none				1
Shocks	Shocks	shock spectrum duration (ms) acceleration (m/s <sup>2</sup> ) number of shocks direction of shocks	Type L 22 40	half sine 11 30 6		IEC 60068-2-27 [11]	Ea: Shock	2
NOTE 1: (Vibration, sinusoidal). No test is recommended as the characteristic severities represent insignificant levels of vibration. The severities are given as peak values.								
NOTE 2: (Shocks). The values for test severity are not specified in IEC 60068-2 series. 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. The equipment function shall be monitored throughout the test.								

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

The specification in table 3 shall apply 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.

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

Environmental parameter			Environmental Condition 3.1E	Environmental test specification T 3.1E: In-use, Temperature-controlled locations - Exceptional				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Air temperature	Low	(°C)	-5	-5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+45	+45 or +55	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	0,5	+25/+45 0,5	half cycle $t_1 = 3$ h	IEC 60068-2-14 [7]	Nb: Change of temperature	3
Humidity	Relative	low (%)	5	none				4
		high (%)	90	93	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5
		condensation	no					
	Absolute	low (g/m <sup>3</sup> )	1	none				4
		high (g/m <sup>3</sup> )	25					6
Radiation	Solar	(W/m <sup>2</sup> )	700					7
	Heat	(W/m <sup>2</sup> )	600					8
<p>NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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). The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5 °C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.</p> <p>NOTE 4: (Relative humidity, low). There is no IEC 60068-2 series test method for this parameter.</p> <p>NOTE 5: (Humidity, relative, high). IEC 60068-2-78 [8] Test Cab shall be used with test values 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 [8] Test Cab.</p> <p>NOTE 7: (Radiation, solar). The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.</p> <p>NOTE 8: (Radiation, heat). The higher test temperature as described in note 2 includes the heating effect.</p>								

## 3.2 Specification T 3.2: Partly temperature-controlled locations

The specification in table 4 and table 5 shall apply 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.

**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	Notes
Air temperature	Low	(°C)	-5	-5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+45	+45 or +55	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	0,5	+25/+55 or +25/+45 0,5	half cycle t <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3
Humidity	Relative	low (%)	5	none	4 d steady state	IEC 60068-2-78 [8]	Cab: Damp heat	4
		high (%)	95	93				5
		condensation (°C) (%)	yes	+30° 90-100	1 cycle	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	6
	Absolute	low (g/m <sup>3</sup> )	1	none				4
		high (g/m <sup>3</sup> )	29					7
Air	Pressure	low (kPa)	70	none				8
		high (kPa)	106	none				8
	Speed	(m/s)	5,0	none				4
Water	Rain	intensity	no					
		low temperature	no					
	Icing & frosting		yes					4
Radiation	Solar	(W/m <sup>2</sup> )	700					9
	Heat	(W/m <sup>2</sup> )	600					10

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	Notes
Chemically active substances	Sulphur	SO <sub>2</sub> (mg/m <sup>3</sup> )	0,3/1,0	none				11
		H <sub>2</sub> S (mg/m <sup>3</sup> )	0,1/0,5	none				11
	Chlorine	salt mist	sea and road salt	none				11
		Cl (mg/m <sup>3</sup> )	0,1/0,3	none				11
		HCl (mg/m <sup>3</sup> )	0,1/0,5	none				11
	Nitrogen	NO <sub>x</sub> (mg/m <sup>3</sup> )	0,5/5,0	none				11
		NH <sub>3</sub> (mg/m <sup>3</sup> )	1,0/3,0	none				11
	Hydrogen fluoride HF	(mg/m <sup>3</sup> )	0,01/0,03	none				11
Ozone O <sub>3</sub>	(mg/m <sup>3</sup> )	0,05/0,1	none				11	
Mechanically active substances	Dust	sedimentation (mg/(m <sup>2</sup> h))	15					12
		suspension (mg/m <sup>3</sup> )	0,4					12
	Sand	(mg/m <sup>3</sup> )	300					12
Flora and fauna	Micro organisms		mould, fungus, etc.	none				13
	Rodents, insects		rodents, etc.	none				13

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	Notes
NOTE 1:	(Air temperature, low).	The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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.						
NOTE 2:	(Air temperature, high).	The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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.						
NOTE 3:	(Air temperature, change).	The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5 °C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.						
NOTE 4:	(Relative humidity, low).	There is no IEC 60068-2 series test method for this parameter.						
NOTE 5:	(Humidity, relative, high).	IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.						
NOTE 6:	(Condensation).	IEC 60068-2-30 [9] Test Db shall be used with test values 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 60068-2-78 [8] Test Cab.						
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:	(Radiation, solar).	The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.						
NOTE 10:	(Radiation, heat).	The higher test temperature as described in note 2 includes the heating effect.						
NOTE 11:	(Chemically active substances).	The characteristic severities are given as mean/maximum values. These severities should be considered when designing the equipment and when choosing components and materials. No test is recommended in the present document.						
NOTE 12:	(Mechanically active substances).	The characteristic severities are much lower than lowest test severity in IEC 60068-2-68 [14] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing components and materials.						
NOTE 13:	(Flora, fauna).	The characteristic severity should be considered when choosing components and materials.						

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	Notes
Vibration	Sinusoidal	velocity (mm/s)	1,5	5	5	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1
		displacement (mm)							
		acceleration (m/s <sup>2</sup> )	2-9	9-200	5-62	62-200			
		frequency range (Hz)							
		axes of vibration			3				
	Random	ASD (m <sup>2</sup> /s <sup>3</sup> )	no	0,02	+12	-12	IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2
		(dB/oct)							
		frequency range (Hz)			5-10	10-50	50-100		
		axes of vibration			3				
Shocks	Shocks	shock spectrum	Type L	half sine			IEC 60068-2-27 [11]	Ea: Shock	3
		duration (ms)	22	11					
		acceleration (m/s <sup>2</sup> )	40	30					
		number of shocks							
		directions of shocks			6				
NOTE 1: (Vibration, sinusoidal). The severities are given as peak values. The characteristic severity given is considered to be too severe for this class. Test severity values are not specified in IEC 60068-2 series. Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test.									
NOTE 2: (Vibration, random). ASD (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test severity values are not specified in IEC 60068-2 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.									
			<b>classes: 3.2/3.3/3.4 (3M3)/3.5 (3M3)</b>		<b>classes: 3.4 (3M5)/3.5 (3M5)</b>				
Acceleration RMS (for information only)			1,06 m/s <sup>2</sup>		1,5 m/s <sup>2</sup>				
NOTE 3: (Shocks). The values for test severity are not specified in IEC 60068-2 series. 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. The equipment function shall be monitored throughout the test.									

### 3.3 Specification T 3.3: Not temperature-controlled locations

The specification in table 6 and table 7 shall apply to weatherprotected or partially weatherprotected locations having neither temperature nor humidity control.

**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	Notes
Air temperature	Low	(°C)	-25	-25	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+55	+55 or +70	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	0,5	-5/+45 0,5	1 cycle t <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3
Humidity	Relative	low (%)	10	none				4
		high (%)	100	93	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5
		condensation (°C)	yes	+30				
	Absolute	low (g/m <sup>3</sup> )	0,5	90-100	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	6
		high (g/m <sup>3</sup> )	29	+30				
Air	Pressure	low (kPa)	70	none				8
		high (kPa)	106	none				8
	Speed	(m/s)	5,0	none				4
Water	Rain	intensity	wind driven					9
		low temperature	no					
	Other sources		dripping water					4
Icing & frosting		yes					4	
Radiation	Solar	(W/m <sup>2</sup> )	1 200					10
	Heat	(W/m <sup>2</sup> )	600					11



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	Notes	
Chemically active substances	Sulphur	SO <sub>2</sub> (mg/m <sup>3</sup> )	0,3/1,0	none				12	
		H <sub>2</sub> S (mg/m <sup>3</sup> )	0,1/0,5	none				12	
	Chlorine	salt mist	sea and road salt	none					12
		Cl (mg/m <sup>3</sup> )	0,1/0,3	none					12
		HCl (mg/m <sup>3</sup> )	0,1/0,5	none					12
	Nitrogen	NO <sub>x</sub> (mg/m <sup>3</sup> )	0,5/1,0	none					12
		NH <sub>3</sub> (mg/m <sup>3</sup> )	1,0/3,0	none					12
	Hydrogen fluoride HF	(mg/m <sup>3</sup> )	0,01/0,03	none					12
Ozone O <sub>3</sub>	(mg/m <sup>3</sup> )	0,05/0,1	none					12	
Mechanically active substances	Dust	sedimentation (mg/(m <sup>2</sup> h))	15						13
		suspension (mg/m <sup>3</sup> )	0,4						13
	Sand	(mg/m <sup>3</sup> )	300						13
Flora and fauna	Micro organisms		mould, fungus, etc.	none					14
	Rodents, insects		rodents, etc.	none					14
<p>NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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). The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5° C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.</p> <p>NOTE 4: (Relative humidity, low). There is no IEC 60068-2 series test method for this parameter.</p> <p>NOTE 5: (Humidity, relative, high). IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.</p> <p>NOTE 6: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test values not higher than climatogram limits for this class.</p> <p>NOTE 7: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [8] Test Cab.</p>									

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	Notes
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). The effect of wind driven rain outside to the equipment in the weatherprotected or partly weatherprotected locations is included in IEC 60068-2-30 [9] Test Db. No test is recommended.								
NOTE 10: (Radiation, solar). The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.								
NOTE 11: (Radiation, heat). The higher test temperature as described in note 2 includes the heating effect.								
NOTE 12: (Chemically active substances). The characteristic severities are given as mean/maximum values. These severities should be considered when designing the equipment and 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 test severity in IEC 60068-2-68 [14] Test L 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 severity should be considered when choosing components and materials.								

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	Notes
Vibration	Sinusoidal	velocity (mm/s)	1,5	5	5-62	3	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1
		displacement (mm)							
		acceleration (m/s <sup>2</sup> )	2-9	9-200					
		frequency range (Hz)							
		axes of vibration				3 x 5 sweep cycles			
	Random	ASD (m <sup>2</sup> /s <sup>3</sup> )	no	0,02	+12	-12	IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2
		(dB/oct)							
		frequency range (Hz)							
		axes of vibration							
Shocks	Shocks	shock spectrum	Type L	half sine			IEC 60068-2-27 [11]	Ea: Shock	3
		duration (ms)	22	11					
		acceleration (m/s <sup>2</sup> )	40	30					
		number of shocks							
		directions of shocks			6	3 in each direction			

NOTE 1: (Vibration, sinusoidal).

The severities are given as peak values. The characteristic severity given is considered to be too severe for this class. Test severity values are not specified in IEC 60068-2 series. Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test.

NOTE 2: (Vibration, random).

ASD (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test severity values are not specified in IEC 60068-2 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.

	classes: 3.2/3.3/3.4 (3M3)/3.5 (3M3)	classes: 3.4 (3M5)/3.5 (3M5)
Acceleration RMS (for information only)	1,06 m/s <sup>2</sup>	1,5 m/s <sup>2</sup>

NOTE 3: (Shocks). Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.

The values for test severity are not specified in IEC 60068-2 series. 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. The equipment function shall be monitored throughout the test.

### 3.4 Specification T 3.4: Sites with heat-trap

The specification in table 8 and table 9 shall apply to weatherprotected or partially weatherprotected locations having neither temperature nor humidity control. Solar radiation and heat-trap conditions may cause high temperatures.

**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	Notes	
Air temperature	Low	(°C)	-40	-40	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1	
	High	(°C)	+70	+70 or +85	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2	
	Change	(°C) (°C/min)	0,5	-5/+45 0,5	2 cycles t <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3	
Humidity	Relative	low (%)	10	none				4	
		high (%)	100	93	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5	
		condensation (°C)	yes	+35					6
	Absolute	low (g/m <sup>3</sup> )	0,1	90-100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1		4
		high (g/m <sup>3</sup> )	35	none					7
Air	Pressure	low (kPa)	70	none				8	
		high (kPa)	106	none				8	
	Speed	(m/s)	5,0	none				4	
Water	Rain	intensity	wind driven					9	
		low temperature	no						
	Other sources		dripping and spraying water					4	
	Icing & frosting		yes					4	
Radiation	Solar	(W/m <sup>2</sup> )	1 200					10	
	Heat	(W/m <sup>2</sup> )	600					11	

Environmental parameter			Environmental Class 3.4	Environmental test specification T3.4: In-use, Sites with heat trap				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Chemically Active substances	Sulphur	SO <sub>2</sub> (mg/m <sup>3</sup> )	0,3/1,0	none				12
		H <sub>2</sub> S (mg/m <sup>3</sup> )	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	none				12
		Cl (mg/m <sup>3</sup> )	0,1/0,3	none				12
		HCl (mg/m <sup>3</sup> )	0,1/0,5	none				12
	Nitrogen	NO <sub>x</sub> (mg/m <sup>3</sup> )	0,5/1,0	none				12
		NH <sub>3</sub> (mg/m <sup>3</sup> )	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m <sup>3</sup> )	0,01/0,03	none				12
Ozone O <sub>3</sub>	(mg/m <sup>3</sup> )	0,05/0,1	none				12	
Chemically active substances	Dust	sedimentation (mg/(m <sup>2</sup> h))	15					13
		suspension (mg/m <sup>3</sup> )	0,4					13
	Sand	(mg/m <sup>3</sup> )	300					13
Flora and fauna	Micro organisms		mould, fungus, etc.	none				14
	Rodents, insects		rodents, etc.	none				14

Environmental parameter			Environmental Class 3.4	Environmental test specification T3.4: In-use, Sites with heat trap				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
NOTE 1:	(Air temperature, low).	The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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.						
NOTE 2:	(Air temperature, high).	The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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.						
NOTE 3:	(Air temperature, change).	The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5 °C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.						
NOTE 4:	(Relative humidity, low).	There is no IEC 60068-2 series test method for this parameter.						
NOTE 5:	(Humidity, relative, high).	IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.						
NOTE 6:	(Condensation).	IEC 60068-2-30 [9] Test Db shall be used with test values 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 60068-2-78 [8] Test Cab.						
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).	The effect of wind driven rain outside to the equipment in the weatherprotected or partly weatherprotected locations is included in IEC 60068-2-30 [9] Test Db. No test is recommended.						
NOTE 10:	(Radiation, solar).	The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.						
NOTE 11:	(Radiation, heat).	The higher test temperature as described in note 2 includes the heating effect.						
NOTE 12:	(Chemically active substances).	The characteristic severities are given as mean/maximum values. These severities should be considered when designing the equipment and 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 test severity in IEC 60068-2-68 [14] Test L 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 severity should be considered when choosing components and materials.						

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: Stationary use, Sites with heat-trap				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Vibration IEC 60721-3-3 [4] Class 3M5	Sinusoidal	displacement (mm) acceleration (m/s <sup>2</sup> ) frequency range (Hz) axes of vibration	3,0 10 2-9 9-200	1,2 4 5-9 9-200 3	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1, 4
	Random	ASD (m <sup>2</sup> /s <sup>3</sup> ) (dB/oct) frequency range (Hz) axes of vibration	no	0,04 +12 -12 5-10 10-50 50-100 3	3 x 30 minutes	IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2, 4
Shocks IEC 60721-3-3 [4] Class 3M5	Shocks	shock spectrum duration (ms) acceleration (m/s <sup>2</sup> ) number of shocks directions of shocks	Type II 6 250	half sine 11 50 6	100 in each direction	IEC 60068-2-27 [11]	Ea: Shocks	3, 4

Environmental parameter			Environmental Class 3.4	Environmental test specification T 3.4: Stationary use, Sites with heat-trap					
Type	Parameter	Detail parameter	Characteristic severity	Test severity		Duration	Reference	Method	Notes
Vibration IEC 60721-3-3 [4] Class 3M3	Sinusoidal	velocity (mm/s)	1,5	5	5	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1, 4
		displacement (mm)							
		acceleration (m/s <sup>2</sup> )	2-9	9-200	5-62	3			
		frequency range (Hz)							
		axes of vibration							
	Random	ASD (m <sup>2</sup> /s <sup>3</sup> )	no	+12	0,02	3 x 30 minutes	IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2, 4
		(dB/oct)							
		frequency range (Hz)		5-10	10-50	3			
		axes of vibration							
Shocks IEC 60721-3-3 [4] Class 3M3	Shocks	shock spectrum	Type L	half sine	3 in each direction		IEC 60068-2-27 [11]	Ea: Shock	3, 4
		duration (ms)							
		acceleration (m/s <sup>2</sup> )	70	30					
		number of shocks							
		directions of shocks							

NOTE 1: (Vibration, sinusoidal).

The severities are given as peak values. The characteristic severity given is considered to be too severe for this class. Test severity values are not specified in IEC 60068-2 series. Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test.

NOTE 2: (Vibration, random).

ASD (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test severity values are not specified in IEC 60068-2 series. The maximum test frequency has been reduced 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.

	classes: 3.2/3.3/3.4 (3M3)/3.5 (3M3)	classes: 3.4 (3M5)/3.5 (3M5)
Acceleration RMS (for information only)	1,06 m/s <sup>2</sup>	1,5 m/s <sup>2</sup>

Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test.

NOTE 3: (Shocks).

The values for test severity are not specified in IEC 60068-2 series. 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. The equipment function shall be monitored throughout the test.

NOTE 4: (Environmental parameter).

In this table two IEC 60721-3-3 [4] classes are given, Class 3M3 may be chosen for equipment 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 IEC 60721-3-3 [4] class 3M5 should be used.



### 3.5 Specification T 3.5: Sheltered locations

The specification in table 10 and table 11 shall apply to sheltered locations where direct solar radiation and heat-trap conditions do not exist.

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

Environmental parameter			Environmental Class 3.5	Environmental test specification T3.5: In-use, Sheltered locations					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes	
Air temperature	Low	(°C)	-40	-40	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1	
	High	(°C)	+40	+40	16 h	IEC 60068-2-2 [6]	Bb/Bd/B3: Dry heat	2	
	Change	(°C) (°C/min)	1,0	-40/+40 1,0	2 cycles $t_1 = 3$ h	IEC 60068-2-14 [7]	Nb: Change of temperature	3	
Humidity	Relative	low (%)	10	none				4	
		high (%)	100	93	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5	
		condensation (°C)	yes	+35					
	Absolute	low (g/m <sup>3</sup> )	0,1	none					4
		high (g/m <sup>3</sup> )	35						7
Air	Pressure	low (kPa)	70	none				8	
		high (kPa)	106	none				8	
	Speed (m/s)	30	none					4	
Water	Rain	intensity	wind driven					9	
		low temperature	no						
	Other sources		dripping and spraying water					9	
	Icing & frosting		yes					4	
Radiation	Solar	(W/m <sup>2</sup> )	no						
	Heat	(W/m <sup>2</sup> )	600	none					

Environmental parameter			Environmental Class 3.5	Environmental test specification T3.5: In-use, Sheltered locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Chemically Active substances	Sulphur	SO <sub>2</sub> (mg/m <sup>3</sup> )	0,3/1,0	none				12
		H <sub>2</sub> S (mg/m <sup>3</sup> )	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	none				12
		Cl (mg/m <sup>3</sup> )	0,1/0,3	none				12
		HCl (mg/m <sup>3</sup> )	0,1/0,5	none				12
	Nitrogen	NO <sub>x</sub> (mg/m <sup>3</sup> )	0,5/1,0	none				12
		NH <sub>3</sub> (mg/m <sup>3</sup> )	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m <sup>3</sup> )	0,01/0,03	none				12
Ozone O <sub>3</sub>	(mg/m <sup>3</sup> )	0,05/0,1	none				12	
Mechanical active substances	Dust	sedimentation (mg/(m <sup>2</sup> h))	15					13
		suspension (mg/m <sup>3</sup> )	0,4					13
	Sand	(mg/m <sup>3</sup> )	300					13
Flora and fauna	Micro organisms		mould, fungus, etc.	none				14
	Rodents, insects		rodents, etc.	none				14

Environmental parameter			Environmental Class 3.5	Environmental test specification T3.5: In-use, Sheltered locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
NOTE 1:	(Air temperature, low).	The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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.						
NOTE 2:	(Air temperature, high).	The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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.						
NOTE 3:	(Air temperature, change).	The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5° C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.						
NOTE 4:	(Relative humidity, low).	There is no IEC 60068-2 series test method for this parameter.						
NOTE 5:	(Humidity, relative, high).	IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.						
NOTE 6:	(Condensation).	IEC 60068-2-30 [9] Test Db shall be used with test values 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 60068-2-78 [8] Test Cab.						
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).	The effect of wind driven rain outside to the equipment in the weatherprotected or partly weatherprotected locations is included in IEC 60068-2-30 [9] Test Db. No test is recommended.						
NOTE 10:	(Radiation, solar).	The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.						
NOTE 11:	(Radiation, heat).	The higher test temperature as described in note 2 includes the heating effect.						
NOTE 12:	(Chemically active substances).	The characteristic severities are given as mean/maximum values. These severities should be considered when designing the equipment and 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 test severity in IEC 60068-2-68 [14] Test L 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 severity should be considered when choosing components and materials.						

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	Notes
Vibration IEC 60721-3-3 [4] Class 3M5	Sinusoidal	displacement (mm)	3,0	1,2			IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1, 4
		acceleration (m/s <sup>2</sup> )	10	4					
		frequency range (Hz)	2-9 9-200	5-9 9-200	3	3 x 5 sweep cycles			
	Random	ASD (m <sup>2</sup> /s <sup>3</sup> ) (dB/oct)	no	0,04			IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2, 4
		frequency range (Hz)		+12 -12					
		axes of vibration		5-10 10-50 50-100	3	3 x 30 minutes			
Shocks IEC 60721-3-3 [4] Class 3M5	Shocks	shock spectrum	Type II	half sine			IEC 60068-2-27 [11]	Ea: Shocks	3, 4
		duration (ms)	6	11					
		acceleration (m/s <sup>2</sup> )	250	50					
		number of shocks		6					
		directions of shocks			6	100 in each direction			

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	Notes
Vibration IEC 60721-3-3 [4] Class 3M3	Sinusoidal	velocity (mm/s) displacement (mm) acceleration (m/s <sup>2</sup> ) frequency range (Hz) axes of vibration	1,5 5 2-9 9-200	5 2 5-62 62-200 3	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1, 4
	Random	ASD (m <sup>2</sup> /s <sup>3</sup> ) (dB/oct) frequency range (Hz) axes of vibration	no	0,02 +12 -12 5-10 10-50 50-100 3	3 x 30 minutes	IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2, 4
Shocks IEC 60721-3-3 [4] Class 3M3	Shocks	shock spectrum duration (ms) acceleration (m/s <sup>2</sup> ) number of shocks directions of shocks	Type L 22 70	half sine 11 30 6	3 in each direction	IEC 60068-2-27 [11]	Ea: Shock	3, 4

NOTE 1: (Vibration, sinusoidal).

The severities are given as peak values. The characteristic severity given is considered to be too severe for this class. Test severity values are not specified in IEC 60068-2 series. Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test.

NOTE 2: (Vibration, random).

ASD (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test severity values are not specified in IEC 60068-2 series. The maximum test frequency has been reduced 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.

	classes: 3.2/3.3/3.4 (3M3)/3.5 (3M3)	classes: 3.4 (3M5)/3.5 (3M5)
Acceleration RMS (for information only)	1,06 m/s <sup>2</sup>	1,5 m/s <sup>2</sup>

Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test.

NOTE 3: (Shocks).

The values for test severity are not specified in IEC 60068-2 series. 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. The equipment function shall be monitored throughout the test.

NOTE 4: (Environmental parameter).

In this table two IEC 60721-3-3 [4] classes are given, Class 3M3 may be chosen for equipment 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 IEC 60721-3-3 [4] class 3M5 should be used.

## 3.6 Specifications T 3.6: Control room locations

### Specification T 3.6: Control room locations - normal operating conditions.

The specification in table 12 and table 13 shall apply to permanently temperature-controlled enclosed locations where humidity is usually not controlled. See table 12.

**Table 12: Test specification T 3.6: Control room locations - climatic tests**

Environmental parameter			Environmental Class 3.6	Environmental test specification T3.6: In-use, Temperature-controlled locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Air temperature	Low	(°C)	+15	+15	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+30	+30 or +40	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	0,5	+25/+30 0,5	half cycle $t_1 = 3$ h	IEC 60068-2-14 [7]	Nb: Change of temperature	3
Humidity	Relative	low (%)	10	none				4
		high (%)	75	85	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5
		condensation	no					
	Absolute	low (g/m <sup>3</sup> )	2	none				4
		high (g/m <sup>3</sup> )	22					7
Air	Pressure	low (kPa)	70	none				8
		high (kPa)	106	none				8
	Speed	(m/s)	5,0	none				4
Water	Rain	intensity	no					
		low temperature	no					
	Other sources		no					
	Icing & frosting		no					
Radiation	Solar	(W/m <sup>2</sup> )	700					10
	Heat	(W/m <sup>2</sup> )	600					11

Environmental parameter			Environmental Class 3.6	Environmental test specification T3.6: In-use, Control room locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Chemically active substances	Sulphur	SO <sub>2</sub> (mg/m <sup>3</sup> )	0,3/1,0	none				12
		H <sub>2</sub> S (mg/m <sup>3</sup> )	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	none				12
		Cl (mg/m <sup>3</sup> )	0,1/0,3	none				12
		HCl (mg/m <sup>3</sup> )	0,1/0,5	none				12
	Nitrogen	NO <sub>x</sub> (mg/m <sup>3</sup> )	0,5/1,0	none				12
		NH <sub>3</sub> (mg/m <sup>3</sup> )	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m <sup>3</sup> )	0,01/0,03	none				12
Ozone O <sub>3</sub>	(mg/m <sup>3</sup> )	0,05/0,1	none				12	
Mechanically active substances	Dust	sedimentation (mg/(m <sup>2</sup> h))	1,5	none				12
		suspension (mg/m <sup>3</sup> )	0,2	none				13
	Sand	(mg/m <sup>3</sup> )	30	none				13
Flora and fauna	Micro organisms		negligible					
	Rodents, insects		negligible					

Environmental parameter			Environmental Class 3.6	Environmental test specification T3.6: In-use, Control room locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
NOTE 1:	(Air temperature, low).							The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If a cold start up test is performed, the characteristic severity should be used as a cold start up 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.
NOTE 2:	(Air temperature, high).							The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). If two test temperatures are given, the lower test temperature applies if the equipment is protected against solar and heat radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar and/or heat radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up 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.
NOTE 3:	(Air temperature, change).							The change of temperature test is normally used to check design tolerance. IEC 60068-2-14 [7] Test Nb shall be used. For change of temperature of 0,5 °C/min, the cooling gradient may be reduced to 0,2 °C/min where test chamber restrictions preclude a gradient of 0,5 °C/min.
NOTE 4:	(Relative humidity, low).							There is no IEC 60068-2 series test method for this parameter.
NOTE 5:	(Humidity, relative, high).							IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.
NOTE 6:	(Condensation).							IEC 60068-2-30 [9] Test Db shall be used with test values 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 60068-2-78 [8] Test Cab.
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).							The effect of wind driven rain outside to the equipment in the weatherprotected or partly weatherprotected locations is included in IEC 60068-2-30 [9] Test Db. No test is recommended.
NOTE 10:	(Radiation, solar).							The higher test temperature as described in note 2 includes the heating effect of solar radiation. Photochemical tests can be made separately for components and materials.
NOTE 11:	(Radiation, heat).							The higher test temperature as described in note 2 includes the heating effect.
NOTE 12:	(Chemically active substances).							The characteristic severities are given as mean/maximum values. These severities should be considered when designing the equipment and 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 test severity in IEC 60068-2-68 [14] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing components and materials.



Table 13: Test specification T 3.6: Control room locations - mechanical tests

Environmental parameter			Environmental Class 3.6	Environmental test specification T 3.6: In-use, Control room locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Vibration	Sinusoidal	displacement (mm) acceleration (m/s <sup>2</sup> ) frequency range (Hz) axes of vibration	0,3  1,0 2-9 9-200	none				1
Shocks	Shocks	shock spectrum duration (ms) acceleration (m/s <sup>2</sup> ) number of shocks direction of shocks	Type L 22 40	half sine 11 30 6	3 in each direction	IEC 60068-2-27 [11]	Ea: Shock	2
<p>NOTE 1: (Vibration, sinusoidal). No test is recommended as the characteristic severities represent insignificant levels of vibration. The severities are given as peak values.</p> <p>NOTE 2: (Shocks). The values for test severity are not specified in IEC 60068-2 series. 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. The equipment function shall be monitored throughout the test.</p>								

## 4 Earthquake test specification

If earthquake conditions are specified by the customer, the earthquake test requirements stated below shall be applied.

The test specification is applicable to classes 3.1 to 3.6.

### 4.1 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 as specified in IEC 60068-2-6 [12] (test Fc), with the following parameter severities:

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

NOTE 1: The vibration amplitude may be reduced to 1 m/s<sup>2</sup> 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:

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

NOTE 2: The Acceleration Spectral Density (ASD) value may be reduced to 0,3 m<sup>2</sup>/s<sup>3</sup> or less in case of sharp resonances.

The time-history stated in table 14 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 9 (class 3.4) or in table 11 (class 3.5) for class 3M5. This test is sufficient to prove compliance with earthquake conditions given in ETSI EN 300 019-1-3 [1].

## 4.2 Test conditioning

See table 14.

The extent to which the equipment under test has to function during tests or merely to survive conditions of test shall be stated in the product specification.

**Table 14: Test specification T 3.1 to T 3.6: Earthquake test**

Environmental parameter			Environmental class 3.x	Environmental test specification T3.x: Earthquake test				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Earthquake	Time-history	RRS	see part 1-3 [1]	figure 1, table 15		IEC 60068-2-57 [13]	Ff: time-history method	(see note)
		frequency range (Hz)	0,3 - 50	1 - 35				
		ZPA (m/s <sup>2</sup> )	15	15				
		axes		3	30 s			
		damping ratio (%)			2			
<p>NOTE: (Earthquake).  RRS (Required Response Spectrum). ZPA (Zero Period Acceleration).  Equipment under test shall be 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 should be included in the test.  Single axis excitation is recommended; 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>								

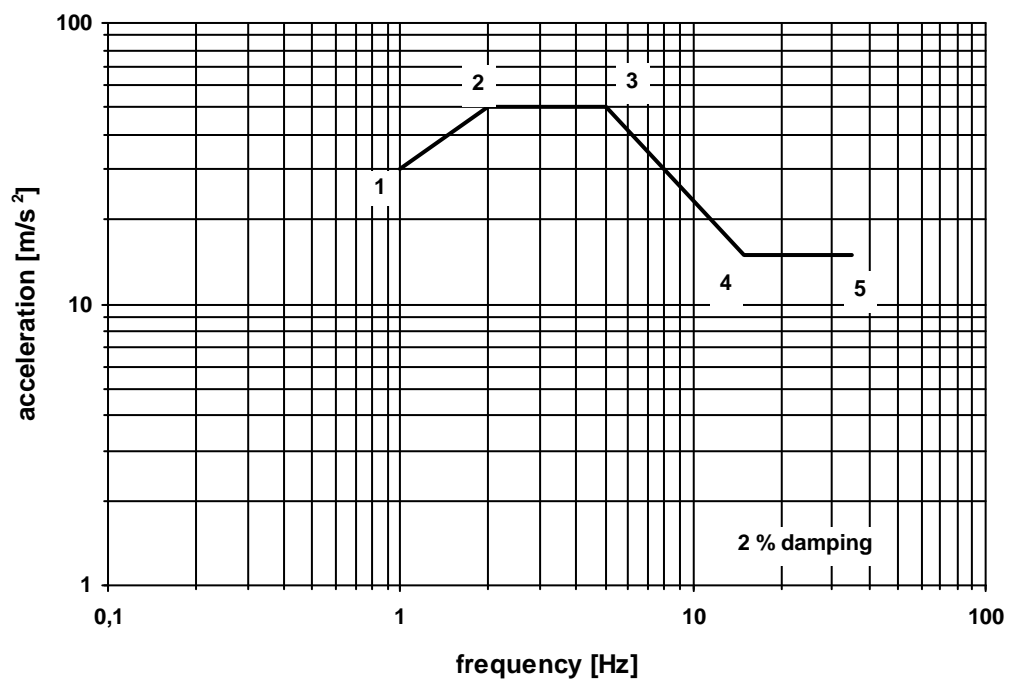


Figure 1: Earthquake Required Response Spectrum

Table 15: Acceleration co-ordinates for the Required Response Spectrum in figure 1

Co-ordinate point	Frequency [Hz]	Values for upper floor acceleration [m/s <sup>2</sup> ]
1	1	30
2	2	50
3	5	50
4	15	15
5	35	15

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## 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

<b>Document history</b>		
Edition 1	May 1994	Publication as ETSI ETS 300 019-2-3
Amendment 1	June 1997	Amendment 1 to 1 <sup>st</sup> Edition of ETSI ETS 300 019-2-3
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