IEC 62498-3

Edition 1.0 2010-08

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Railway applications – Environmental conditions for equipment –
Part 3: Equipment for signalling and telecommunications

Applications ferroviaires – Conditions d'environnement pour le matériel –
Partie 3: Equipement pour la signalisation et les télécommunications

IEC 62498-3:2010

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX U

ICS 45.060

ISBN 978-2-88912-116-8

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 62498-3 has been prepared by IEC technical committee 9: Electrical equipment and systems for railways.

This standard is based on EN 50125-3.

The text of this standard is based on the following documents:

FDIS	Report on voting
9/1404/FDIS	9/1453/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62498 series, under the general title *Railway applications – Environmental conditions for equipment,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of November 2010 have been included in this copy.

RAILWAY APPLICATIONS – ENVIRONMENTAL CONDITIONS FOR EQUIPMENT –

Part 3: Equipment for signalling and telecommunications

1 Scope

This part of IEC 62498 specifies the environmental conditions.

The scope of this International Standard covers the design and the use of equipment and any portable equipment for signalling and telecommunications systems (including test, measure, monitoring equipment, etc.).

The portable equipment must comply with the sections of this International Standard relevant to their use.

This International Standard does not specify the test requirements for equipment.

In particular the standard intends to define

- interface conditions between the equipment and its environment,
- parameters to be used by designers when calculating RAMS (Reliability, Availability, Maintenability, Safety) and life time with respect to environmental condition effects.

The defined environmental conditions are considered as normal in service.

Microclimates surrounding components may need special requirements to be defined by the product standard.

The effects of any signalling and telecommunications equipment (in either operating or failure mode of operation) on the overall signalling system safety are not within the scope of this International Standard. This International Standard does not provide the designer with information to enable him to determine the safety risk associated with environmental conditions. The safety of persons in the vicinity of (or working on) the signalling and telecommunications equipment is also outside the scope of this International Standard. The effects of vandalism on the equipment are not considered in this International Standard.

This International Standard applies to all signalling and telecommunications systems except those used for cranes, mining vehicles and cable cars. It does not define the specifications for train-borne signalling and telecommunications systems (see IEC 62498-1).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*

IEC 60721-2-1:1982, *Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity*
Amendment 1 (1987)

IEC 60721-2-3:1987, *Classification of environmental conditions – Part 2-3: Environmental conditions appearing in nature – Air pressure*

IEC 60721-3-3:1994, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weather protected locations*

IEC 60721-3-4:1995, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 4: Stationary use at non-weather protected locations*

IEC 62236-1, *Railway applications – Electromagnetic compatibility – Part 1: General*

IEC 62236-2, *Railway applications – Electromagnetic compatibility – Part 2: Emission of the whole railway system to the outside world*

IEC 62236-4, *Railway applications – Electromagnetic compatibility – Part 4: Emission and immunity of the signalling and telecommunications apparatus*

IEC 62497-1, *Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment*

IEC 62497-2, *Railway applications – Insulation coordination – Part 2: Overvoltages and related protection*

ISO 4354, *Wind actions on structures*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1
environmental conditions
range of physical, chemical, electrical and biological conditions external to the equipment to which it is subjected in service

3.2
equipment housing
case, or other protective housing, provided by the manufacturer to mount his equipment and protect it from accidental damage, and occasionally from EMC or environmental effects. It may offer protection to personnel e.g. from electric shock.

Where the equipment housing provides the full required environmental protection, then it is treated as a cubicle to define the relevant environmental parameters.

The housing normally contains only a single supplier's equipment, and is only a part of a signalling or telecommunications system

3.3
cubicle
housing for apparatus which normally is used to co-locate various parts of the signalling or telecommunications system equipment, on occasion from different suppliers. It may contain various equipment housings installed within the cubicle and offers further environmental protection.

A cubicle is normally only used to install apparatus and is in general not sufficiently large to afford protection from weather to staff working on the apparatus.

No climatic or temperature control is provided on cubicles but ventilation or occasionally fan assisted ventilation is required.

Large housings which allow access to personnel but do not have the thermal properties of shelters, should be treated as cubicles

3.4
shelter/container
shelters/containers are normally provided when a larger volume of equipment is to be co-located at a single point or temperature/humidity sensitive equipment is to be installed.

Shelters/containers normally have double walls with insulation material (or an air gap) between them. Shelters/containers also normally have limited facilities for personnel.

Shelters/containers may also be provided with temperature control, especially where temperature sensitive apparatus is installed.

Where shelters/containers are fitted with climatic control (temperature and humidity control), they shall be treated as buildings with climatic control (buildings CC)

3.5
building
permanent construction provided with main services (e.g. water, electricity, gas, etc.) designed to protect equipment against the action of environmental conditions. A building may or may not be provided with climatic control

4 Environmental conditions

4.1 General

In this standard, normal environmental conditions are classified.

The customer shall specify clearly in his technical specification the required class for each environmental parameter. If no class is specified, the class with suffix 1 shall be assumed.

The severities specified are those which will have a low probability of being exceeded. All specified values are maximum or limit values. These values may be reached, but do not occur permanently. Depending on the situation there may be different frequencies of occurrence related to a certain period of time. Such frequencies of occurrence have not been included in this International Standard, but should be considered for any environmental parameter.

They should additionally be specified if applicable.

4.2 Pressure

4.2.1 Altitude

Table 1 gives the different classes of altitude relative to sea level at which the equipment shall perform as specified.

Using AX class, the maximum altitude shall be specified by the customer.

Altitude is relevant, in particular for the air pressure level and its consequence on cooling systems. The air pressure shall be considered according to IEC 60721-2-3.

Table 1 – Altitude relative to sea level

Classes	Altitude range relative to sea level m
A1	up to 1 400
A2	up to 1 000
A3	up to 1 200
AX	more than 1 400

4.2.2 Pulse pressure

In case that there are different pressure conditions by area in a tunnel according to train speed, shape of the train head, cross-section of tunnel, etc., the strength of devices shall be considered depending on their locations in the tunnel (e.g., in the main tunnel, in the adit, in the short side branch, in the inclined shaft).

In one example case, variation of pressure caused by train entering tunnel is:

$\Delta P = \pm 5$ kPa

The associated rate of change of pressure is:

$\Delta P/\Delta t = 0{,}5$ to 1 kPa/s

4.3 Temperature

Table 2 shows the overall system air temperature parameters.

Table 2 – Temperature ranges at different sites

Climatic classes	External ambient	In cubicle [a] [b]	In shelter [a] [b]		In building [a] [b]	
			NTC [c]	TC [d]	NCC [c]	CC [e]
T1	(–25 +40) °C	(–25 +70) °C	(–5 +55) °C	(+15 +30) °C	(0 +45) °C	(+18 +27) °C
T2	(–40 +35) °C	(–40 +65) °C	(–20 +50) °C	(+15 +30) °C	(–5 +40) °C	(+18 +27) °C
T3	Ordinary condition [f]	(–10 +60) °C	(–10 +45) °C		(–10 +45) °C	(0 +45) °C [g]
T4	Cold district [f]	(–20 +60) °C				
T5	Severe cold district [f]	(–30 +60) °C				
TX	(–55 +40) °C	(–55 +70) °C	(–35 +55) °C	(+15 +30) °C	(–5 +45) °C	(+18 +27) °C

[a] The temperatures inside cubicle, shelter or building are values measured in free air not directly adjacent to heat emitting elements.

[b] The maximum temperatures inside a cubicle, a shelter NTC and a building NCC are higher than maximum ambient temperatures because of the effects of solar radiation and power dissipation of installed equipment

[c] The higher values of lowest temperatures compared to those for external ambient are due to heat emitting equipment.

[d] 3K2 of IEC 60721-3-3

[e] 3K1 of IEC 60721-3-3

[f] There is no external ambient.

[g] (+5 +35) °C in case of the climate control of high reliability.

CC: with climatic control	TC: with temperature control
NCC: without climatic control	NTC: without temperature control

The above table was derived from IEC 60721-2-1 where open air temperatures are measured 2 m above ground. All classes have been extended at the lower temperatures to allow for installation of signalling and telecommunications equipment at ground level.

The effects of rapid temperature changes shall be considered. Changes of 0,5 °C/min over a range of 20 °C may be assumed for open air changes.

The designer(s) shall consider such factors as equipment power dissipation, surface exposed to solar radiation, ventilation including forced ventilation, use of thermostatic controlled heaters, heat dissipation coefficients of walls.

To enable the customer to verify the supplier compliance with the temperature levels specified in Table 2 and to verify good temperature design of all installed equipment, the relevant data shall be exchanged between customer and supplier, such as:

– geometrical characteristics of sub-assemblies,
– localisation of the main heat emitting elements and their heat dissipation,
– thermal parameters (resistance, capacity, etc.),
– characteristics of the cooling system.

The effect of the climatic or temperature control operating outside its specified parameters should be considered for each individual installation.

All signalling and telecommunications system shall operate within the relevant limits of Table 2.

The yearly average temperature of each type of site (for RAMS calculation) to be used are the following:

– +40 °C for equipment housing, cubicle;
– +30 °C for shelter NTC;
– +25 °C for shelter TC and building (NCC and CC).

RAMS calculations shall take into account the real yearly average temperature of each equipment part or sub assembly.

For deviations from the temperatures shown in Table 2, the customer shall specify the temperature levels required.

4.4 Humidity

The equipment shall be designed to withstand the humidity levels in the complete range of the air temperature as defined in 4.3 above and as shown in the climatograms of Figures B.1 to B.6 of Annex B which gives the relationship between humidity and temperature variations for the different climatic classes.

Table 3 below gives the min. and max. values of relative and absolute humidity for the different climatic classes.

Table 3 – Humidity ranges at different sites

Climatic classes	Humidity	External ambient		In cubicle		In shelter				In building			
						NCC		CC [a]		NCC		CC [b]	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
T1, T3, T4, T5	R %	15	100	5	100	5	100	10	75	5	95	20	75
	A g/m^3	0,55	25 [c]	0,55	25 [c]	0,55	25 [c]	2	22	0,55	25 [c]	4	15
T2	R %	20	100	5	100	5	100	10	75	5	95	20	75
	A g/m^3	0,12	22 [c]	0,12	22 [c]	0,12	22 [c]	2	22	0,12	22 [c]	4	15
TX	R %	15	100	5	100	5	100	10	75	5	95	20	75
	A g/m^3	0,02	25 [c]	0,02	25 [c]	0,02	25 [c]	2	22	0,02	25 [c]	4	15

[a] 3K2 of IEC 60721-3-3

[b] 3K1 of IEC 60721-3-3

[c] 30 g/m^3 for tunnel

CC: with climatic control.

NCC: without climatic control.

R: Relative humidity.

A: Absolute humidity.

NOTE Table 3 is derived from IEC 60721-2-1 for calculations, from IEC 60721-3-3 and IEC 60721-3-4 for values.

On cold surfaces, 100 % relative humidity may occur causing condensation on parts of equipment.

Sudden changes of the air temperature may cause localised condensation of water on parts of equipment.

The yearly average humidity level of the external ambient is 75 % of relative humidity.

On 30 days in the year, continuously, the level of the external ambient relative humidity can be in the range of 75 % to 95 %.

4.5 Wind

Equipment exposed to air movement shall be designed to withstand the stress generated. The stress caused by air movement can be generated by two sources.

a) Natural wind

The force (F_w) produced by natural wind shall be calculated as below:

$$F_w = q \times c \times A$$

where

F_w is the force (N);

q is the pressure head (N/m²);

c is the form factor (without dimension);

A is the equipment surface perpendicular to the direction of the wind (m²).

The formula shown above has been simplified for general signalling and telecommunications applications. For complex installations (e.g. buildings) refer to ISO 4354.

The pressure head (q) shall be calculated by:

$$q = \delta/2 \times v^2$$

where

δ is the density of air (kg/m^3);

v is the speed of air (m/s).

The maximum speed of wind is for example taken as 35 m/s. In this case we have the following values:

$$q = 1{,}25/2 \times 35 \times 35 = 0{,}76 \text{ kN/m}^2$$

$$F_{wMax} = 0{,}76 \times c \times A$$

If the customer requires a higher wind speed to be used in this calculation, then the relevant value shall be specified to the supplier.

b) Air movement produced in the area of the track by the passing of a train

The air movement surrounding a moving train is extremely complex and it is not possible to derive a single value.

The customer shall advise the designer of the value of q to be used to calculate air movement pressure caused by trains.

Annex C shows some examples of q and c factors which may be used for guidance.

4.6 Rain

Equipment exposed to rain shall be designed to withstand a rain rate of 6 mm/min for classes T1 and T2 and a rain rate of 3-5 mm/min for classes T3 and a rain rate of 10-20 mm/min for classes T4 and a rain rate of 15 mm/min for class TX.

The designer shall also consider the combined effect of rain and wind.

The customer should consider whether more severe water protection is required (e.g. flooding) and specify his requirement to the supplier in accordance with IEC 60529 IP code.

4.7 Snow and hail

Consideration shall be given to the effect of snow and/or hail. The maximum diameter of the hailstones is for example taken as 15 mm, larger diameter may occur exceptionally.

Consideration shall be given to all forms of snow which may occur.

The effects of snow driven by wind or passing vehicles shall be considered.

4.8 Ice

Equipment exposed to the effects of ice forming or falling shall be designed to operate in that environment.

In such conditions the performance of equipment shall be specified either in the product standard or by the customer.

4.9 Solar radiation

Equipment exposed to the effects of solar radiation shall be designed to ensure that it continues to operate and comply with the parameters of the design specifications.

The maximum level of solar radiation is 1 120 W/m² for equipment directly exposed according to IEC 60721-3-4.

Care shall be taken to minimize the effects of UV radiation on the equipment exposed to solar radiation.

For equipment in other situations (e.g. inside, behind a window, etc.), the designer shall choose other values and justify his choice to the customer.

4.10 Lightning

Consideration shall be given to the effects of lightning on the equipment.

For protection of the equipment against lightning refer to IEC 62497-2.

4.11 Pollution

The effects of pollution shall be considered in the design of equipment and components.

The micro-environmental conditions and the effects of pollution in combination with humidity are described in IEC 62497-1.

The severity of pollution will depend upon the location of the equipment.

The effects of pollution may be reduced by the use of appropriate protection. In this case the protection against water and solid objects shall be specified using the protection degree definition of IEC 60529.

The effects of the following kinds of pollution shall be considered:

- chemical active substances:
  - salinity,
  - H_2S,
  - weedkiller (product to be specified by the customer),
  - organic elements,
  - other chemical substances;
- biological active substances;
- mechanically active substances:
  - dust: due to presence of carbon or metallic powder, dust may become electrically conductive with the presence of humidity,
  - stones coming from the ballast,
  - sand, if specified for the application.

Table 4 below gives the levels of pollution for "External ambient" areas.