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European Standard (Telecommunications series)

**Equipment Engineering (EE);
Environmental conditions and environmental tests for
telecommunications equipment;
Part 2-8: Specification of environmental tests;
Stationary use at underground locations**



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Foreword

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

The present document consists of 2 parts as follows:

Part 1: "Classification of environmental conditions".

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

Part 2: "Specification of environmental tests".

NOTE 2: Specifies the recommended test severities and test methods for the different environmental classes.

Each part of the standard is divided into sub-parts. Sub-part 2-0 forms a general overview of Part 2.

This sub-part 2-8 deals with stationary use at underground locations.

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

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 sub-part 2-8 of this multi-part EN apply to stationary use of equipment at underground locations covering the environmental conditions stated in ETS 300 019-1-8 [1].

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] ETS 300 019-1-8: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-8: Classification of environmental conditions; Stationary use at underground locations".
- [2] IEC 60068-2: "Basic environmental testing procedures - Part 2: Tests".
- [3] ETS 300 019-2-0: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-0: Specification of environmental tests; Introduction".

3 Environmental test specifications

The detailed descriptions of the environmental conditions are in clauses 4 and 5 of ETS 300 019-1-8 [1].

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

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

3.1 Specification T 8.1: Partly weatherprotected underground locations

This specification applies to underground enclosures in footway boxes, manholes and some tunnels etc. which are protected from direct weather influences. The location has no temperature or humidity control, but the variations in the temperature are limited due to the stabilizing influence of the surroundings. The equipment may be immersed in water during exceptional conditions.

Table 1: Test specification T 8.1: Partly weatherprotected underground locations - climatic tests

Environmental parameter			Environmental Class 8.1	Environmental test specification T 8.1: In-use, partly weatherprotected underground locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Air temperature	low	(°C)	-10	-10	16 h	IEC 60068-2-1	Ab/Ad: Cold	
	high	(°C)	+40	+40	16 h	IEC 60068-2-2	Bb/Bd: Dry heat	
	change	(°C/min) (°C)	5	-10/+40	2 cycles t1 = 3 h	IEC 60068-2-14	Na: Rapid change of temperature	1
Humidity	relative	low(%)	5					2
		high (%)	100			IEC 60068-2-56	Cb: Damp heat Steady state	3
		(%) (°C)		93 +30	21 d			
	condensation	(%) (°C)	yes	90-100 +40	2 cycles	IEC 60068-2-30	Db: Damp heat cyclic Variant 1	4
	absolute	low(g/m ³) high (g/m ³)	0,5 23					2 5
Air	pressure	low(kPa)	70	none				6
		high (kPa)	106	none				6
	speed	(m/s)	1	none				2
	rain	intensity low temperature	no no					
Water	other sources	(m) (kPa)	dripping water condensed water immersion to soil water	2 19,6	1 h	IEC 60068-2-17	Qf: Immersion	7
	icing & frosting		yes					2
Radiation	solar heat	(W/m ²)	no					
		(W/m ²)	yes					8

Environmental parameter			Environmental Class 8.1	Environmental test specification T 8.1: In-use, partly weatherprotected underground locations					
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes	
Chemically active substances	sulphur	SO ₂ (mg/m ³)	0,3/1,0	none				9	
		H ₂ S (mg/m ³)	0,1/0,5	none				9	
	chlorine	salt mist	sea and road salts		none				9
		Cl ₂ (mg/m ³)		0,1/0,3	none				9
		HCl (mg/m ³)		0,1/0,5	none				9
	nitrogen	NO _x (mg/m ³)		0,5/1,0	none				9
		NH ₂ (mg/m ³)		1,0/3,0	none				9
	hydrogen fluoride	HF (mg/m ³)		0,01/0,03	none				9
ozone	O ₃ (mg/m ³)		0,05/0,1	none				9	
Mechanically active substances	dust	sedimentation (mg/(m ² h))	15	none				10	
		suspension (mg/m ³)	0,4	none				10	
	sand	(mg/m ³)	300	none				10	
Flora and fauna	micro organisms	mould, fungus, etc.		none				11	
	rodents, insects			none					

NOTE 1: no = this condition does not occur in this class.
NOTE 2: none = verification is required only in special cases.
NOTE 3: n = number of note, see clause 5.

Table 2: Test specification T 8.1: Partly weatherprotected underground locations - mechanical tests

Environmental parameter			Environmental Class 8.1	Environmental test specification T 8.1: Stationary use, partly weatherprotected underground locations				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Vibration IEC 60721-3-3 Class 3M5	sinusoidal	displacement (mm) acceleration (m/s ²) frequency range (Hz) axes of vibration	3,0 10 2-99-200	1,2 4 5-99-200 3	3 x 5 sweep cycles	IEC 60068-2-6	Fc: Vibration (sinusoidal)	12; 15
	random	ASD (m ² /s ³) (dB/oct) frequency range (Hz) axes of vibration		0,04 +12 -12 5-10 10-50 50-100 3	3 x 30 minutes	IEC 60068-2-64	Fh: Vibration, broad-band (digital control)	13; 15
Shocks IEC 60721-3-3 Class 3M5	shocks	shock spectrum duration (ms) acceleration (m/s ²) number of bumps directions of bumps	Type II 6 250	half sine 11 50 6	100 in each direction	IEC 60068-2-29	Eb: Bump	14; 15
Vibration IEC 60721-3-3 Class 3M3	sinusoidal	velocity (mm/s) displacement (mm) acceleration (m/s ²) frequency range (Hz) axes of vibration	1,5 5 2-99-200	5 2 5-62 62-200 3	3 x 5 sweep cycles	IEC 60068-2-6	Fc: Vibration (sinusoidal)	12; 15
	random	ASD (m ² /s ³) (dB/oct) frequency range (Hz) axes of vibration		0,02 +12 -12 5-10 10-50 50-100 3	3 x 30 minutes	IEC 60068-2-64	Fh: Vibration, broad-band (digital control)	13; 15
Shocks IEC 60721-3-3 Class 3M3	shocks	shock spectrum duration (ms) acceleration (m/s ²) number of shocks directions of shocks	Type L 22 70	half sine 11 30 6	3 in each direction	IEC 60068-2-27	Ea: Shock	14; 15

NOTE 1: n= number of note, see clause 5.

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 class 8.1.

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 in a manner based on that of IEC Publication 60068-2 [2] subpart 6 (test Fc), with the following parameter severities:

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

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

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

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

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

The time-history stated in table 3 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 2 for class 3M5. This test is sufficient to prove compliance with the earthquake conditions given in ETS 300 019-1-8 [1].

4.2 Test conditioning

See table 3.

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 3: Test specification T 8.1: Earthquake test

Environmental parameter			Environmental class 8.1	Environmental test specification T8.1: Earthquake test				
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	Notes
Earthquake	time-history	RRS	fig.1, tab.4	fig.1, tab.4	30 s	IEC 60068-2-57	Ff: time-history method	16
		frequency range (Hz)	0,3 - 50	1-35				
		ZPA (m/s ²)	5	5				
		axes		3				
		damping ratio (%)		2				
				NOTE: n = number of note, see clause 5.				

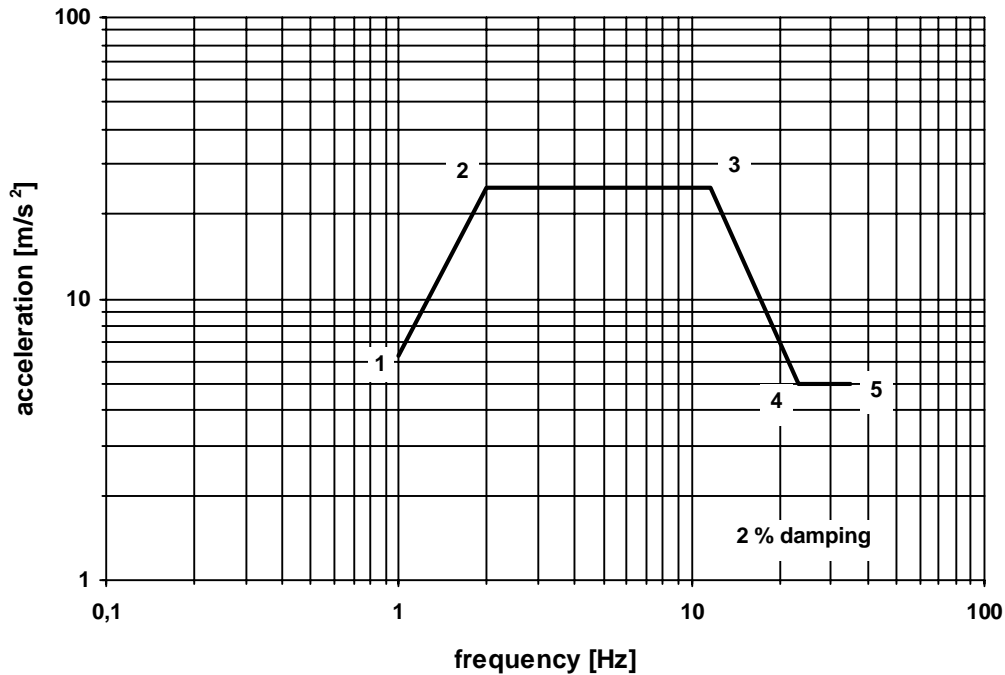


Figure 1: Earthquake Required Response Spectrum

Table 4: Acceleration co-ordinates for the Required Response Spectrum

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

5 Notes to tables

5.1 General note

The present document applies to the use of stationary equipment at underground locations covered by the environmental conditions stated in ETS 300 019-1-8 [1].

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

5.2 Notes to Tables 1 to 3

NOTE 1: (Air temperature, change)

IEC 60068-2-14 [2] Test Na is recommended with value not specified in IEC 60068-2 [2]. The equipment shall be monitored throughout the test. If preferred two tests may be carried out as follows: -10/+5 °C and +5/+40 °C.

NOTE 2:

There is no IEC 60068-2 [2] test method for this parameter.

NOTE 3: (Humidity, relative high)

IEC 60068-2-56 [2] Test Cb is recommended.

NOTE 4: (Condensation)

IEC 60068-2-30 [2] Test Db is recommended.

NOTE 5: (Humidity absolute high)

This is covered by IEC 60068-2-30 [2] Test Db: Damp heat, cyclic.

NOTE 6: (Air pressure, low, high)

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

NOTE 7: (Water, other sources)

IEC 60068-2-17 [2] Test Qf: Immersion is recommended. The effect of dripping and condensed water is also covered by this test.

NOTE 8: (Solar, heat)

The heating effect of all sources is included in high temperature test.

NOTE 9: (Chemically active substances)

For chemically active substances the characteristic severity should be considered when choosing components and materials. No test is recommended in this standard. Characteristic severities of chemical active substances are max. values.

NOTE 10: (Mechanically active substances)

The immersion test will normally ensure compliance with the dust and sand requirement. The characteristic severities are much lower than lowest severities in IEC 60068-2-68 [2] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and when choosing materials and components.

NOTE 11: (Flora, fauna)

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

NOTE 12: (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 not specified in IEC 60068-2 [2]. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.

NOTE 13: (Vibration, random)

ASD (Acceleration Spectral Density). Random vibration testing method may be used instead of the sinusoidal vibration test. Test severity values not specified in IEC 60068-2 [2]. The maximum test frequency has been reduced because between 100 Hz and 200 Hz the contribution is insignificant.

	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 ²	1,5 m/s ²

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

NOTE 14: (Shocks)

The values for test severity are not specified in IEC 60068-2 [2]. 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 15: (Environmental parameter)

In this table two IEC classes are given. IEC 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 class 3M5 should be used.

NOTE 16: (Earthquake)

RRS (Required Response Spectrum). ZPA (Zero Period Acceleration).

The equipment under test mounted in the "in use" position. The testing configuration shall be worst case in terms of weight and stiffness. The influence of connections, piping, cables, etc. shall be taken into account when mounting the specimen. The normal "in service" mounting structure of the specimen 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.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

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

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

History

Document history		
Edition 1	September 1997	Publication as ETS 300 019-2-8
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