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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].

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

## 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.

## 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].

## 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 <a href="http://docbox.etsi.org/Reference">http://docbox.etsi.org/Reference</a>.

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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".

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#### 2.2 Informative references

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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.

## 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	3.1: Temperature-controlled locations - climatic te	sts

I	Environment	al parameter		Environmental Class 3.1	Environmental test specification T 3.1: In-use, Temperature-controlled locations					
Туре	Parameter	Detail parameter		Characteristic severity	Test severity			Method	Notes	
	Low		(°C)	+5	+5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1	
Airtomporatura	High		(°C)	+40	+40 or +50	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2	
Air temperature	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	
		low	(%)	5	none				4	
	Relative	high	(%) (°C)	85	85 +30	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5	
Humidity		condensation		no						
	Absolute	low	(g/m <sup>2</sup> )	1	none				4	
		high	(g/m <sup>2</sup> )	25					7	
	Pressure	low	(kPa)	70	none				8	
Air	Flessule	high	(kPa)	106	none				8	
	Speed		(m/s)	5,0	none				4	
	Rain	intensity		no						
	IXalli	low temperatur	е	no						
Water	Other sources			no						
	Icing & frosting			no						
	Solar		(W/m <sup>2</sup> )	700					10	
Radiation	Heat		(W/m <sup>2</sup> )	600					11	

	Enviro	Environmental Class 3.1	Environmental test specification T 3.1: In-use, Temperature-controlled locations							
	Туре	Parameter	Detail pa	arameter	Characteristic	Test severity	Duration	Reference	Method	Notes
					severity					
			SO <sub>2</sub>	(mg/m <sup>3</sup> )	0,3/1,0	none				12
		Sulphur	H <sub>2</sub> S	(mg/m <sup>3</sup> )	0,1/0,5	none				12
			salt mist		sea and road salt	none				12
		Chlorine	CI	(mg/m <sup>3</sup> )	0,1/0,3	none				12
Chemicall	y active substances		HCI	(mg/m <sup>3</sup> )	0,1/0,5	none				12
			NO <sub>x</sub>	(mg/m <sup>3</sup> )	0,5/1,0	none				12
		Nitrogen	NH <sub>3</sub>	(mg/m <sup>3</sup> )	1,0/3,0	none				12
		Hydrogen fluoride HF	0	(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
		<u> </u>	sedimentati	· • ·	1,5	none				12
		Dust		(mg/(m <sup>2</sup> h))						
/lechanic	ally active substances		suspension	(mg/m <sup>3</sup> )	0,2	none				13
		Sand	- I	(mg/m <sup>3</sup> )	30	none				13
lora and	fauna	Micro organisms			negligible					
nora anu	laulia	Rodents, insects			negligible					
	specification). If a col class characteristic se achieved. (Air temperature, high The equipment under specification). If two t equipment is ventilate up test is performed, range) by the product (Air temperature, characteristic)	r test shall remain oper test temperatures are g ed (natural or forced). the characteristic seve t specification. In this c inge).	med, the cha roduct special rational throu given, the low The higher te writy should b ase, the high	aracteristic s fication. In th ughout this to ver test temperat e used as a n temperatur	severity should be his case, the cold s est (without any da berature applies if t ure includes the he high start up temp re start up test sha	used as a cold start up test sha mage or deterion the equipment is eating effects of perature, but it n Il commence or	start up temp Il commence pration of pe s protected a solar and/ou nay be modifunce high tem	perature, but it once low tem rformance, acc against solar a r heat radiatior fied (within the perature stabil	may be moo perature sta cording to pro- nd heat radia I. If a high te class chara- ity is achieve	lified (within bility is oduct ation or the mperature s cteristic seve ed.
NOTE 5:	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. (Relative humidity, low). There is no IEC 60068-2 series test method for this parameter. (Humidity, relative, high). IEC 60068-2-78 [8] Test Cab shall be used with test values not higher than climatogram limits for this class.									
	(Condensation). IEC 60068-2-30 [9] T	est Db shall be used w	vith test value	es not highe	r than climatogram	limits for this c	lass.			

# 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.

Envir	onmental parameter		Environmental Class 3.1	Environmental test specification T 3.1: In-use, Temperature-controlled locations					
Туре	Parameter	Detail parameter	Characteristic severity	Test severity Duration Reference Method					
NOTE 9: (Water, rain).	•	-				•	•		
The effect of wind dri	ven rain outside to the	equipment in the weath	erprotected or part	ly weatherprote	cted locatior	ns is included i	n IEC 60068	-2-30 [9] Test	
Db. No test is recom									
NOTE 10: (Radiation, solar).									
The higher test temp components and mat		n note 2 includes the hea	ting effect of solar	radiation. Photo	ochemical te	sts can be ma	de separatel	y for	
NOTE 11: (Radiation, heat).									
The higher test temp	erature as described i	n note 2 includes the hea	iting effect.						
NOTE 12: (Chemically active su	ibstances).								
The characteristic se	verities are given as n	nean/maximum values. T	hese severities sh	ould be conside	red when de	esigning the eq	juipment and	l when	
choosing component	s and materials. No te	st is recommended in the	e present documer	nt.					
NOTE 13: (Mechanically active	substances).								
		er than lowest test severit equipment and when cho			nd therefore	no test is reco	mmended.	This condition	

	Environmenta	al parameter	Environmental Class 3.1	Environmental test specification T 3.1: In-use, Temperature-controlled locations					
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes	
Vibration	Sinusoidal	acceleration $(m/s^2)$	0,3 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	

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.

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Environmental test specification T 3.1E: In-use.

	Environmentai	paramet	CI	Condition 3.1E			e-controlled location			
Туре	Parameter	Detail	parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes	
	Low		(°C)	-5	-5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1	
Air	High		(°C)	+45	+45 or +55	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2	
temperature	e Change		(°C) (°C/min)	0,5	+25/+45 0,5	half cycle t <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3	
		low	(%)	5	none				4	
Humidity	Relative	high	(%) (°C)	90	93 +30	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5	
Humidity		condens	ation	no						
	Absolute	Iow		(g/m <sup>3</sup> )	1	none				4
	Absolute	high	(g/m <sup>3</sup> )	25					6	
	Solar		(W/m <sup>2</sup> )	700					7	
Radiation	Heat		(W/m <sup>2</sup> )	600					8	
T s ti NOTE 2: (/ T	pecification). If the class charact chieved. Air temperature the equipment u	inder test a cold stat teristic sev , high). Inder test	rt up test is per verity range) by shall remain op	formed, the character the product specific perational throughou	eristic severity show cation. In this case it this test (without	uld be used as a the cold start u any damage or	a cold start up tempera p test shall commence deterioration of perfor	mance, according to p ature, but it may be mo e once low temperatur mance, according to p inst solar and heat rac	odified (within e stability is roduct	
s c S NOTE 3: (. T	tart up test is per haracteristic ser tability is achiev Air temperature	erformed, verity rang ed. , change). emperature	the characteris ge) by the prod	tic severity should b	e used as a high s this case, the high	tart up temperat temperature sta	ure, but it may be mod irt up test shall comme	eat radiation. If a high t dified (within the class ence once high tempe d. For change of temp	ature	

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

NOTE 4: (Relative humidity, low). There is no IEC 60068-2 series test method for this parameter.

Environmental 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.

Environmental

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.

#### 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.

#### NOTE 8: (Radiation, heat). The higher test temperature as described in note 2 includes the heating effect.

## 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.

	Environmental	parameter		Environmental Class 3.2			I test specification perature-controlled		
Туре	Parameter	Detail para	ameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
	Low		(°C)	-5	-5	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
Air	High		(°C)	+45	+45 or +55	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
temperature	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
		low	(%)	5	none				4
	Relative	high	(%) (°C)	95	93 +30	4 d steady state	IEC 60068-2-78 [8]	Cab: Damp heat	5
Humidity		condensation	(°C) (%)	yes	+30° 90-100	1 cycle	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	6
		low	(g/m <sup>3</sup> )	1	none				4
	Absolute	high	(g/m <sup>3</sup> )	29					7
	Danasa	low	(kPa)	70	none				8
Air	Pressure	high	(kPa)	106	none				8
	Speed		(m/s)	5,0	none				4
	Rain	intensity		no					
Water		low temperatu	re	no					
vvaler	Other sources			no					
	Icing & frosting			yes					4
Radiation	Solar		(W/m <sup>2</sup> )	700					9
naulation	Heat		(W/m <sup>2</sup> )	600					10

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

	Environmental p	arameter		Environmental Class 3.2	Environmental test specification T 3.2: In-use, Partly temperature-controlled locations					
Туре	Parameter	Detail parameter		Characteristic severity	Test severity	Duration	Reference	Method	Notes	
		SO <sub>2</sub> (mg/m <sup>3</sup> )		0,3/1,0	none				11	
	Sulphur	H <sub>2</sub> S	(mg/m <sup>3</sup> )	0,1/0,5	none				11	
		salt mist		sea and road salt	none				11	
	Chlorine	CI	(mg/m <sup>3</sup> )	0,1/0,3	none				11	
Chemically active		HCI	(mg/m <sup>3</sup> )	0,1/0,5	none				11	
substances	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	
		sedimentation		15					12	
Mechanically	Dust		(mg/(m <sup>2</sup> h))							
active substances		suspension	(mg/m <sup>3</sup> )	0,4					12	
5003101065	Sand		(mg/m <sup>3</sup> )	300					12	
Flora and	Micro organisms	•	- ·	mould, fungus, etc.	none				13	
fauna	Rodents, insects			rodents, etc.	none				13	

	Environmental p	arameter	Environmental Class 3.2	En		est specification rature-controlle		se,
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
NOTE 1:	(Air temperature, low).	est shall remain operatior	al throughout this to	st (without any da	mage or deter	ioration of perfo	mance acco	rding to product
		start up test is performed						
		cteristic severity range) by	y the product specific	ation. In this case	e, the cold start	up test shall co	mmence once	elow
NOTE 2:	temperature stability is (Air temperature, high).							
	The equipment under to	est shall remain operatior						
		st temperatures are given						
	or the equipment is ver	ntilated (natural or forced) st is performed, the chara	). The higher test tem acteristic severity sho	perature includes	high start up te	rects of solar an	d/or neat radi	ation. If a nign dified (within the
		verity range) by the produ						
	temperature stability is							
NOTE 3:	(Air temperature, change	ge). ature test is normally used	d to check design tole	arance JEC 60068	R-2-11 [7] Test	Nh shall ha usa	d For change	of temperature
		ng gradient may be reduc						
NOTE 4:	(Relative humidity, low)	).			•	0	,	
		-2 series test method for	this parameter.					
NOTE 5:	(Humidity, relative, high IEC 60068-2-78 [8] Tes	t). St Cab shall be used with	test values not highe	r than climatogra	m limits for this	class.		
NOTE 6:	(Condensation).		toot valuee not night	r than onnatogra				
		st Db shall be used with te	est values not higher	than climatogram	limits for this	class.		
NOTE 7:	(Humidity, absolute, hig	gn). d to be partly included in	the damp heat test I	=C 60068-2-78 [8	1 Test Cab			
NOTE 8:	(Air pressure, low and h		the damp heat test h	20 00000-2-70 [0	] 1631 040.			
		ed for normal applications	, because the effect of	of air pressure is e	evaluated at th	e component lev	/el.	
NOTE 9:	(Radiation, solar).	ature as described in not	o 2 includes the heati	ng offect of color	radiation Dha	toohomiaal tooto	aan ha mada	apparately for
	components and mater		e z includes the heat	ng ellect of solar			can be made	separately ior
NOTE 10:	(Radiation, heat).							
		ature as described in note	e 2 includes the heati	ng effect.				
NOTE 11:	(Chemically active subs	stances). erities are given as mean/	maximum values. Th	ese severities shr	ould be conside	ered when desid	ining the equi	nment and whe
		and materials. No test is i						
NOTE 12:	(Mechanically active su			<b></b>				
		rities are much lower tha nsidered when designing					test is recom	mended. This
NOTE 13:	(Flora, fauna).	isidered when designing		men choosing cor		ווומוכוומוג.		
		rity should be considered	d when choosing com	ponents and mat	erials.			

	Environme	ental parameter		Environmer Class 3.2					t specification T 3.2 ture-controlled loca		
Туре	Parameter	Detail param	Detail parameter		stic	Test sev	verity	Duration	Reference	Method	Notes
Vibration	Sinusoidal	velocity displacement acceleration frequency range axes of vibration	(mm/s) (mm) (m/s <sup>2</sup> ) (Hz)	1,5 5 2-9 9-		5 5-62 3	2 62-200	3 x 5 sweep cycles		Fc: Vibration (sinusoidal)	1
	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
Shocks	Shocks	shock spectrum duration acceleration number of shocks directions of shock	(ms) (m/s <sup>2</sup> ) s	Type L 22 40		half si 11 30 6	ne	3 in each direction	IEC 60068-2-27 [11	Ea: Shock	3
NOTE 1: NOTE 2:	IEC 60068-2 (Vibration, ra ASD (Accele specified in I	nusoidal). es are given as peal series. Equipment andom). eration Spectral Den	k values. under tes nsity) ranc The max	t shall be mour lom vibration te imum test frequ	nted in esting uency	n the "in use" p method may b has been red	oosition. The used inst	ne equipment functio	or this class. Test sev n shall be monitored al vibration test. The een 100 Hz and 200	throughout the test. test severity values	are not
					es: 3.	.2/3.3/3.4 (3M3	8)/3.5 (3M3	3) classes: 3.4	(3M5)/3.5 (3M5)		
			eration RI formation			1,06 m/s <sup>2</sup>		1,5	m/s <sup>2</sup>		
NOTE 3:	(Shocks). The values f as test sever	or test severity are i ity have been consi	not specif idered mo	ied in IEC 6006 pre appropriate	68-2 s than	series. The sev that given by t	erities are		s. The energy conter	nt and the SRS of th	e shock given

## 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.

	Environmenta	l parameter		Environmental Class 3.3			tal test specification perature-controlled		
Туре	Parameter	Detail para	Detail parameter		Test severity	Duration	Reference	Method	Notes
	Low		(°C)	-25	-25	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
Air	High		(°C)	+55	+55 or +70	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2
temperature			(°C)		-5/+45	1 cycle	IEC 60068-2-14 [7]	Nb: Change of	3
	Change	(°C/min)		0,5	0,5	t <sub>1</sub> = 3 h		temperature	
		low	(%)	10	none				4
	Relative	high	(%) (°C)	100	93 +30	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5
Humidity		condensation	(%) (°C)	yes	90-100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	6
		low	(g/m <sup>3</sup> )	0,5	none				4
	Absolute	high	(g/m <sup>3</sup> )	29					7
	Dessesses	low	(kPa)	70	none				8
Air	Pressure	high	(kPa)	106	none				8
	Speed		(m/s)	5,0	none				4
	Rain	intensity		wind driven					9
Water	Nain	low temperature	e e	no					
vvalei	Other sources			dripping water					4
	Icing & frosting			yes					4
Radiation	Solar		(W/m <sup>2</sup> )	1 200					10
Raulation	Heat		(W/m <sup>2</sup> )	600					11

	Environmental	parameter		Environmental Class 3.3			est specificat ature-controll		
Туре	Parameter	Detail par	ameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
		SO <sub>2</sub> (mg/m <sup>3</sup> )		0,3/1,0	none				12
	Sulphur	H <sub>2</sub> S	(mg/m <sup>3</sup> )	0,1/0,5	none				12
		salt mist		sea and road salt	none				12
	Chlorine	CI	(mg/m <sup>3</sup> )	0,1/0,3	none				12
Chemically		HCI	(mg/m <sup>3</sup> )	0,1/0,5	none				12
active substances	• •••	NO <sub>x</sub>	(mg/m <sup>3</sup> )	0,5/1,0	none				12
	INITROAPD	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	Dust	sedimentation	(mg/(m <sup>2</sup> h))	15					13
active	Dust	suspension	(mg/m <sup>3</sup> )	0,4					13
substances	Sand		(mg/m <sup>3</sup> )	300					13
Flora and	Micro organisms	•	( <b>0</b> /	mould, fungus, etc.	none				14
fauna	Rodents, insects			rodents, etc.	none				14
The spe (with tem NOTE 2: (Air	cification). If a cold s hin the class charac perature stability is temperature, high).	start up test is p teristic severity achieved.	erformed, the range) by the	proughout this test (with characteristic severity product specification. I	should be used a n this case, the	as a cold sta cold start up	rt up temperat test shall com	ure, but it ma mence once	y be modified low
spe or tl tem clas	cification). If two tes ne equipment is ven perature start up tes	t temperatures a tilated (natural c st is performed, erity range) by t	are given, the or forced). The the character	nroughout this test (with lower test temperature e higher test temperatu istic severity should be pecification. In this case	applies if the ec re includes the h used as a high s	uipment is p eating effect start up temp	protected agair ts of solar and perature, but it	nst solar and I /or heat radia may be modi	neat radiation tion. If a high fied (within th

#### 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.

		Environmental	parameter	Environmental Class 3.3	Environmental test specification T 3.3: In-use, Not temperature-controlled locations						
Туре	•	Parameter	Detail parameter	Characteristic	Test severity	Duration	Reference	Method	Notes		
				severity							
NOTE 8:	(Air pr	essure, low and h	nigh).								
	No tes	st is recommende	d for normal applications, be	cause the effect of air p	ressure is evalua	ated at the c	omponent leve	el.			
NOTE 9:	(Wate	r, rain).									
	The ef	ffect of wind drive	n rain outside to the equipme	ent in the weatherprote	cted or partly wea	atherprotecte	ed locations is	included in			
	IEC 60	0068-2-30 [9] Tes	t Db. No test is recommende	ed.		-					
NOTE 10:		ation, solar).									
	The hi	igher test tempera	ature as described in note 2 i	ncludes the heating eff	ect of solar radiat	tion. Photocl	hemical tests of	an be made s	separately for		
	compo	onents and materi	als.	C C							
NOTE 11:	: (Radia	ation, heat).									
	The hi	igher test tempera	ature as described in note 2 i	ncludes the heating eff	ect.						
NOTE 12:	: (Cherr	nically active subs	stances).	C C							
	The ch	haracteristic seve	rities are given as mean/max	kimum values. These se	everities should b	e considere	d when design	ing the equip	ment and		
	when	choosing compon	ents and materials. No test i	s recommended in the	present documer	nt.	C C	• • •			
NOTE 13:		anically active su			•						
	The ch	haracteristic seve	rities are much lower than lo	west test severity in IEC	C 60068-2-68 [14	] Test L and	therefore no t	est is recomm	ended. This		
			sidered when designing the								
NOTE 14:			0 0								
	<u>`</u>	haracteristic seve									

Parameter	Detail paramete velocity		Ch	aracteristic	Т	est sev	erity	Duration	Reference	Method	Notes
	velocity			severity						metriou	Notes
Sinusoidal	displacement acceleration frequency range axes of vibration	(m/s <sup>2</sup> )	1,5 2-9	5 9-200	5 5-62	3		3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1
Random	ASD frequency range axes of vibration	(m <sup>2</sup> /s <sup>3</sup> ) (dB/oct) (Hz)		no	+12 5-10		-12	3 x 30 minutes	IEC 60068-2-64 [10]	Fh: Vibration, broad-band random (digital control)	2
Shocks	number of shocks	S Í		Type L 22 40		half sin 11 30 6	ne	3 in each direction	IEC 60068-2-27 [11]	Ea: Shock	3
e severities are C 60068-2 serie ibration, randon SD (Acceleration IEC 60068-2 se	e given as peak va es. Equipment unc n). n Spectral Density eries. The maximu	ler test sl ) random m test fre	hall be n vibrat equenc	mounted in the ion testing meth by has been red	"in use" nod may	position be used	h. The equi	pment function shall f the sinusoidal vibra	be monitored throug tion test. The test se	hout the test. verity values are r	ot specifi
				classes: 3.2/3	3.3/3.4 (3	BM3)/3.5	(3M3)	classes: 3.4 (3M5	)/3.5 (3M5)		
				1	l,06 m/s	2		1,5 m/s <sup>2</sup>	2		
	Shocks bration, sinuso e severities are C 60068-2 serie bration, randor D (Acceleration EC 60068-2 se d high frequence	axes of vibration         ASD         Random       frequency range axes of vibration         shock spectrum duration         Shocks       acceleration number of shocks directions of shock directions of shock         bration, sinusoidal).       e severities are given as peak valobot component uncobration, random).         D (Acceleration Spectral Density EC 60068-2 series. The maximu d high frequency ends the ASD is         Acceleration         Acceleration	axes of vibration         ASD       (m²/s³) (dB/oct)         frequency range (Hz) axes of vibration         shock spectrum duration       (ms) acceleration (m/s²) number of shocks         bration, sinusoidal).         e severities are given as peak values. The C 60068-2 series. Equipment under test s bration, random).         D (Acceleration Spectral Density) random EC 60068-2 series. The maximum test fred high frequency ends the ASD is reduced         Acceleration RM (for information of the test of test of the test of test of the test of test o	axes of vibration         ASD       (m²/s³) (dB/oct)         frequency range (Hz) axes of vibration         shock spectrum duration       (ms) acceleration         Shocks       acceleration (m/s²) number of shocks directions of shocks         bration, sinusoidal).       as peak values. The chara C 60068-2 series. Equipment under test shall be bration, random).         D (Acceleration Spectral Density) random vibrat EC 60068-2 series. The maximum test frequence d high frequency ends the ASD is reduced by 12         Acceleration RMS (for information only)	axes of vibration         ASD       (m²/s³) (dB/oct)         frequency range (Hz) axes of vibration       no         Shock spectrum       Type L         duration       (ms)       22         Shocks       acceleration       (m/s²)         bration, sinusoidal).       acceleration speak values. The characteristic severit         bration, sinusoidal).       acceleration speak values. The characteristic severit         bration, sinusoidal).       bration, random).         D (Acceleration Spectral Density) random vibration testing mether         EC 60068-2 series. The maximum test frequency has been red         d high frequency ends the ASD is reduced by 12 dB/oct.         Classes: 3.2/3         Acceleration RMS         (for information only)	axes of vibration       ASD       (m²/s³) (dB/oct)       no       +12 5-10         Random       frequency range (Hz) axes of vibration       no       +12 5-10         Shock spectrum       Type L duration       (ms)       22 40         Shocks       acceleration       (m/s²)       40         bration, sinusoidal).       e severities are given as peak values. The characteristic severity given i C 60068-2 series. Equipment under test shall be mounted in the "in use" bration, random).       D (Acceleration Spectral Density) random vibration testing method may EC 60068-2 series. The maximum test frequency has been reduced to d high frequency ends the ASD is reduced by 12 dB/oct.         Classes: 3.2/3.3/3.4 (3 (for information only)       1,06 m/s	axes of vibration3ASD(m²/s³)no0,02(dB/oct)+125-1010-50frequency range (Hz)5-1010-50axes of vibration33shock spectrumType Lhalf siduration(ms)2211duration(ms²)4030number of shocks66bration, sinusoidal).e severities are given as peak values. The characteristic severity given is conside6celeration sinusoidal).e severities are given as peak values. The characteristic severity given is conside6D (Acceleration Spectral Density) random vibration testing method may be usedEC 60068-2 series. The maximum test frequency has been reduced to 100 Hz, d high frequency ends the ASD is reduced by 12 dB/oct.1,06 m/s²Acceleration RMS (for information only)1,06 m/s²1,06 m/s²	axes of vibration3ASD(m²/s³)no0,02frequency range (Hz)5-1010-5050-100axes of vibration33shock spectrumType Lhalf sineduration(ms)2211acceleration(m/s²)4030number of shocks66bration, sinusoidal).e severities are given as peak values. The characteristic severity given is considered to bec 60068-2 series. Equipment under test shall be mounted in the "in use" position. The equiporation, random).D (Acceleration Spectral Density) random vibration testing method may be used instead ofEC 60068-2 series. The maximum test frequency has been reduced to 100 Hz, because bd high frequency ends the ASD is reduced by 12 dB/oct.Acceleration RMS (for information only)1,06 m/s²	axes of vibration       3       cycles         ASD       (m²/s³) (dB/oct)       no       0,02         frequency range (Hz) axes of vibration       5-10       10-50       50-100         shock spectrum duration       Type L       half sine duration       3         shock spectrum duration       Type L       half sine duration       3         shock spectrum duration       (ms)       22       11         Shocks       acceleration       (m/s²)       40       30         number of shocks directions of shocks       6       3       in each direction         bration, sinusoidal).       e severities are given as peak values. The characteristic severity given is considered to be too severe for this or C 60068-2 series. Equipment under test shall be mounted in the "in use" position. The equipment function shall bration, random).         D (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibra EC 60068-2 series. The maximum test frequency has been reduced to 100 Hz, because between 100 Hz and d high frequency ends the ASD is reduced by 12 dB/oct.         Image: Acceleration RMS (for information only)       1,06 m/s²       1,5 m/s²	axes of vibration       3       cycles         ASD       (m²/s³) (dB/oct)       no       0,02         frequency range (Hz) axes of vibration       5-10       10-50       50-100       3 x 30 minutes         Shock spectrum       Type L       half sine duration       is hock spectrum       IEC 60068-2-27 [11]         Shocks       acceleration       (ms²) number of shocks       40       30       3 in each direction         Shocks       acceleration       (ms²) number of shocks       6       3 in each direction         bration, sinusoidal).       e severities are given as peak values. The characteristic severity given is considered to be too severe for this class. Test severity values to acceleration random).         D (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test se         EC 60068-2 series. The maximum test frequency has been reduced to 100 Hz, because between 100 Hz and 200 Hz the contribution test.         b 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/s²       1,5 m/s²	axes of vibration       3       cycles         ASD       (m²/s³) (dB/oct)       no       0,02         frequency range (Hz)       5-10       10-50       50-100         axes of vibration       3       x 30 minutes         shock spectrum       Type L       half sine         duration       (m/s²)       40         acceleration       (m/s²)       40         number of shocks       6         bration, sinusoidal).       eseverities are given as peak values. The characteristic severity given is considered to be too severe for this class. Test severity values are not spec         Co068-2 series. Equipment under test shall be mounted in the "in use" position. The equipment function shall be monitored throughout the test. bration, random).         D (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test severity values are not spec         EC 60068-2 series. The maximum test frequency has been reduced to 100 Hz, because between 100 Hz and 200 Hz the contribution is insignificant.         bration frequency ends the ASD is reduced by 12 dB/oct.

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.

	Environmental	l parameter		Environmental Class 3.4	Environmental test specification T 3.4: In-use, Sites with heat trap							
Туре	Parameter	Detail parameter		Characteristic severity	Test severity	Duration	Reference	Method	Notes			
	Low		(°C)	-40	-40	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1			
Air	High		(°C)	+70	+70 or +85	16 h	IEC 60068-2-2 [6]	Bb/Bd/Be: Dry heat	2			
emperature	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			
	Relative	low	(%)	10	none				4			
		high	(%) (°C)	100	93 +35	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5			
Humidity		condensation	(%) (°C)	yes	90-100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	6			
	Absolute	low	(g/m <sup>3</sup> )	0,1	none				4			
		high	(g/m <sup>3</sup> )	35					7			
	-	low	(kPa)	70	none				8			
Air	Pressure	high	(kPa)	106	none				8			
	Speed		(m/s)	5,0	none				4			
	Rain	intensity		wind driven					9			
	Naill	low temperature		no								
Water	Other sources			dripping and spraying water					4			
	Icing & frosting			yes					4			
Dediction	Solar		(W/m <sup>2</sup> )	1 200					10			
Radiation	Heat		(W/m <sup>2</sup> )	600					11			

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

	Environmental pa	arameter		Environmental Class 3.4	Environmental test specification T3.4: In-use, Sites with heat trap						
Туре	Parameter	Detail	parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes		
		SO <sub>2</sub> (mg/m <sup>3</sup> )		0,3/1,0	none				12		
	Sulphur	H <sub>2</sub> S	(mg/m <sup>3</sup> )	0,1/0,5	none				12		
		salt mist		sea and road salt	none				12		
Chemically Active	Chlorine	CI	(mg/m <sup>3</sup> )	0,1/0,3	none				12		
		HCI	(mg/m <sup>3</sup> )	0,1/0,5	none				12		
substances	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		
		sedimenta	tion	15					13		
Chemically	Dust		(mg/(m <sup>2</sup> h))								
active substances		suspensio		0,4					13		
3003101063	Sand		(mg/m <sup>3</sup> )	300					13		
Flora and	Micro organisms	•	· • •	mould, fungus, etc.	none				14		
fauna	Rodents, insects			rodents, etc.	none				14		

	Environmental pa	rameter	Environmental Class 3.4	Envi		test specificat tes with heat t		-use,
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
	specification). If a cold sta	t shall remain operational art up test is performed, th ristic severity range) by th	ne characteristic severity	/ should be used	l as a cold st	art up tempera	ture, but it m	nay be modified
NOTE 2:	(Air temperature, high). The equipment under tes specification). If two test t or the equipment is ventil temperature start up test	t shall remain operational temperatures are given, th ated (natural or forced). T is performed, the charact ity range) by the product	ne lower test temperatur he higher test temperat eristic severity should b	e applies if the e ure includes the e used as a high	equipment is heating effe start up tem	protected agai cts of solar and perature, but it	nst solar and d/or heat radi may be mo	d heat radiation iation. If a high dified (within the
NOTE 3:	(Air temperature, change) The change of temperatu							
NOTE 4:	(Relative humidity, low).	series test method for this			·	0		
NOTE 5:	(Humidity, relative, high).	Cab shall be used with tes		n climatogram lim	nits for this c	lass.		
NOTE 6:	(Condensation).	Db shall be used with test	· ·	C C				
NOTE 7:	(Humidity, absolute, high)		Ũ	0				
NOTE 8:	(Air pressure, low and hig					component leve	el.	
NOTE 9:	(Water, rain). The effect of wind driven	rain outside to the equipn Db. No test is recommend	nent in the weatherprote					
NOTE 10:	(Radiation, solar).	ure as described in note 2		fect of solar radia	ation. Photoc	chemical tests	can be made	e separately for
NOTE 11:	(Radiation, heat).	ure as described in note 2	includes the heating ef	fect.				
NOTE 12:	(Chemically active substa The characteristic severit when choosing component	ances). ies are given as mean/ma nts and materials. No test	aximum values. These s	everities should		ed when desigr	ning the equi	pment and
	condition should be consi	stances). ies are much lower than le idered when designing the					test is recom	mended. This
	(Flora, fauna). The characteristic severit	y should be considered w	hen choosing compone	nts and materials	3.			

Env	vironmental	parameter			ironmental lass 3.4	Environmental test specification T 3.4: Stationary use, Sites with heat-trap							
Туре	Parameter	Detail paran	neter		Characteristic severity				Duration	Reference	Method	Notes	
Vibration IEC 60721-3-3 [4] Class 3M5	Sinusoidal	displacement acceleration frequency range axes of vibration	(m/s <sup>2</sup> ) (Hz)	3,0 2-9	10 9-200	1,2 5-9	3	4 9-200	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1, 4	
		ASD frequency range axes of vibration	· · ·		no	+12 5-10	0,04 10-50 3	-12 50-100	3 x 30 minutes		Fh: Vibration, broad-band random (digital control)	2, 4	
Shocks IEC 60721-3-3 [4] Class 3M5	Shocks	shock spectrum duration acceleration number of shock directions of shock			Type II 6 250		half sir 11 50 6	ne	100 in each direction	IEC 60068-2-27 [11]	Ea: Shocks	3, 4	

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

	Environmental	parameter	Environmental Class 3.4	Env		cification T 3.4: Station T 3.4: Station	onary use,	
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Vibration IEC 60721-3-3 Class 3M3	[4] 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 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 Class 3M3	[4] 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
IEC NOTE 2: (Vib ASI IEC	60068-2 series. oration, random). D (Acceleration S 60068-2 series.	ven as peak values. The cl Equipment under test shal Spectral Density) random vi The maximum test frequer low and high frequency en	l be mounted in the bration testing meth ncy has been reduce	"in use" position. The equ od may be used instead c ed has been reduced to 10	ipment function shall	be monitored through tion test. The test seve	out the test. erity values are no	t specified in
	_		classes: 3.2/	3.3/3.4 (3M3)/3.5 (3M3)	classes: 3.	4 (3M5)/3.5 (3M5)		
		cceleration RMS or information only)	1,06 m/s <sup>2</sup> 1,5 m/s <sup>2</sup>					
NOTE 3: (Shu The test Equ NOTE 4: (En In th equ	ocks). values for test s severity have be ipment under tes vironmental para his table two IEC ivalent to those g	st shall be mounted in the " everity are not specified in een considered more appro- st shall be mounted in the " meter). 60721-3-3 [4] classes are given for partly and not tem ass 3M5 should be used.	IEC 60068-2 series priate than that give in use" position. The given, Class 3M3 m	. The severities are given on by the characteristic se e equipment function shall ay be chosen for equipme	as peak values. The verity. be monitored throug ent to be installed in l	energy content and th hout the test. ocations where the me	echanical condition	s are

## 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.

	Environmental p	arameter		Environmental Class 3.5	Environmental test specification T3.5: In-use, Sheltered locations						
Туре	Parameter	Detail	parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes		
	Low		(°C)	-40	-40	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1		
Air	High		(°C)	+40	+40	16 h	IEC 60068-2-2 [6]	Bb/Bd/B3: Dry heat	2		
temperature	Change		(°C) (°C/min)	1,0	-40/+40 1,0	2 cycles t <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3		
		low	(%)	10	none				4		
	Relative	high	(%) (°C)	100	93 +35	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5		
Humidity		condensa	(%) (°C)	yes	90-100 +35	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	6		
	Absolute	low	(g/m <sup>3</sup> )	0,1	none				4		
		high	(g/m <sup>3</sup> )	35					7		
	Pressure	low	(kPa)	70	none				8		
Air		high	(kPa)	106	none				8		
	Speed		(m/s)	30	none				4		
	Rain	intensity		wind driven					9		
		low tempe	erature	no							
Water	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						

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

	Environmental pa	arameter		Environmental Class 3.5	Environmental test specification T3.5: In-use, Sheltered locations						
Туре	Parameter	Detail	parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes		
	0.1.1	SO2	(mg/m <sup>3</sup> )	0,3/1,0	none				12		
	Sulphur	H <sub>2</sub> S (mg/m <sup>3</sup> )		0,1/0,5	none				12		
		salt mist		sea and road salt	none				12		
	Chlorine	CI	(mg/m <sup>3</sup> )	0,1/0,3	none				12		
Chemically Active substances		HCI	(mg/m <sup>3</sup> )	0,1/0,5	none				12		
		NO <sub>x</sub>	(mg/m <sup>3</sup> )	0,5/1,0	none				12		
	Nitrogen	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	Dust	sedimenta		15					13		
active substances		suspensio	n (mg/m <sup>3</sup> )	0,4					13		
Substances	Sand			300					13		
Flora and	Micro organisms			mould, fungus, etc.	none				14		
fauna	Rodents, insects			rodents, etc.	none				14		

	Environmental pa	rameter	Environmental Class 3.5	En		test specificat heltered locati		use,		
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes		
	specification). If a cold sta	t shall remain operational art up test is performed, th ristic severity range) by the	ne characteristic sev	verity should be u	used as a cold	d start up tempe	erature, but it	may be modified		
NOTE 2:	(Air temperature, high). The equipment under tes specification). If two test or the equipment is ventil temperature start up test the class characteristic se	t shall remain operational temperatures are given, th ated (natural or forced). T is performed, the charact everity range) by the prod	ne lower test temper The higher test temp eristic severity shou	rature applies if t erature includes Id be used as a l	the equipment the heating e high start up t	t is protected ag ffects of solar a emperature, bu	gainst solar a and/or heat ra it it may be m	nd heat radiation diation. If a high odified (within		
NOTE 3:	emperature stability is achieved. 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 emperature 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).			than climatograr	n limits for thi	s class.				
NOTE 6:	(Condensation).	Db shall be used with test	Ũ	0						
NOTE 7:	(Humidity, absolute, high)		C C	C C						
NOTE 8:	(Air pressure, low and hig					ne component l	evel.			
NOTE 9:	(Water, rain). The effect of wind driven	rain outside to the equipn Db. No test is recommend	nent in the weatherp	·		·		ſ		
NOTE 10:	(Radiation, solar).	ure as described in note 2		g effect of solar	radiation. Pho	otochemical tes	ts can be mad	de separately for		
NOTE 11:	(Radiation, heat).	ure as described in note 2	includes the heatin	a effect.						
NOTE 12:	2: (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.									
	3: (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.									
	(Flora, fauna). The characteristic severit	y should be considered w	hen choosing comp	onents and mate	erials.					

Env	vironmenta	l parameter		Environmenta Class 3.5	Environmental test specification T 3.5: In-use, Sheltered locations						
Туре	Parameter	Detail param	eter	Characteristic severity	Т	est sev	erity	Duration	Reference	Method	Notes
Vibration IEC 60721-3-3 [4] Class 3M5	Sinusolual	displacement acceleration frequency range axes of vibration	(m/s <sup>2</sup> )	3,0 10 2-9 9-200	1,2 0 5-9	3	4 9-200	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1, 4
		ASD frequency range axes of vibration	(m <sup>2</sup> /s <sup>3</sup> ) (dB/oct) (Hz)	no	+12 5-10	0,04 10-50 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 acceleration number of shocks directions of shock		Type II 6 250		half sir 11 50 6	ne	100 in each direction		Ea: Shocks	3, 4

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

E	nvironmenta	l parameter		Environmental Class 3.5						
Туре	Parameter	Detail parame	eter	Characteristic severity	Test severity	Duration	Reference	Method	Notes	
Vibration IEC 60721-3-3 [4 Class 3M3	] Sinusoidal	velocity displacement acceleration frequency range axes of vibration	(mm/s) (mm) (m/s <sup>2</sup> ) (Hz)	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 (dB/oct) frequency range axes of vibration	(m <sup>2</sup> /s <sup>3</sup> ) (Hz)	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	shock spectrum Type duration (ms) 22				half sine 11 30 6	3 in each direction	IEC 60068-2-27 [11]	Ea: Shock	3, 4	
The se IEC 60 NOTE 2: (Vibrat ASD (/ IEC 60	068-2 series. ion, random). Acceleration S 068-2 series.	ven as peak values Equipment under te pectral Density) ran	est shall b ndom vibr frequenc	be mounted in the ration testing met by has been reduc	ty given is considered t e "in use" position. The hod may be used inste- ced has been reduced t iced by 12 dB/oct.	equipment function s ad of the sinusoidal v	hall be monitored throu ibration test. The test s	ughout the test.	not specified in	
				classes: 3.2	/3.3/3.4 (3M3)/3.5 (3M3	3) classes	: 3.4 (3M5)/3.5 (3M5)			
	Acceleration RMS 1,06 m/s <sup>2</sup> 1,5 m/s <sup>2</sup>									
NOTE 3: (Shock The va test se Equipr NOTE 4: (Enviro In this equiva	ts). Iues for test s verity have be nent under tes onmental para table two IEC lent to those g	everity are not spec een considered more st shall be mounted meter). 60721-3-3 [4] class	ified in IE e appropri in the "in es are gi not tempo	EC 60068-2 series riate than that giv use" position. Th ven, Class 3M3 n	ne equipment function s s. The severities are given by the characteristic ne equipment function s nay be chosen for equit locations or where the	ven as peak values. T c severity. shall be monitored thr pment to be installed	The energy content and oughout the test. in locations where the	mechanical condition	ons are	

## 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.

	Environmental	oarameter		Environmental Class 3.6	Environmental test specification T3.6: In-use, Temperature-controlled locations						
Туре	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 <sub>1</sub> = 3 h	IEC 60068-2-14 [7]	Nb: Change of temperature	3		
Humidity	Relative	low	(%)	10	none				4		
		high	(%) (°C)	75	85 +30	4 d	IEC 60068-2-78 [8]	Cab: Damp heat steady state	5		
		condensa	tion	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 tempe	erature	no							
	Other sources			no							
	Icing & frosting			no							
Radiation	Solar		(W/m <sup>2</sup> )	700					10		
	Heat		(W/m <sup>2</sup> )	600					11		

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

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	Environmenta	l parameter		Environmental Class 3.6	Environmental test specification T3.6: In-use, Control room locations						
Туре	Parameter	Detail pa	rameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes		
Chemically	Sulphur	SO <sub>2</sub>	(mg/m <sup>3</sup> )	0,3/1,0	none				12		
active substances		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		
		CI	(mg/m <sup>3</sup> )	0,1/0,3	none				12		
		HCI	(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	Dust	sedimentation	0	1,5	none				12		
substances		suspension	(mg/m <sup>3</sup> )	0,2	none				13		
	Sand		(mg/m <sup>3</sup> )	30	none				13		
Flora and	Micro organisms	6		negligible							
fauna	Rodents, insects	6		negligible							

	Environmental	parameter	Environmental Class 3.6	Enviro	onmental test Control	specification room locati		use,
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference		Notes
NOTE 1:	(Air temperature, low).			·				
		test shall remain operational						
		If a cold start up test is perfe						
		ass characteristic severity ra	inge) by the product spe	cification. In this c	ase, the cold s	start up test s	hall comme	ence once low
	temperature stability is							
NOTE 2:	(Air temperature, high)							
		test shall remain operational						
		If two test temperatures are						
		nent is ventilated (natural or						
		start up test is performed, the						
		cteristic severity range) by t	he product specification	. In this case, the h	nigh temperatu	ure start up te	est shall cor	nmence once
	high temperature stabi							
NOTE 3:	(Air temperature, chan							
		ature test is normally used to						
		min, the cooling gradient ma	ay be reduced to 0,2 °C/	min where test cha	amber restricti	ons preclude	a gradient	of 0,5 °C/min.
NOTE 4:	(Relative humidity, low							
	There is no IEC 60068	3-2 series test method for thi	s parameter.					
	(Humidity, relative, hig				<i>.</i>			
		est Cab shall be used with te	st values not nigher tha	n climatogram limit	is for this class	5.		
	(Condensation).	at Dhiahall ha waad with taa			for this aloos			
		est Db shall be used with tes	t values not nigher than	climatogram limits	for this class.			
NOTE 7:	(Humidity, absolute, hi	ign). ed to be partly included in th	a damp boot toot IEC G	060 2 70 [0] Toot	Cab			
	(Air pressure, low and				Cab.			
		ed for normal applications, b	acquire the offect of air	prossuro is ovalua	tod at the con	nonont loval		
	(Water, rain).	eu loi normai applications, c		pressure is evalua	lieu al line con	iponent level	•	
		en rain outside to the equipr	ment in the weathernrot	acted or partly wea	thernrotected	locations is i	ncluded in	
		est Db. No test is recommend		cied of parity wea	lineipiolecieu	1002110113 13 1		
	(Radiation, solar).							
		rature as described in note 2	2 includes the heating et	fect of solar radiat	ion Photoche	mical tests ca	an he made	separately for
	components and mate							
	(Radiation, heat).							
		rature as described in note 2	2 includes the heating ef	fect.				
NOTE 12:	(Chemically active sub		<b>J</b>					
		erities are given as mean/ma	aximum values. These s	everities should be	e considered v	when desiani	ng the eaui	pment and
		onents and materials. No tes				5	5 11	•
NOTE 13:	(Mechanically active si							
		erities are much lower than I	lowest test severity in IE	C 60068-2-68 [14]	Test L and th	erefore no te	st is recom	mended. This
		onsidered when designing th						

	Environmer	ntal parameter			onmental Iss 3.6	Environmental test specification T 3.6: In-use, Control room locations						
Туре	Parameter	Detail paramete	r	Characteristic severity		Test severity	Duration	Reference	Method	Notes		
Vibration	Sinusoidal	displacement acceleration frequency range axes of vibration	(mm) (m/s <sup>2</sup> ) (Hz)	0,3 2-9	1,0 9-200	none				1		
Shocks	Shocks	shock spectrum duration acceleration number of shocks direction of shocks	(ms) (m/s <sup>2</sup> )	T	ype L 22 40	half sine 11 30 6	3 in each direction	IEC 60068-2-27 [11]	Ea: Shock	2		
NOTE 2: (	Shocks). The values for te	nended as the chara	ecified in	IEC 60068	-2 series. The	e severities are gi	ven as peak values.	ies are given as peak The energy content a		the shocl		

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

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.

## 4 Earthquake test specification

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

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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:

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

NOTE 1: The vibration amplitude may be reduced to  $1 \text{ m/s}^2$  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 <sup>2</sup> /s <sup>3</sup>	-3 dB/octave
Duration:	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.

Environmental parameter		Environmental class 3.x	Environmental test specification T3.x: Earthquake test					
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Earthquake T	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				
ŘI Ed	quipment unde	Response Spectrum). er test shall be mounted fluence of connections ng structure of the spec	d in the "in use" po , piping, cables, e	osition. The testing tc. shall be taken i	nto accoun			

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.

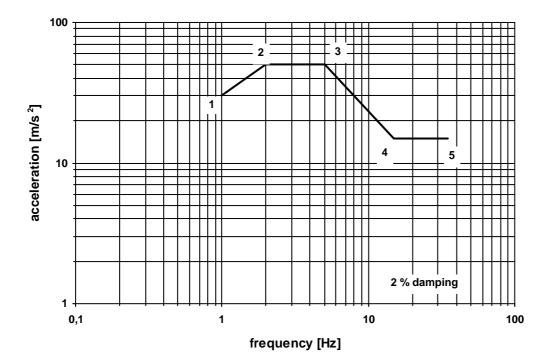


Figure 1: Earthquake Required Response Spectrum

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

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

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

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## History

Document history				
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		
Amendment 2	May 1998	Amendment 2 to 1st Edition of ETSI ETS 300 019-2-3		
V2.1.2	September 1999	Publication		
V2.2.1	March 2003	Publication		
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