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Foreword

This multi-part European Telecommunication Standard (ETS) has been produced by the Equipment Engineering (EE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETS 300 019 is concerned with environmental conditions and environmental tests for telecommunications equipment and comprises two main parts, each with subdivisions:

- ETS 300 019-1: "Classification of environmental conditions".

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

- ETS 300 019-2: "Specification of environmental tests".

  Part 2 specifies the recommended test severities and test methods for the different environmental classes.

Part 2-0 forms a general overview of Part 2. This part, (Part 2-5), deals with ground vehicle installations.

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1 Scope

This European Telecommunication Standard (ETS) specifies test methods and severities for the verification of the required resistibility of equipment according to the relevant environmental class.

The tests in Part 2-5 of this multi-part standard apply to the use of equipment installed permanently or temporarily in ground vehicles and cover the vehicles and the environmental conditions stated in ETS 300 019-1-5 [1].

The tests cover installations in vehicles powered by electric motors and combustion engines. Applications in combustion engine compartments are excluded.

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 019-1-5: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 1-5: Classification of environmental conditions; Ground vehicle installations".

[2] IEC 68-2: "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 given in Clauses 4 and 5 of ETS 300 019-1-5 [1].

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

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 utilisation of the equipment under test. The heat dissipation shall be maximised, except for the steady state, low temperature test, where it shall be minimised.

3.1 Specification T 5.1: Protected installation

This specification applies to use in weatherprotected heated locations in vehicles which are used in areas with or without well developed road systems depending on the selected IEC mechanical class. See tables 1, 2 and 2a.

Table 1: Test specification T 5.1: Protected installation - climatic tests

Environmental parameter			Environmental Class 5.1	Environmental test specification T 5.1: Vehicle, protected installation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Air temperature	low	(°C)	-25	-25 (11)	16 h	IEC 68-2-1	Ab/Ad: Cold (10)
	high	(°C)	+40 a),e)	+40 (1) or +55	16 h	IEC 68-2-2	Bb/Bd: Dry heat
		(°C)	+70 b),c)	+70 or +85 (2)	16h	IEC 68-2-2	Bb/Bd: Dry heat
	change	rapid (°C)	-25/+30	(3)			
		gradual (°C)	-25/+30	-25/+30	5 cycles	IEC 68-2-14	Na: Change of temperature
		(°C/min)	5 not c)		t_1 = 3 h		
		(°C)	-25/+60	-25/+30	5 cycles	IEC 68-2-14	Na: Change of temperature
		(°C/min)	10 c)		t_1 = 3 h		
Temperature	change	air/water (°C)	no not c)				
		air/water (°C)	+60/+5 c)	(16)			
		air/snow (°C)	+60/-5 c)	(16)			
Humidity	relative	slow temperature change (%) (°C)	95 +40	93 +40	4 d	IEC 68-2-56	Cb: Damp heat steady state
		rapid temperature change (%) (°C)	95 -25/+30 not d)	90-100 +40	2 cycles	IEC 68-2-30	Db: Damp heat, cyclic, Variant 2 (19)
		(%) (°C)	95 +10/+70 d)	90-100 +55	2 cycles	IEC 68-2-30	Db: Damp heat, cyclic, Variant 2 (19)
		low (%) (°C)	10 +30	(16)			
	absolute	rapid temperature change (g/m^3) (°C)	60 +70/+15	(17)			
Air	pressure	low (kPa)	70	none			
	speed	(m/s)	20	none			

(continued)

Table 1 (continued): Test specification T 5.1: Protected installation - climatic tests

Environmental parameter			Environmental Class 5.1	Environmental test specification T 5.1: Vehicle, protected installation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Water	rain	intensity	no				
	other sources	velocity (m/s)	0,3	none			
	wetness		wet surfaces	(4)			
Radiation	solar	(W/m^2)	700	(22)			
	heat	(W/m^2)	600	(5)			
Chemically active substances	sulphur	SO_2 (mg/m^3)	0,3/1,0 (6)	none (9)			
		H_2S (mg/m^3)	0,1/0,5 (6)	none (9)			
	chlorine	sea salts	salt mist	none (9)			
		road salts	solid salt, salt water	none (9)			
		HCl (mg/m^3)	0,1/0,5 (6)	none (9)			
	nitrogen	NO_x (mg/m^3)	0,5/1,0 (6)	none (9)			
		NH_3 (mg/m^3)	1,0/3,0 (6)	none (9)			
	hydrogen fluoride HF	(mg/m^3)	0,01/0,03 (6)	none (9)			
	ozone O_3	(mg/m^3)	0,05/0,1 (6)	none (9)			
Mechanically active substances	dust	sedimentation ($mg/(m^2\ h)$) ($mg/(m^2\ h)$)	3,0 1,0 (7)	(16) (16)			
	sand	(mg/m^3)	0,1 no (7)	(16)			

(continued)

Table 1 (concluded): Test specification T 5.1: Protected installation - climatic tests

Environmental parameter			Environmental Class 5.1	Environmental test specification T 5.1: Vehicle, protected installation			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Flora and	micro organisms		mould, fungus, etc.	none (9)			
Fauna	rodents, insects		rodents, etc.	none (9)			
Contaminating fluids	oil	motor	no (no (8))				
		gearbox	no (no (8))				
		hydraulic	no (yes (8))				
		transformer	no (yes (8))				
	fluid	brake	no (yes (8))				
		cooling	no (yes (8))				
	grease		no (yes (8))				
	fuel		no (no (8))				
	battery electrolyte		no (yes (8))				

no = this condition does not occur in this class.
none = verification is required only in special cases.

(n) = NOTE (n = number of note), see subclause 3.3.

Key:
a) Ventilated compartment
b) Unventilated compartment.
c) Engine compartment.
d) Near refrigerated air conditioning.
e) Outdoor air.

Table 2: Test specification T 5.1: Protected installation - mechanical tests (IEC Class 5M2)
Test specification T 5.2: Partly protected installation - mechanical tests (IEC Class 5M2)

Environmental parameter			Environmental Class 5.1 & 5.2	Environmental test specification T 5.1 and 5.2: Vehicle, protected and partly protected installations.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s^2) frequency range (Hz)	3,3 10 15 2-9 9- 200- 200 500	none			
	random	ASD (12) (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	1 0,3 10-200 200-500	0,96 -3 5-20 20-500 3 axes (14)	3 x 10 min	IEC 68-2-36	Fdb: Random Vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s^2) number of shocks directions of shocks	Type I Type II 11 6 100 300	half sine 6 300 6	3 shocks in each direction	IEC 68-2-27	Ea: Shock
	bump	acceleration (13) (m/s^2) duration (ms) number of bumps directions of bumps	no	250 6 6 (15)	500 bumps in each direction	IEC 68-2-29 (18)	Eb: Bump
Fall	free fall	height (mm) mass (kg) attitude falls	no				
	drop and topple	height (mm) angle (degrees) edges	no				
Acceleration,	steady state		no				
Load	static load	(kPa)	no				

no = this condition does not occur in this class.
none = verification is required only in special cases.

(n) = NOTE (n = number of note), see subclause 3.3.

Table 2a: Test specification T 5.1: Protected installation - mechanical tests (IEC Class 5M3)
Test specification T 5.2: Partly protected installation - mechanical tests (IEC Class 5M3)

Environmental parameter			Environmental Class 5.1 & 5.2	Environmental test specification T 5.1 and 5.2: Vehicle, protected and partly protected installations.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s^2) frequency range (Hz)	7,5 20 2-8 8-200 200-500	none			
	random	ASD (12) (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	3 1,0 10-200 200-500	1,92 -3 5-20 20-500 3 axes (14)	 3 x 10 min	IEC 68-2-36	Fdb: Random Vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s^2) number of shocks directions of shocks	Type I Type II 11 6 300 1000	half sine 6 1000 6	 3 shocks in each direction	IEC 68-2-27	Ea: Shock
	bump	acceleration (13) (m/s^2) duration (ms) number of bumps directions of bumps	no	250 6 6 (15)	 500 bumps in each direction	IEC 68-2-29 (18)	Eb: Bump
Fall	free fall	height (mm) mass (kg) attitude falls	no				
	drop and topple	height (mm) angle (degrees) edges	no				
Acceleration,	steady state		no				
Load	static load	(kPa)	no				

no = this condition does not occur in this class.
none = verification is required only in special cases.

(n) = NOTE (n = number of note), see subclause 3.3.

3.2 Specification T 5.2: Partly protected installation

This specification applies to use in vehicles in areas with or without developed road systems depending on the selected IEC mechanical class excluding only non-weatherprotected use in unheated vehicles at extremely low temperature conditions, see tables 2 and 3.

Table 3: Test specification T 5.2: Partly protected installation - climatic tests

Environmental parameter			Environmental Class 5.2	Environmental test specification T 5.2: Vehicle, partly protected installations.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Air temperature	low	(°C)	-40	-40 (11)	16 h	IEC 68-2-1	Ab/Ad: Cold (10)
	high	(°C)	+40 a),e)	+40 (1) or +55	16 h	IEC 68-2-2	Bb/Bd: Dry heat
		(°C)	+70 b),c)	+70 or +85 (2)	16 h	IEC 68-2-2	Bb/Bd: Dry heat
	change	rapid (°C)	-40/+30	(3)			
		gradual (°C) (°C/min)	-40/+30 5 not c)	-40/+30	5 cycles t_1 = 3 h	IEC 68-2-14	Na: Change of temperature
		(°C) (°C/min)	-40/+70 10 c)	-40/+30	5 cycles t_1 = 3 h	IEC 68-2-14	Na: Change of temperature
Temperature	change	air/water (°C)	-40/+5 not c)	(16)			
		air/water (°C)	+70/+5 c)	(16)			
		air/snow (°C)	+70/-5 c)	(16)			
Humidity	relative	slow temperature change (%) (°C)	95 +45	93 +40	4 d	IEC 68-2-56	Cb: Damp heat steady state
		(%) (°C)	95 -40/+30 not d)	90-100 +40	2 cycles	IEC 68-2-30	Db: Damp heat, cyclic Variant 2 (19)
		rapid temperature change (%) (°C)	95 +10/+70 d)	90-100 +55	2 cycles	IEC 68-2-30	Db: Damp heat, cyclic Variant 2 (19)
		low (%) (°C)	10 +30	(16)			
	absolute	rapid temperature change (g/m^3) (°C)	60 +70/+15	(17)			
Air	pressure	low (kPa)	70	none			
	speed	(m/s)	20	none			

(continued)

Table 3 (continued): Test specification T 5.2: Partly protected installation - climatic tests

Environmental parameter			Environmental Class 5.2	Environmental test specification T 5.2: Vehicle, partly protected instalations.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Water	rain	intensity mm/min	6	0,01 m^3/min 90 kPa	3 min/m^2 or 15 min (20)	IEC 68-2-18	Rb: Impacting water Method 2.2
	other sources	velocity (m/s)	1,0	(21)			
	wetness		wet surfaces	(4)			
Radiation	solar	(W/m^2)	1120	(22)			
	heat	(W/m^2) (W/m^2)	600 (not c) 1120 (c)	(5) (5)			
Chemically active substances	sulphur	SO_2 (mg/m^3)	0,3/1,0 (6)	none (9)			
		H_2S (mg/m^3)	0,1/0,5 (6)	none (9)			
	chlorine	sea salts	salt mist	none (9)			
		road salts	solid salt, salt water	none (9)			
		HCl (mg/m^3)	0,1/0,5 (6)	none (9)			
	nitrogen	NO_x (mg/m^3)	0,5/1,0 (6)	none (9)			
		NH_3 (mg/m^3)	1,0/3,0 (6)	none (9)			
	hydrogen fluoride HF	(mg/m^3)	0,01/0,03 (6)	none (9)			
	ozone O_3	(mg/m^3)	0,05/0,1 (6)	none (9)			
Mechanically active substances	dust	sedimentation ($mg/(m^2 h)$) ($mg/(m^2 h)$)	3,0 1,0 (7)	(16) (16)			
	sand	(mg/m^3)	0,1 no (7)	(16)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (9)			
	rodents, insects		rodents, etc.	none (9)			

(continued)

Table 3 (concluded): Test specification T 5.2: Partly protected installation climatic tests

Environmental parameter			Environmental Class 5.2	Environmental test specification T 5.2: Vehicle, partly protected installations.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Contaminating fluids	oil	motor	no (no (8))				
		gearbox	no (no (8))				
		hydraulic	no (yes (8))				
		transformer	no (yes (8))				
	fluid	brake	no (yes (8))				
		cooling	no (yes (8))				
	grease		no (yes (8))				
	fuel		no (no (8))				
	battery electrolyte		no (yes (8))				

no = this condition does not occur in this class.
none = verification is required only in special cases.

(n) = NOTE (n = number of note), see subclause 3.3.

Key:
a) Ventilated compartment
b) Unventilated compartment.
c) Engine compartment.
d) Near refrigerated air conditioning.
e) Outdoor air.

3.3 Notes to tables 1 to 3

NOTE 1: If protected against solar and heat radiation.

NOTE 2: Includes heat-trap effect and effect of direct solar radiation on equipment.

NOTE 3: This effect is included in test Na.

NOTE 4: This effect is included in test Db.

NOTE 5: The heating effect on equipment is covered by test Bb/Bd.

NOTE 6: Mean/maximum values.

NOTE 7: Cabin only.

NOTE 8: Electrical engine compartment only.

NOTE 9: The characteristic severities should be considered when choosing components and materials. Therefore no tests are required at equipment level.

NOTE 10: The equipment under test shall remain operational throughout this test, except for the cold start-up test which shall commence once low temperature stability is achieved.

NOTE 11: The cold start-up temperature may be modified by the product specification. The cold start-up temperature shall be declared whenever reference is made to conformance with any in-use class from ETS 300 019.

NOTE 12: Acceleration Spectral Density.

NOTE 13: Peak values.

NOTE 14: If normal attitude is specified, then the severity for the horizontal axis ASD is reduced by a factor of 10.

NOTE 15: If normal attitude is specified the equipment shall be tested in one direction in its operational position.

NOTE 16: No suitable tests exist in IEC 68-2 [2].

NOTE 17: This effect is partly included in test Db.

NOTE 18: Bump test is recommended in addition to shocks as the number of expected shocks is high.

NOTE 19: Variant 2 has been chosen rather than variant 1 due to the high temperatures \ absolute humidities involved and the difficulty in maintaining tolerances in most chambers with heat producing specimens.

NOTE 20: Whichever is greater.

NOTE 21: This effect is included in test Rb.

NOTE 22: The heating effect on equipment is covered by test Bb/Bd. Photochemical tests for materials can be made separately.

Annex A (informative): Bibliography

The following references are used for informative purposes within this ETS.

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

IEC 68-1: "Environmental testing Part 1: General and guidance".

History

Document history	
May 1994	First Edition
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