INTERNATIONAL STANDARD

IEC 60721-3-3

Edition 2.2
2002-10

Edition 2:1994 consolidated with amendments 1:1995 and 2:1996

Classification of environmental conditions –

Part 3-3:
Classification of groups of environmental parameters and their severities –
Stationary use at weatherprotected locations

*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*

Reference number
IEC 60721-3-3:1994+A1:1995+A2:1996(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (www.iec.ch/online_news/ justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

  Email: custserv@iec.ch
  Tel: +41 22 919 02 11
  Fax: +41 22 919 03 00

INTERNATIONAL STANDARD

IEC 60721-3-3

Edition 2.2
2002-10

Edition 2:1994 consolidated with amendments 1:1995 and 2:1996

Classification of environmental conditions –

Part 3-3:
Classification of groups of environmental parameters and their severities –
Stationary use at weatherprotected locations

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CONTENTS

FOREWORD 7

1 Scope 11
2 Normative references 11
3 Definitions 13
4 General 13
5 Classification of groups of environmental parameters and their severities 15
6 Sets of environmental condition class combinations 21

Annex A (informative) Survey of conditions affecting the choice of environmental parameters and their severities 35
Annex B (informative) Climatograms 65
Annex C (informative) Examples for practical application of the classification specified in this standard 87
Annex D (informative) Summary of conditions covered by sets of class combinations 93
Annex E (informative) Explanation of the environmental conditions in tropical areas as specified in classes 3K9 and 3K10 97

Figure 1 – Model shock response spectra (first order maximax shock response spectra) 33
Figure B.1 – Climatogram for class 3K1 (tolerance bands for temperature are marked by broken lines) 65
Figure B.2 – Climatogram for class 3K2 67
Figure B.3 – Climatogram for class 3K3 69
Figure B.4 – Climatogram for class 3K4 71
Figure B.5 – Climatogram for class 3K5 73
Figure B.6 – Climatogram for class 3K6 75
Figure B.7 – Climatogram for class 3K7 77
Figure B.8 – Climatogram for class 3K7L 79
Figure B.9 – Climatogram for class 3K8 81
Figure B.10 – Climatogram for class 3K8H 83
Figure B.11 – Climatogram for class 3K8L 85
Figure E.1 – Climatograms for tropical damp type of climate and tropical dry type of climate 101

Table 1 – Classification of climatic conditions....23
Table 2 – Classification of special climatic conditions....25
Table 3 – Classification of biological conditions....25
Table 4 – Classification of chemically active substances....27
Table 5 – Classification of mechanically active substances....29
Table 6 – Classification of mechanical conditions....29
Table 7 – Sets of environmental class combinations....29
Table 8 – Time to flashover....31
Table 9 – Thermal conditions prior to flashover....31
Table 10 – Thermal conditions following flashover....31
Table 11 – Conditions with respect to visibility through smoke....31
Table 12 – Conditions of chemically active substances....31

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.

3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.

6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60721-3-3 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.[1)]

This consolidated version of IEC 60721-3-3 consists of the second edition (1994) [documents 75(CO)102A and 75(CO)110], its amendment 1 (1995) [documents 75/224/FDIS and 75/246/RVD] and its amendment 2 (1996) [documents 75/279/FDIS and 75/289/RVD].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

IEC 60721 consists of the following parts, under the general title: *Classification of environmental conditions:*

– Part 1, Environmental parameters and their severities
– Part 2, Environmental conditions appearing in nature
– Part 3, Classification of groups of environmental parameters and their severities

Annexes A to D are for information only.

---

1) IEC technical committee 75: "Classification of environmental conditions" has been transformed into technical committee 104.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2007. At this date, the publication will be

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

CLASSIFICATION OF ENVIRONMENTAL CONDITIONS –

Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weatherprotected locations

1 Scope

This section of IEC 60721-3 classifies groups of environmental parameters and their severities to which products are subjected when mounted for stationary use at weather-protected locations under use conditions, including periods of erection work, down time, maintenance and repair.

Weatherprotected locations, where products may be mounted for stationary use permanently or temporarily, include land-based and offshore enclosed and sheltered locations. Use in and on vehicles is excepted.

Environmental conditions directly related to explosion hazards, fire extinction and ionizing radiation are excluded. Only environmental conditions as such are considered. No special description of the effects of these conditions on the products is given.

Environmental conditions directly related to explosion hazards, fire extinction and ionizing radiation are excluded. Any other unforeseen incidents are also excluded. The possibility of their occurrence should be taken into account in special cases.

Microclimate within a product is not included.

Conditions of stationary use at non-weatherprotected locations, portable and non-stationary use, use in vehicles and ships, conditions of storage and transportation, and microclimates inside products are given in other sections of IEC 60721-3.

A limited number of classes of environmental conditions is given, covering a broad field of application. The user of this standard should select the lowest classification necessary for covering the conditions of the intended use.

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 60721-1:1990, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

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

IEC 60721-2-8:1994, *Classification of environmental conditions – Part 2: Environmental conditions appearing in nature – Section 8: Fire exposure*

IEC 60721-3-0:1984, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 0: Introduction*
Amendment 1 (1987)

ISO/IEC Guide 52: 1990, *Glossary of fire terms and definitions*

3 Definitions

In addition to the definitions in clause 3 of IEC 60721-1 and ISO/IEC Guide 52, the following definitions apply:

3.1
stationary use
the product is mounted firmly on the structure or on mounting devices or it is permanently placed at a certain site. It is not intended for portable or non-stationary use, but short periods of handling during erection work, down time, maintenance and repair at the location are included

3.2
weatherprotected location
a location at which the product is protected from weather influences:

– *totally weatherprotected location* (enclosed location): direct weather influences are totally excluded;

– *partially weatherprotected location* (sheltered location): direct weather influences are not totally excluded.

4 General

For further general guidance, see IEC 60721-3-0.

During periods of erection work, which are often connected with down time, the user should be aware that conditions might differ from those experienced during the period of operation. Therefore the selection of another class may be necessary for this period, unless special precautions have been taken.

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 local situation there may be different frequencies of occurrence related to a certain period of time. Such frequencies of occurrence should be considered for any environmental parameter. They should additionally be specified if applicable. Information on duration and frequencies of occurrence is given in Amendment No. 1 to IEC 60721-3-0 as clause 6.

Attention is drawn to the fact that combinations of the environmental parameters given may increase the effect on a product. This applies especially to the presence of high relative humidity in addition to biological conditions or to conditions of chemically or mechanically active substances.

The environmental conditions present at a location may be affected by other influences, e.g. heat dissipation sources, special process conditions, etc.

Measurements of the environmental conditions present at a location should be made at a representative point in the vicinity of the product.

It is recognized that extreme or special environmental conditions may exist. Specifications for products to operate under such special conditions are a matter for negotiation between supplier and user.

5 Classification of groups of environmental parameters and their severities

A number of classes are specified in tables 1 to 6 and 8 to 12 for:

– climatic conditions (K);
– special climatic conditions (Z);
– biological conditions (B);
– conditions of chemically active substances (C);
– conditions of mechanically active substances (S);
– mechanical conditions (M);
– conditions during the initial phase of a fire (T, P, F, V, H).

This classification allows a number of possible combinations of environmental conditions, which bear upon products wherever used. It represents the real situation in respect of world-wide conditions of use, due to local influences of open-air climate, construction of buildings, mounting, process conditions, etc.

(See also clause 6.)

A class of conditions normally includes classes with lower severity digits.

For certain parameters it has not yet been possible to specify quantitative severities.

For a given location or product, reference should be made to the total set of classes, e.g.:

3K2/3Z1/3Z4/3B1/3C2/3S1/3M4 and 3T1/3P3/3F2/3V2/3H3.

(See also clause 6.)

Annex A explains the basis of the classes. It contains a summary of the conditions covered by each class and gives a survey of conditions affecting the choice of environmental parameters and their severities.

Annex B contains climatograms showing the interdependence of air temperature, relative humidity and absolute humidity for the climatic classes specified in table 1.

Annex C gives two examples for practical application of this classification.

5.1 Climatic conditions

The climatic conditions specified for classes 3K1 to 3K8 represent the conditions at weather-protected locations. They have been experienced world-wide over long periods of time, taking into account all the parameters that can influence them, e.g. external (open-air) climatic conditions, type of building construction, temperature/humidity controlling systems and internal conditions, e.g. heat dissipation from mounted equipment, presence of humans, etc. The conditions should cover all normal cases, but not exceptional events, e.g. failure of air-conditioning systems.

Climatic conditions in tropical areas as specified in classes 3K9 and 3K10 are explained in annex E.

When selecting appropriate classes attention should be paid to the fact that the climatic conditions inside buildings depend on the outside (open-air) conditions, especially air temperature and solar radiation, and the type of building construction. Walls with good thermal insulation or high thermal capacity can consistently smooth the peaks of outside air temperature variations between day and night, or exceptionally for a longer period. Walls with poor thermal insulation or low thermal capacity cannot have that effect, and peaks can be magnified due to the effect of solar radiation during the day and the effect of building radiation at night. The effect of solar radiation can be increased by either heat-trap or greenhouse effects.

The actual interdependence of air temperature and humidity cannot be shown by stating severities only. Therefore climatograms are given in annex B.

5.2 Special climatic conditions

As the parameters heat radiation, movement of surrounding air, water from sources other than rain, high air temperature, and low air pressure may in practice occur with any of their severities in combination with any of the other climatic conditions, these special conditions are specified in table 2. In this case an assumption of the coincidence of events of increasing severity would lead to unnecessary overdesign.

5.3 Biological conditions

No quantitative severities have been specified for these conditions. The specified parameters of table 3 are typical, but may not be complete.

5.4 Chemically active substances

Contamination of natural atmosphere is mainly caused by chemical emissions from industrial activities, motor-driven vehicles and heating systems. A further chemical influence is caused by aerosols of sea salts. The contamination may affect the function and the materials of products.

The values given in this classification have been experienced in surveys for several years. Maximum values are given, because direct influence of higher concentrations over a short period normally causes more damage to material, which cannot regenerate. Mean values are given additionally, because their influence may be important for the long-term effect on the internal parts of the products.

In practice not all contaminants (parameters) classified in this standard are present simultaneously. Furthermore, the probability is low that the concentrations of those contaminants really present increase simultaneously and homogeneously. Depending on the local situation, there are often higher values of one contaminant only. The values specified for class 3C1 will normally be experienced in rural areas and areas with low industrial activities. The values specified for class 3C2 are experienced in urban areas. Therefore the severity of each of these two classes should be considered as the requirements for the combined effect of all parameters stated. The severities of classes 3C3 and 3C4, however, cannot be considered as the requirements for the combined effect of all parameters stated in order to avoid any uneconomical overdesign. For these classes it is possible to select only the severities of those single parameters, which might be relevant to the case of application. If single parameters of the classes 3C3 or 3C4 are selected for the description of the chemically active substances present at a location, for all other parameters which are not specially named, the severities of class 3C2 are valid.

NOTE Chemically active liquids and chemically active solids other than sea salts are not considered in this standard.

5.5 Mechanically active substances

Sand and dust are classified together, as the effects caused by these environmental conditions are similar.

5.6 Mechanical conditions

The conditions of vibrations (sinusoidal) are classified by severity levels of acceleration and displacement amplitude in high and low frequency ranges respectively.

Random vibration is not considered in this standard. It may be included when sufficient information is available.

Non-stationary vibration including shock is classified by using the first order undamped maximax shock response spectrum. See 6.1.3 of IEC 60721-1.

5.7 Conditions during the initial stage of a fire

The environmental fire conditions are described in IEC 60721-2-8. Their relation to the initial phase of a fire in a compartment has been the base for the selection of the parameters and their severities applied for the classes covering the pertinent conditions. The main parameters are:

a) *for pre-flashover fire conditions:*

- time to flashover (table 8);
- heat flux to various surfaces and items in the location;
- gas temperature of the upper gas layer in the location;
- rate of heat release (RHR), related to the rate of heat release causing flashover in the location (RHRfo) and, accordingly, given by the ratio RHR/RHRfo (table 9).

b) *for post-flashover fire conditions:*

- maximum gas temperature, combined with the duration of the heating phase of the location fire development (table 10).

c) *for conditions of smoke and chemically active substances:*

- optical density (table 11);
- concentration of hydrogen chloride (table 12).

All the parameters listed contribute towards a description of the environmental fire conditions. Some of the parameters specify fire exposure characteristics. This applies to the classes of table 9 concerning the reaction to fire of materials and products during the pre-flashover fire condition, and to the parameters connected to the classes of table 10 with respect to the fire behaviour and resistance of, for instance, load-supporting and separating structures, doors, ventilation systems during the post-flashover fire condition. Without being direct fire exposure characteristics, parameters such as the heat release ratio of the classes in table 9 and the times in table 8 are decisive for the risk of flashover and, if flashover occurs, for the safe escape of people from the fire. The gas temperatures of the classes of table 9 and the parameters of tables 11 and 12 are all fire exposure characteristics of importance for the functioning of optical detectors and for the probability of people to survive during evacuation or to remain within safe areas of refuge during the fire. The concentration of hydrogen chloride resulting from a fire is important for evaluating the risk of contamination of electric products by subsequent corrosion

6 Sets of environmental condition class combinations

As indicated in clause 5 the classification allows a number of possible combinations of environmental conditions bearing on products wherever used. The number of possibilities, and thus the flexibility, is therefore very great. In practice, however, this flexibility is not always an advantage when, for instance, environmental condition specifications for a certain location are drawn up by different parties, invariably producing small but disturbing divergencies.

In order to limit the possibilities to general cases, standard sets of class combinations may be selected from table 7. For a given location or product, reference may then be made to this standard, for example IE32. Only when conditions are not considered to be covered by this specification, is reference made to each class as indicated in clause 5. Alternatively, if some severities of parameters deviate from that or those of the class combination, this should be expressed by the addition to the set designation of the following phrase: "but ... (parameter) ... (severity and unit)", for example IE32 but sand 30 mg/m³.

Annex D gives a summary of conditions covered by the sets of class combinations.

Table 1 – Classification of climatic conditions

Environmental parameter	Unit	Class												
		3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L	3K9[8]	3K10[8]
a) Low air temperature	°C	+20[3]	+15	+5	+5	–5	–25	–40	–40	–55	–25	–55	+5	–20
b) High air temperature [5]	°C	+25[3]	+30	+40	+40[5]	+45[5]	+55	+70	+40	+70	+70	+55	+40	+55
c) Low relative humidity	%	20	10	5	5	5	10	10	10	10	10	10	30	4
d) High relative humidity	%	75	75	85	95	95	100	100	100	100	100	100	100	100
e) Low absolute humidity	g/m^3	4	2	1	1	1	0,5	0,1	0,1	0,02	0,5	0,02	6	0,9
f) High absolute humidity	g/m^3	15	22	25	29	29	29	35	35	35	35	29	36	27
g) Rate of change of temperature [1]	°C/min	0,1	0,5	0,5	0,5	0,5	0,5	1,0	1,0	1,0	1,0	1,0	1,0	1,0
h) Low air pressure [7]	kPa	70	70	70	70	70	70	70	70	70	70	70	70	70
i) High air pressure [2]	kPa	106	106	106	106	106	106	106	106	106	106	106	106	106
j) Solar radiation	W/m^2	500	700	700	700	700	1120	1120	None	1120	1120	1120	1120	1120
k) Heat radiation	None	No	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]
l) Movement of surrounding air [4]	m/s	0,5	1,0[5]	1,0[5]	1,0[5]	1,0[5]	1,0[5]	5,0[5]	5,0[5]	5,0[5]	5,0[5]	5,0[5]	5,0[5]	5,0[5]
m) Condensation	None	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
n) Wind-driven precipitation (rain, snow, hail, etc.)	None	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
o) Water from sources other than rain	None	No	No	No	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]	[6]
p) Formation of ice	None	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

[1] Averaged over a period of time of 5 min.

[2] Conditions in mines are not considered.

[3] These are air-conditioned locations with a tolerance of ±2 °C on stated temperature values.

[4] A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.

[5] If applicable, a special value may be selected from table 2.

[6] Conditions occurring at the locations concerned to be selected from table 2.

[7] Severity value of 70 kPa covers worldwide application (altitudes up to 3 000 m). For some restricted applications, a value may be selected from table 2.

[8] Further information on classes 3K9 (tropical damp) and 3K10 (tropical dry) is given in annex E.

Table 2 – Classification of special climatic conditions

Environmental parameter	Class	Unit	Special condition Z
b) High air temperature	3Z11	°C	+55
h) Low air pressure [3]	3Z12	kPa	84
k) Heat radiation	3Z1	None	Negligible
	3Z2	None	Heat radiation, e.g. in the vicinity of room heating systems
	3Z3	None	Heat radiation, e.g. in the vicinity of room heating systems or commercial ovens or industrial furnaces
l) Movement of surrounding air [1]	3Z4	m/s	5
	3Z5	m/s	10
	3Z6	m/s	30
o) Water from sources other than rain [2]	3Z7	None	Dripping water
	3Z8	None	Spraying water
	3Z9	None	Splashing water
	3Z10	None	Water jets

[1] A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.

[2] Underwater conditions are not included.

[3] Class 3Z12 corresponds to an altitude of approximately 1 400 m.

Table 3 – Classification of biological conditions

Environmental parameter	Unit	Class		
		3B1	3B2	3B3
a) Flora	None	No	Presence of mould, fungus, etc.	Presence of mould, fungus, etc.
b) Fauna	None	No	Presence of rodents and other animals harmful to products, excluding termites	Presence of rodents and other animals harmful to products, excluding termites

Table 4 – Classification of chemically active substances

Environmental parameter	Unit[1]	Class[2]								
		3C1R	3C1L	3C1	3C2		3C3[3]		3C4[3]	
		Maximum value	Maximum value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	Mean value	Maximum value
a) Sea salts	None	No	No	No [4]	Salt mist		Salt mist		Salt mist	
b) Sulphur dioxide	mg/m³	0,1	0,1	0,1	0,3	1,0	5,0	10	13	40
	cm³/m³	0,037	0,037	0,037	0,11	0,37	1,85	3,7	4,8	14,8
c) Hydrogen sulphide	mg/m³	0,0015	0,01	0,01	0,1	0,5	3,0	10	14	70
	cm³/m³	0,001	0,0071	0,0071	0,071	0,36	2,1	7,1	9,9	49,7
d) Chlorine	mg/m³	0,001	0,01	0,01	0,1	0,3	0,3	1,0	0,6	3,0
	cm³/m³	0,00034	0,0034	0,0034	0,034	0,1	0,1	0,34	0,2	1,0
e) Hydrogen chloride	mg/m³	0,001	0,01	0,01	0,1	0,5	1,0	5,0	1,0	5,0
	cm³/m³	0,00066	0,0066	0,0066	0,066	0,33	0,66	3,3	0,66	3,3
f) Hydrogen fluoride	mg/m³	0,001	0,003	0,003	0,01	0,03	0,1	2,0	0,1	2,0
	cm³/m³	0,0012	0,0036	0,0036	0,012	0,036	0,12	2,4	0,12	2,4
g) Ammonia	mg/m³	0,03	0,3	0,3	1,0	3,0	10	35	35	175
	cm³/m³	0,042	0,42	0,42	1,4	4,2	14	49	49	247
h) Ozone	mg/m³	0,004	0,01	0,01	0,05	0,1	0,1	0,3	0,2	2,0
	cm³/m³	0,002	0,005	0,005	0,025	0,05	0,05	0,15	0,1	1,0
i) Nitrogen oxides (expressed in equivalent values of nitrogen dioxide)	mg/m³	0,01	0,1	0,1	0,5	1,0	3,0	9,0	10	20
	cm³/m³	0,005	0,052	0,052	0,26	0,52	1,56	4,68	5,2	10,4

1) The values given in cm³/m³ have been calculated from the values given in mg/m³ and refer to a temperature of 20 °C and a pressure of 101,3 kPa. The table uses rounded values.

2) Mean values are expected long-term values. Maximum values are limit or peak values, occurring over a period of time of not more than 30 min per day.

3) It is not mandatory to consider each of classes 3C3 and 3C4 as a requirement for the combined effect of all parameters stated. If applicable, values of single parameters may be selected from these classes. In this case the severities of class 3C2 are valid for all parameters not especially named.

4) Salt mist may be present in sheltered locations of coastal areas and in offshore sites.

Table 5 – Classification of mechanically active substances

Environmental parameter	Unit	Class			
		3S1	3S2	3S3	3S4
a) Sand	mg/m^3	None	30	300	3 000
b) Dust (suspension)	mg/m^3	0,01	0,2	0,4	4,0
c) Dust (sedimentation)	$mg/(m^2 \cdot h)$	0,4	1,5	15	40

Table 6 – Classification of mechanical conditions

Environmental parameter	Unit	Class							
		3M1	3M2	3M3	3M4	3M5	3M6	3M7	3M8
a) Stationary vibratation, sinusoidal:									
displacement amplitude	mm	0,3	1,5	1,5	3,0	3,0	7,0	10	15
acceleration amplitude	m/s^2	1	5	5	10	10	20	30	50
frequency range	Hz	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200
b) Non-stationary vibration including shock: (see figure 1)									
shock response spectrum type L, peak acceleration *â*	m/s^2	40	40	70	None	None	None	None	None
shock response spectrum type I, peak acceleration *â*	m/s^2	None	None	None	100	None	None	None	None
shock response spectrum type II, peak acceleration *â*	m/s^2	None	None	None	None	250	250	250	250

Table 7 – Sets of environmental class combinations

Condition	Set of class combinations						
	IE31	IE32	IE33	IE34	IE35	IE36	IE37
Climatic	3K2	3K3	3K3	3K4	3K5	3K6	3K7
Special climatic	–	3Z2	3Z2	3Z2	3Z2	3Z2	3Z2
	–	3Z4	3Z4	3Z4	3Z4	3Z5	3Z5
	–	–	–	3Z8	3Z8	3Z8	3Z8
Biological	3B1	3B1	3B1	3B2	3B2	3B2	3B2
Chemically active substances	3C1	3C1	3C2	3C2	3C2	3C2	3C2
Mechanically active substances	3S1	3S1	3S2	3S2	3S3	3S3	3S3
Mechanical	3M1	3M1	3M2	3M2	3M3	3M3	3M3

Table 8 – Time to flashover

Environmental parameter	Unit	Class 3T1	3T2	3T3	3T4	3T5
Time to flashover	min	20	12	8	4	2

Table 9 – Thermal conditions prior to flashover

Environmental parameter	Unit	Class 3P1	3P2	3P3	3P4	3P5
Heat flux to materials and products	kW/m²	10	20	30	50	75
Gas temperature (upper layer of gas)	°C	150	300	400	500	600
Ratio between rate of heat release and rate of heat release causing flashover	–	0,2	0,4	0,6	0,8	1

Table 10 – Thermal conditions following flashover

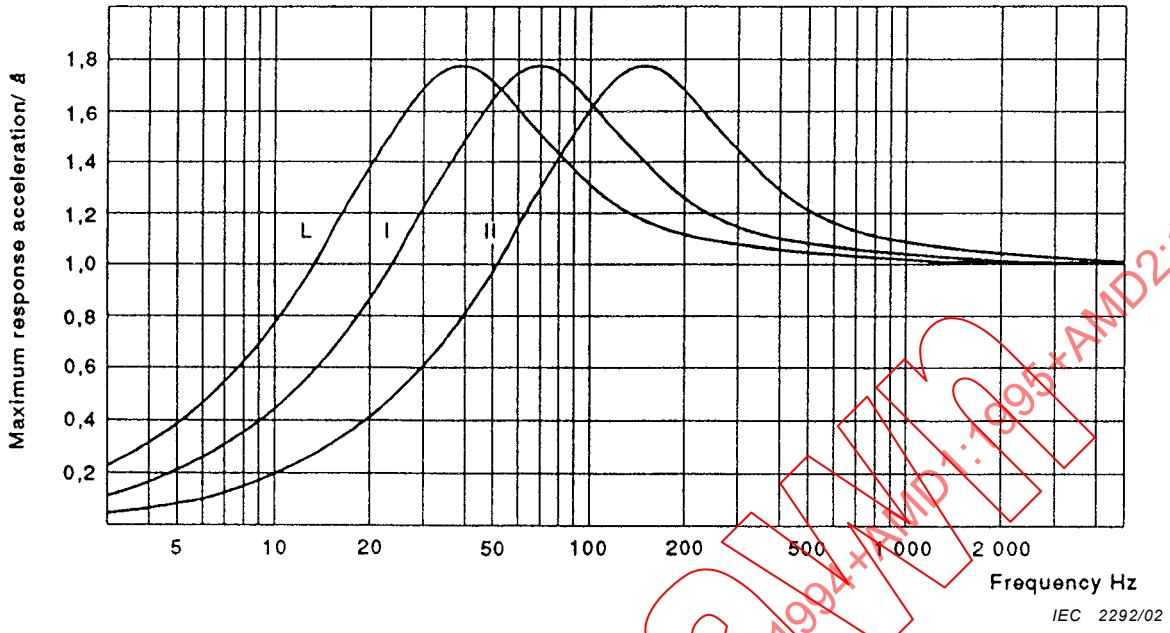
Environmental parameter	Unit	Class 3F1	3F2	3F3	3F4
Maximum gas temperature	°C	600	800	1 000	1 200
Duration of heating phase	min	10	20	30	60

Table 11 – Conditions with respect to visibility through smoke

Environmental parameter	Unit	Class 3V1	3V2	3V3	3V4	3V5
Optical density	1/m	0,02	0,05	0,2	0,5	1
NOTE For explanation, see figure 13 of IEC 60721-2-8.						

Table 12 – Conditions of chemically active substances

Environmental parameter	Unit	Class 3H1	3H2	3H3	3H4
Concentration of hydrogen chloride	mg/m³	200	500	1 000	4 000
Duration	min	10			



Example of durations for half-sine pulse:

Spectrum type L: duration 22 ms
Spectrum type I: duration 11 ms
Spectrum type II: duration 6 ms

Figure 1 – Model shock response spectra
(first order maximax shock response spectra)

For explanation see note 6 relating to table 1 of IEC 60721-1 (1990)

Annex A
(informative)

Survey of conditions affecting the choice of environmental parameters and their severities

A.1 General

In this annex the basis of the classes is explained. It gives a survey of conditions affecting the choice of environmental parameters and their severities, and it contains a summary of the conditions covered by each class.

A.2 Survey of conditions

For each environmental parameter the various possible conditions, which will result in different levels of environmental conditions, are presented. The conditions are arranged in order of increasing severities.

The first column of the tabulated subclauses A.2.1 to A.2.5 describes the conditions. In the vertical columns headed "Class", an x indicates the conditions covered by the class. The lowest class covering a certain condition may be found by reading horizontally from that condition to the first x encountered.

The procedure of finding an appropriate class as described above is valid for all the subclauses, but A.2.1 contains the additional factor of type of climate given in columns 2 to 10, to which attention has to be paid.

The lowest class covering a certain condition can thus be found by reading vertically down to the relevant type of climate column to the first x in the horizontal line of the relevant condition, then reading horizontally to the right to the first x encountered as previously described.

The types of climate are described in IEC 60721-2-1, and are:

Extremely Cold (except the Central Antarctic)
Cold
Cold Temperate
Warm Temperate
Warm Dry
Mild Warm Dry
Extremely Warm Dry
Warm Damp
Warm Damp, Equable

It should be noted that, if a certain condition referred to in this annex is covered by a certain class, it does not necessarily mean that the class describes, for each single parameter, the lowest environmental severity needed to cover the condition.

A.2.1 K. Climatic conditions

Conditions of stationary use	Type of climate									Class*										
	Extremely cold	Cold	Cold temperate	Warm temperate	Warm dry	Mild warm dry	Extremely warm dry	Warm damp	Warm damp, equable	3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L
a) Low air temperature °C										+20	+15	+5	+5	–5	–25	–40	–40	–55	–25	–55
Fully air-conditioned location	x	x	x	x	x	x	x	x	x	x[1)]	x	x	x	x	x	x	x	x	x	x
Continuously temperature-controlled locations	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Temperature controlled locations. Heating or cooling may be switched off for periods, but occurrence of extremely low temperatures is prevented	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x
Locations without temperature control. Heating may be used, where necessary, to avoid extremely low temperatures	x	x	x	x	x	x	x	x	x					x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate							x	x	x		x	x	x	x	x	x	x	x	x	x
						x	x	x	x			x	x	x	x	x	x	x	x	x
				x	x	x	x	x	x					x	x	x	x	x	x	x
			x	x	x	x	x	x	x							x	x	x		x
	x	x	x	x	x	x	x	x	x									x		x
Locations without temperature control. The building construction provides minimal protection from daily variations in outside (i.e. open-air) climate								x	x			x	x	x	x	x	x	x	x	x
							x	x	x					x	x	x	x	x	x	x
				x	x	x	x	x	x						x	x	x	x	x	x
			x	x	x	x	x	x	x							x	x	x		x
	x	x	x	x	x	x	x	x	x									x		x
b) High air temperature (see table 2) °C										+25	+30	+40	+40 Z	+45 Z	155	+70	+40	+70	+70	+55
Fully air-conditioned locations	x	x	x	x	x	x	x	x	x	x[1)]	x	x	x	x	x	x	x	x	x	x
Continuously temperature-controlled locations	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Temperature controlled locations. Heating or cooling may be switched off for periods, but occurrence of extremely low temperatures is prevented	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x
Locations without temperature control. Building contruction is designed, where necessary, to avoid extremely high temperatures	x	x	x	x	x	x	x	x	x					x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x								x	x	x	x	x	x	x	x	x	x
	x	x	x	x					x				x	x	x		x	x	x	x
	x	x	x	x	x	x		x	x					x	x		x	x	x	x
	x	x	x	x	x	x	x	x	x						x		x	x	x	
																	x			
Locations without temperature control. The building construction provides minimal protection from daily variations in outside (i.e. open-air) climate	x	x	x	x				x	x						x	x		x	x	x
	x	x	x	x	x	x		x	x							x		x	x	

A.2.1 K. Climatic conditions *(continued)*

Conditions of stationary use	Type of climate									Class*									
	Extremely cold	Cold	Cold temperate	Warm temperate	Warm dry	Mild warm dry	Extremely warm dry	Warm damp	Warm damp, equable	3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L
c) Low relative humidity %										20	10	5	5	5	10	10	10	10	10	10
Fully air-conditioned location	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Continuously temperature-controlled locations. Additional humidification may be used, where necessary, to avoid extremely dry conditions	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Temperature controlled locations. Heating or cooling may be switched off for periods. Additional humidification may be used, where necessary, to avoid extremely dry condition	x	x	x	x	x	x	x	x	x			x	x	x						
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x x	x x	x x	x x	x x	x x	x x	x x	x x		x	x x	x x	x x	x x	x x	x x	x x	x x	x x
Locations without temperature control. The building construction provides minimal protection from daily variations in outside (i.e. open-air) climate						x	x	x x	x x		x	x x	x x	x x	x x	x	x	x	x	x
d) High relative humidity %										75	75	85	95	95	100	100	100	100	100	100
Fully air-conditioned location	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Continuously temperature-controlled locations. Dehumidification may be used, where necessary, to avoid extremely humid conditions	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Temperature controlled locations. Heating or cooling may be switched off for periods.			x	x								x	x	x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x x	x x	x x	x x	x x	x x	x	x	x				x	x	x x	x x	x x	x x	x x	x x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x	x	x	x	x	x						x	x	x	x	x	x
e) Low absolute humidity g/m^3										4	2	1	1	1	0,5	0,1	0,1	0,02	0,5	0,02
Fully air-conditioned location	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Continuously temperature-controlled locations. Additional humidification may be used, where necessary, to avoid extremely dry conditions	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x

A.2.1 K. Climatic conditions *(continued)*

Conditions of stationary use	Type of climate									Class*									
	Extremely cold	Cold	Cold temperate	Warm temperate	Warm dry	Mild warm dry	Extremely warm dry	Warm damp	Warm damp, equable	3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L
Temperature controlled locations. Heating or cooling may be switched off for periods. Additional humidification may be used, where necessary, to avoid extremely dry condition	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
					x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
				x	x	x	x	x	x							x	x	x		x
																		x		x
Locations without temperature control. The building construction provides minimal protection from daily variations in outside (i.e. open-air) climate							x	x	x		x	x	x	x	x	x	x	x	x	x
						x	x	x	x		x	x	x	x	x	x	x	x	x	x
				x	x	x	x	x	x						x	x	x	x	x	x
			x	x	x	x	x	x	x							x	x	x		x
		x	x	x	x	x	x	x	x									x		x
f) High relative humidity g/m³										15	22	25	29	29	29	35	35	35	29	35
Fully air-conditioned location	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Continuously temperature-controlled locations. Dehumidification may be used, where necessary, to avoid extremely humid conditions	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Temperature controlled locations. Heating or cooling may be switched off for periods.	x	x	x	x	x	x					x	x	x	x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x	x	x	x					x	x	x	x	x	x	x	x	x
	x	x	x	x	x	x	x	x					x	x	x	x	x	x	x	x
	x	x	x	x	x	x	x	x	x							x	x	x	x	
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x							x	x	x	x	x	x	x	x	x	x
	x	x	x	x	x	x						x	x	x	x	x	x	x	x	x
	x	x	x	x	x	x	x						x	x	x	x	x	x	x	x
	x	x	x	x	x	x	x	x								x	x	x	x	
g) Rate of change of temperature °C/min										0,1	0,5	0,5	0,5	0,5	0,5	1,0	1,0	1,0	1,0	1,0
Air-conditioned or continuously temperature-controlled locations	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Temperature-controlled locations. Heating or cooling may be switched off for periods.	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
									x		x	x	x	x	x	x	x	x	x	x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x

A.2.1 K. Climatic conditions *(continued)*

Conditions of stationary use	Type of climate									Class*										
	Extremely cold	Cold	Cold temperate	Warm temperate	Warm dry	Mild warm dry	Extremely warm dry	Warm damp	Warm damp, equable	3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L
h) Low air pressure (see table 2) kPa										70 Z	70 Z	70 Z	70 Z	70 Z	70 Z	70 Z	70 Z	70 Z	70 Z	70 Z
Locations at or below 3 000 m altitude, vented to the surrounding atmosphere	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
i) High air pressure kPa										106	106	106	106	106	106	106	106	106	106	106
Locations on the Earth's surface, vented to the surrounding atmosphere	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
j) Solar radiation W/m^2										500	700	700	700	700	1120	1120	None	1120	1120	1120
Locations protected from solra radiation	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Air-conditioned location	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x
Locations with glazed openings (windows, doors, etc.)	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x
Locations in transparent structures, or locations with unglazed openings	x	x	x	x	x	x	x	x	x						x	x		x	x	x
k) heat radiation (see table 2)										None	Z	Z	Z	Z	Z	Z	Z	Z	Z	z
Air-conditioned location	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Any other locations	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
l) Movement of surrounding air (see table 2) m/s											0,5	1,0 z	1,0 z	1,0 z	1,0 z	5,0 z	5,0 z	5,0 z	5,0 z	5,0 z
Locations with no doors or windows openabled to the open air, e.g.air-conditioned locations	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Locations with doors or windows openabled to the open air, or only partially weather protected Locations with draughts due to process conditions	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
m) Condensation											No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Air-conditioned or continuously temperature-controlled locations	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Temperature-controlled locations. Heating or cooling may be switched off for periods. Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x x	x x	x	x	x	x	x		x	x	x x	x x	x x	x x	x x	x x	x x	x x
Locations without temperature control. The building construction provides protection from daily variations in outside (i.e. open-air) climate	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x

A.2.1 K. Climatic conditions *(concluded)*

Conditions of stationary use	Type of climate									Class*										
	Extremely cold	Cold	Cold temperate	Warm temperate	Warm dry	Mild warm dry	Extremely warm dry	Warm damp	Warm damp, equable	3K1	3K2	3K3	3K4	3K5	3K6	3K7	3K7L	3K8	3K8H	3K8L
n) Wind-driven precipitation (rain, snow, hail, etc.)											No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Totally weatherprotected locations	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Partially weatherprotected	x	x	x	x	x	x	x	x	x						x	x	x	x	x	x
o) Water form sources other than rain (see table 2)										None	None	None	Z	Z	Z	Z	Z	Z	Z	
Locations without conditions of additional water	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Locations with conditions of additional water, e.g. due to special use of thhe building or to process conditions	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x
p) Formation of ice										No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Air-conditioned continuously temperature-controlled or temperature controllled locations	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Locations without temperature control	x	x	x	x	x	x	x	x	x		x	x	x	x x	x x	x x	x x	x x	x x	x x

1) These are air-conditioned locations with a tolerance of ±2 °C on stated temperature values.

* The new classes 3K9 and 3K10 will be inserted in the table in a future revision.

A.2.2 B. Biological conditions

Condition of stationary use	Class		
	3B1	3B2	3B3
a) *Flora*	No	Presence of mould, fungus, etc.	Presence of mould, fungus, etc.
Locations with risks of growth of mould, fungus, etc., or protected from growth of mould, fungus, etc.	x	x	x
Locations with risks of growth of mould, fungus, etc. Not protected from growth of mould, fungus, etc.		x	x
b) *Fauna*	No	Presence of rodents and other animals harmful to products, excluding termites	Presence of rodents and other animals harmful to products, including termites
Locations with negligible risks of attacks by rodents and other animals, including termites. Protected from animals	x	x	x
Locations with risks of attacks by rodents and other animals, excluding termites. Not protected from animals		x	x
Locations with risks of attacks by rodents and other animals, including termites. Not protected from animals			x

A.2.3 C. Chemically active substances

Environmental parameter		Class									
		3C1R	3C1L	3C1	3C2		3C3		3C4	
		Maximum value	Maximum value	Maximum value	Mean value	Maximum value	Mean value	Maximum value	Mean value	Maximum value
a) Sea salts and road salts		No	No	No	Salt mist		Salt mist		Salt mist	
b) Sulphur dioxide	mg/m^3	0,01	0,1	0,1	0,3	1,0	5,0	10	13	40
c) Hydrogen sulphide	mg/m^3	0,0015	0,01	0,01	0,1	0,5	3,0	10	14	70
d) Chlorine	mg/m^3	0,001	0,01	0,1	0,1	0,3	0,3	1,0	0,6	3,0
e) Hydrogen chloride	mg/m^3	0,001	0,01	0,1	0,1	0,5	1,0	5,0	1,0	5,0
f) Hydrogen fluoride	mg/m^3	0,001	0,003	0,003	0,01	0,03	0,1	2,0	0,1	2,0
g) Ammonia	mg/m^3	0,03	0,3	0,3	1,0	3,0	10	35	35	175
h) Ozone	mg/m^3	0,004	0,01	0,01	0,05	0,1	0,1	0,3	0,2	2,0
i) Nitrogen oxides	mg/m^3	0,01	0,1	0,1	0,5	1,0	3,0	9,0	10	20
Location with stringently monitored and controlled atmosphere (clean room category)		x	x	x	x		x		x	
Location with continuously controlled atmosphere			x	x	x		x		x	
Locations in rural and some urban areas with industrial activities or with moderate traffic				x	x		x		x	
Locations in urban areas with industrial activities or with heavy traffic					x		x		x	
Locations in immediate neigbourhood of industrial sources with chemical emissions							x		x	
Locations within industrial plants. Emission of chemical pollutants in high concentrations									x	
NOTE It is not mandatory to consider each of the classes 3C3 and 3C4 as a requirement for the combined effect of all parameters stated. If applicable, values of single parameters may be selected from these classes. In such cases, the severities of class 3C2 are valid for all parameters not especially named.										

A.2.4 S. Mechanically active substances

Condition of stationary use		Class			
		3S1	3S2	3S3	3S4
a) Sand	mg/m^3	None	30	300	3 000
b) Dust (suspension)	mg/m^3	0,01	0,2	0,4	4,0
c) Dust (sedimentation)	$mg/(m^2 \cdot h)$	0,4	1,5	15	40
Locations where precautions have been taken to minimize the presence of dust. Locations not in close proximity to sand sources		x	x	x	x
Locations without special precautions to minimize the presence of sand or dust but not in proximity to sand or dust sources			x	x	x
Locations in close proximity to sand or dust sources				x	x
Locations with processes producing sand or dust, or in geographical areas with high proportion of wind-driven sandor dust in air					x

A.2.5 M. Mechanical conditions

Condition of stationary use		Class							
		3M1	3M2	3M3	3M4	3M5	3M6	3M7	3M8
a) Stationary vibration, sinusoidal:									
displacement amplitude	mm	0,3	1,5	1,5	3,0	3,0	7,0	10	15
acceleration amplitude	m/s^2	1	5	5	10	10	20	30	50
frequency range	Hz	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200	2-9 9-200
Locations where levels of vibration are insignificant or of a low significance		x	x x	x x	x x	x x	x x	x x	x x
Locations where levels of vibration are significant or high					x	x	x x	x x	x x
Locations where levels of vibration are very high or extremely high								x	x x
b) Non-stationary vibration, including shock:									
shock response spectrum type L, peak acceleration *â*	m/s^2	40	40	70	None	None	None	None	None
shock response spectrum type I, peak acceleration *â*	m/s^2	None	None	None	100	None	None	None	None
shock response spectrum type II, peak acceleration *â*	m/s^2	None	None	None	None	250	250	250	250
Locations with insignificant levels of shock		x	x x	x x	x x	x x	x x	x x	x x
Locations where levels of shock are of low significance or significant				x	x x	x x	x x	x x	x x
Locations where levels of shock are of low significance or significant						x	x x	x x x	x x x x

NOTE Alternative classes are given to allow for product design, mounting and intensity of vibration or shock.

A.3 Summary of conditions covered by the classes

This summary contains a description of the complete classification.

A.3.1 K. Climatic conditions

These are covered by eleven class notations as follows:

3K1 This class applies to fully air-conditioned enclosed locations.

Air temperature and humidity control is used continuously to maintain the required conditions.

Installed products may be exposed to attenuated solar radiation and to movements of surrounding air due to draughts from the air-conditioning system. They are not subjected to heat radiation, condensed water, precipitation, water from sources other than rain, or formation of ice.

The conditions of this class may be found in rooms of such construction that a confined range of temperature and humidity may be maintained.

3K2 In addition to the conditions covered by 3K1, the class 3K2 applies to continuously temperature-controlled enclosed locations. Humidity is not controlled.

Heating, cooling or humidification is used where necessary to maintain the required conditions, especially where there is a large difference between them and the open-air climate.

Installed products may be exposed to solar radiation and to heat radiation. They may also be exposed to movements of surrounding air due to draughts in buildings, e.g. through open windows, or due to special process conditions.

The conditions of this class may be found in continuously manned offices, workshops and other rooms for special applications.

3K3 In addition to the conditions covered by 3K2, the class 3K3 applies to temperature-controlled enclosed locations. Humidity is not controlled.

Heating or cooling is used to maintain the required conditions, especially where there is a large difference between them and the open-air climate.

The conditions of this class may be found in normal living or working areas, e.g. living rooms, rooms for general use (theatres, restaurants, etc.), offices, shops, workshops for electronic assemblies and other electrotechnical products, telecommunication centres, storage rooms for valuable and sensitive products.

3K4 In addition to the conditions covered by 3K3, the class 3K4 applies to temperature-controlled enclosed locations with a wide range of relative humidity. Humidity is not controlled.

Installed products may be subjected to condensed water and to water from sources other than rain.

The conditions of this class may be found in certain living and working areas, e.g. kitchens, bathrooms, workshops with processes producing high humidity, certain cellars, ordinary storage rooms, stables, garages. For the more humid open-air climates they may also be found in living-rooms and rooms for general use.

3K5 In addition to the conditions covered by 3K4, the class 3K5 applies to enclosed locations having neither temperature nor humidity control.

Heating may be used to raise low temperatures, especially where there is a large difference between the conditions of this class and the open-air climate.

Installed products may be subjected to formation of ice.

The conditions of this class may be found in some entrances and staircases of buildings, in garages, cellars, certain workshops, buildings in factories and industrial process plants, unattended equipment stations, certain telecommunication buildings, ordinary storage rooms for frost-resistant products, farm buildings, etc.

3K6 In addition to the conditions covered by class 3K5, the classes 3K6, 3K7 and 3K8
3K7 apply to the weatherprotected locations, having neither temperature nor humidity
3K8 control. The locations may have openings directly to the open air, i.e. may be only partially weatherprotected.

Class climatic conditions may be affected to a varying extent by the conditions of the open-air climate and the type of building (see subclause 5.1, Climatic conditions).

Installed products may be exposed to solar radiation (exception: 3K7L). They may also be subjected to limited wind-driven precipitation, including snow.

The conditions of these classes may be found in some entrances of buildings, some garages, in sheds, shacks, lofts, telephone booths, buildings in factories and industrial process plants, unattended equipment stations, unattended buildings for telecommunication purposes, ordinary storage rooms for frost-resistant products, farm buildings, etc.

This description includes classes 3K7L, 3K8L and 3K8H.

3K9 Class 3K9 represents the conditions covered by the Warm Damp and Warm Damp Equable types of Open-Air Climate (tropical damp type of climate, in areas with tropical rainforests).

3K10 Class 3K10 represents the conditions covered by the Warm Dry, Mild Warm Dry and Extremely Warm Dry types of Open-Air Climate (tropical dry type of climate, in areas near the tropics such as deserts).

A.3.2 B. Biological conditions

These are covered by three class notations as follows:

3B1 This class applies to locations without particular risks of biological attacks. It includes protective measures, e.g. special product design, or installations in locations of such construction that mould growth, attacks of animals, etc., are not probable.

3B2 In addition to the conditions covered by class 3B1, the class 3B2 applies to locations where mould growth, or attacks of animals, except termites, may occur.

3B3 In addition to the conditions covered by class 3B2, the class 3B3 applies to locations where attacks of termites may occur.

A.3.3 C. Chemically active substances

These are covered by six class notations as follows:

3C1R This class applies to locations with a stringently monitored and controlled atmosphere (clean room category).

3C1L In addition to the conditions covered by class 3C1R, this class applies to locations where the atmosphere is continuously controlled.

3C1 In addition to the conditions covered by class 3C1L, this class applies to locations in rural and some urban areas with low industrial activities and moderate traffic. In winter, heating methods in concentrated urban areas may cause increased contamination. Salt mist may be present in sheltered locations of coastal areas and in offshore sites.

3C2 In addition to the conditions covered by class 3C1, the class 3C2 applies to locations with normal levels of contaminants, experienced in urban areas with industrial activities scattered over the whole area, or with heavy traffic.

3C3 In addition to the conditions covered by class 3C2, the class 3C3 applies to locations in the immediate neighbourhood of industrial sources with chemical emissions.

3C4 In addition to the conditions covered by class 3C3, the class 3C4 applies to locations within industrial process plants. Emissions of chemical pollutants in high concentrations may occur.

A.3.4 S. Mechanically active substances

These are covered by four class notations as follows:

3S1 This class applies to locations where precautions have been taken to minimize the presence of dust. Ingress of sand is prevented.

3S2 In addition to the conditions covered by class 3S1, the class 3S2 applies to locations without special precautions to minimize the presence of sand or dust, but not situated in proximity to sand or dust sources.

3S3 In addition to the conditions covered by class 3S2, the class 3S3 applies to locations in close proximity to sand or dust sources.

3S4 In addition to the conditions covered by class 3S3, the class 3S4 applies to locations with processes producing sand or dust, or which are situated in geographical areas with a high proportion of wind-driven sand or dust in air.

A.3.5 M. Mechanical conditions

These are covered by eight class notations as follows:

3M1 This class applies to locations with insignificant vibration and shock.

3M2 In addition to the conditions covered by class 3M1, the class 3M2 applies to locations with vibration of low significance, e.g. for products fastened to light supporting structures subjected to negligible vibrations.

3M3 In addition to the conditions covered by class 3M2, the class 3M3 applies to locations with shock of low significance, e.g. shocks transmitted from local blasting or pile-driving activities, slamming doors, etc.

3M4 In addition to the conditions covered by class 3M3, the class 3M4 applies to locations with significant vibration and shock, e.g. transmitted from machines or passing vehicles in the vicinity, etc.

3M5 In addition to the conditions covered by class 3M4, the class 3M5 applies to locations where the level of shock is high, e.g. adjacent to heavy machines, conveyor belts, etc.

3M6 In addition to the conditions covered by class 3M5, the class 3M6 applies to locations where the level of vibration is high, e.g. close to heavy machines.

3M7 In addition to the conditions covered by class 3M6, the class 3M7 applies to locations where the level of vibration is very high, e.g. for products mounted directly on machines.

3M8 In addition to the conditions covered by class 3M7, the class 3M8 applies to locations where the level of vibration is extremely high, e.g. products mounted on power-hammers, etc.

NOTE Selection of the relevant class is dependent on product design, mounting and intensity of vibration or shock.

A.3.6 T Time to flashover

This is covered by five class notations as follows:

3T1 This class applies to conditions at enclosed locations in, for instance, dwellings, offices and hotels, with incombustible materials on walls and ceiling, and with fittings, furnishings, etc. made of material with a low rate of combustion. For furnishings such as chairs, sofas and beds, this requires cover and filling material to be flame retardant treated.

3T2 In addition to the conditions covered by 3T1, class 3T2 applies to locations with combustible material on walls and ceiling, having a low rate of combustion such as gypsum plaster board with paper, PVC or textile wall covering.

3T3 In addition to the conditions covered by 3T2, class 3T3 applies to locations with fittings, furnishings, etc. made of material with a moderate rate of combustion. Chairs and sofas with standard polyurethane filling material, and cotton or wool-viscose as cover materials, are examples of such furnishings.

3T4 In addition to the conditions covered by 3T3, class 3T4 applies to locations with combustible material on walls and ceiling, having a moderate rate of combustion such as particle boards.

3T5 In addition to the conditions covered by 3T4, class 3T5 applies to locations with combustible material on walls and ceiling, and with fittings, furnishings, etc. made of material with a high rate of combustion. These conditions may be found in locations with wood panelling, insulating fibre board on walls and ceiling, and with furnishings such as chairs and sofas with acrylic cover material.

A.3.7 P Thermal conditions prior to flashover

These are covered by five class notations as follows:

3P1 This class applies to conditions at enclosed locations with a low fire load density and having a low rate of combustion (see A.3.6). The conditions of this class may be found in garages, mechanical workshops and sport centres.

3P2 In addition to the conditions covered by 3P1, class 3P2 applies to locations with fittings, furnishings, etc. made of material having a moderate rate of combustion (see A.3.6).

3P3 In addition to the conditions covered by 3P2, class 3P3 applies to locations with a moderate fire load density. The conditions of this class may be found in dwellings, schools and hospitals.

3P4 In addition to the conditions covered by 3P3, class 3P4 applies to locations with fittings, furnishings, etc. made of material with a high rate of combustion.

3P5 In addition to the conditions covered by 3P4, class 3P5 applies to locations with a high or very high fire load density such as some types of offices, shopping centres, libraries, and plastic and timber industries.

A.3.8 F Thermal conditions following flashover

These are covered by four class notations as follows:

3F1 This class applies to conditions at enclosed locations having a low fire load density (see A.3.7).

3F2 In addition to the conditions covered by 3F1, class 3F2 applies to locations having a moderate fire load density (see A.3.7).

3F3 In addition to the conditions covered by 3F2, class 3F3 applies to locations having a high fire load density (see A.3.7).

3F4 In addition to the conditions covered by 3F3, class 3F4 applies to locations having a very high fire load density. The conditions of this class may be found in special offices, libraries and archives.

A.3.9 V Conditions with respect to visibility through smoke

These are covered by four class notations.

No specific descriptive summary is considered necessary. However, a specific visibility of 10 m corresponding to an optical density of 0,1 1/m is normally required for evacuation of public spaces; for dwellings, a specific visibility of 2 m to 3 m corresponding to an optical density of 0,5 1/m is normally sufficient.

A.3.10 H Conditions of chemically active substances

These are covered by four class notations as follows:

3H1 This class covers conditions at enclosed locations not immediately adjacent to a space with a fire in material liable to exude chemically active substances, e.g. PVC cables.

3H2 In addition to the conditions covered by 3H1, class 3H2 applies to locations adjacent to a space with a fire in material liable to exude chemically active substances, e.g. PVC cables.

3H3 In addition to the conditions covered by 3H2, class 3H3 applies to locations with a fire in a moderate amount of material liable to exude chemically active substances, e.g. PVC cables.

3H4 In addition to the conditions covered by 3H3, class 3H4 applies to locations with a fire in a large amount of material liable to exude chemically active substances, e.g. PVC cables.

Annex B
(informative)

Climatograms

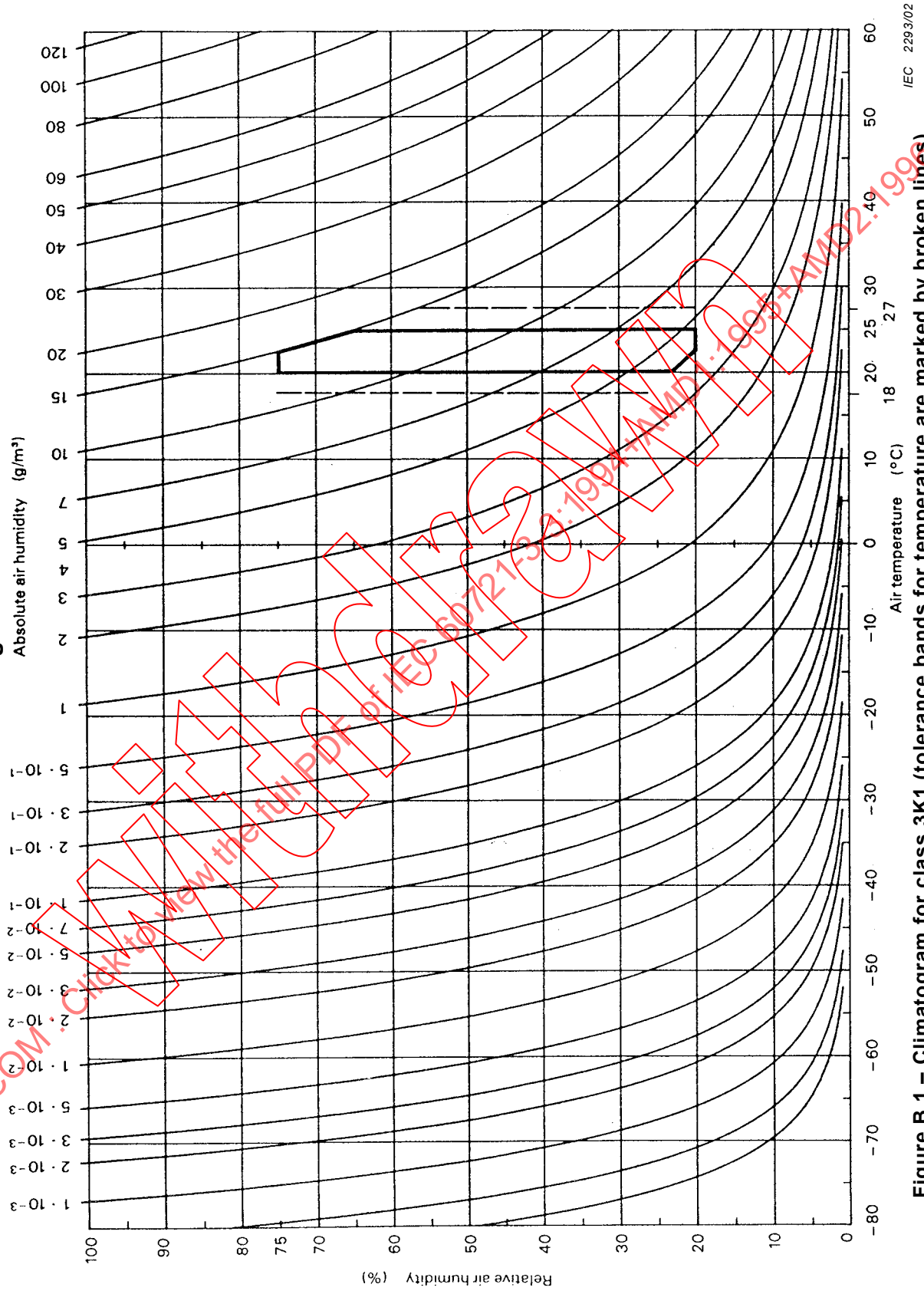


Figure B.1 – Climatogram for class 3K1 (tolerance bands for temperature are marked by broken lines)

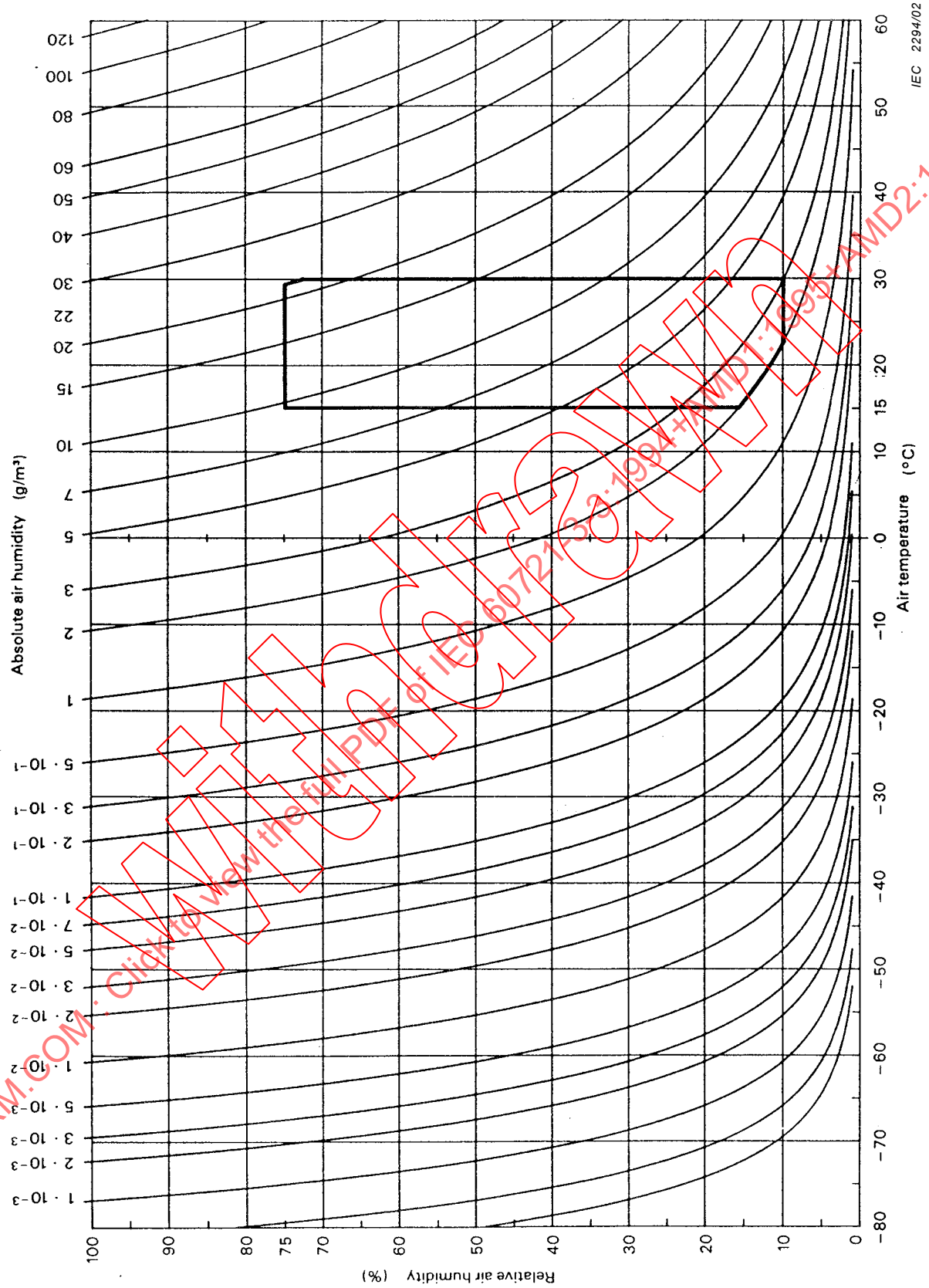


Figure B.2 – Climatogram for class 3K2

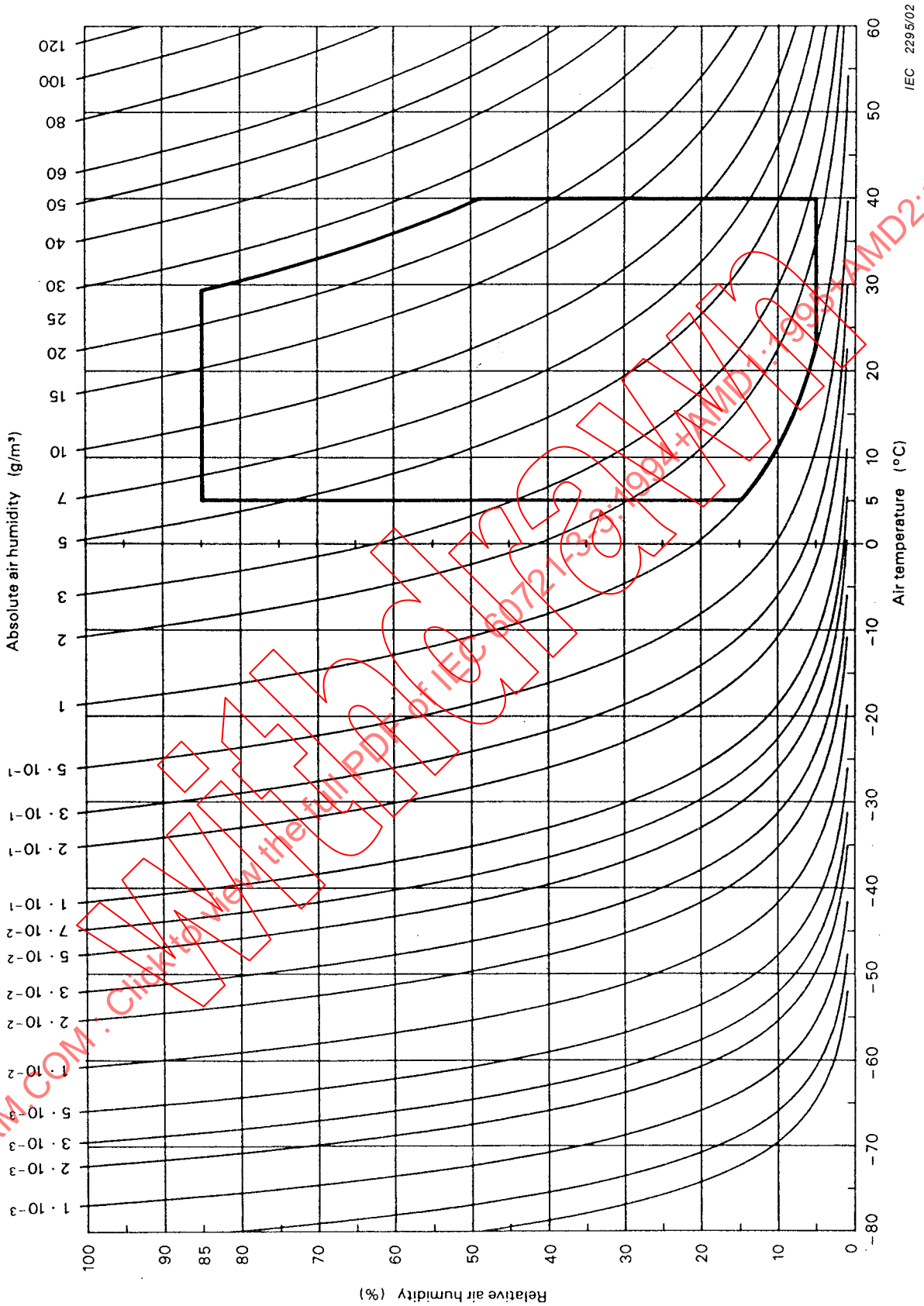


Figure B.3 – Climatogram for class 3K3

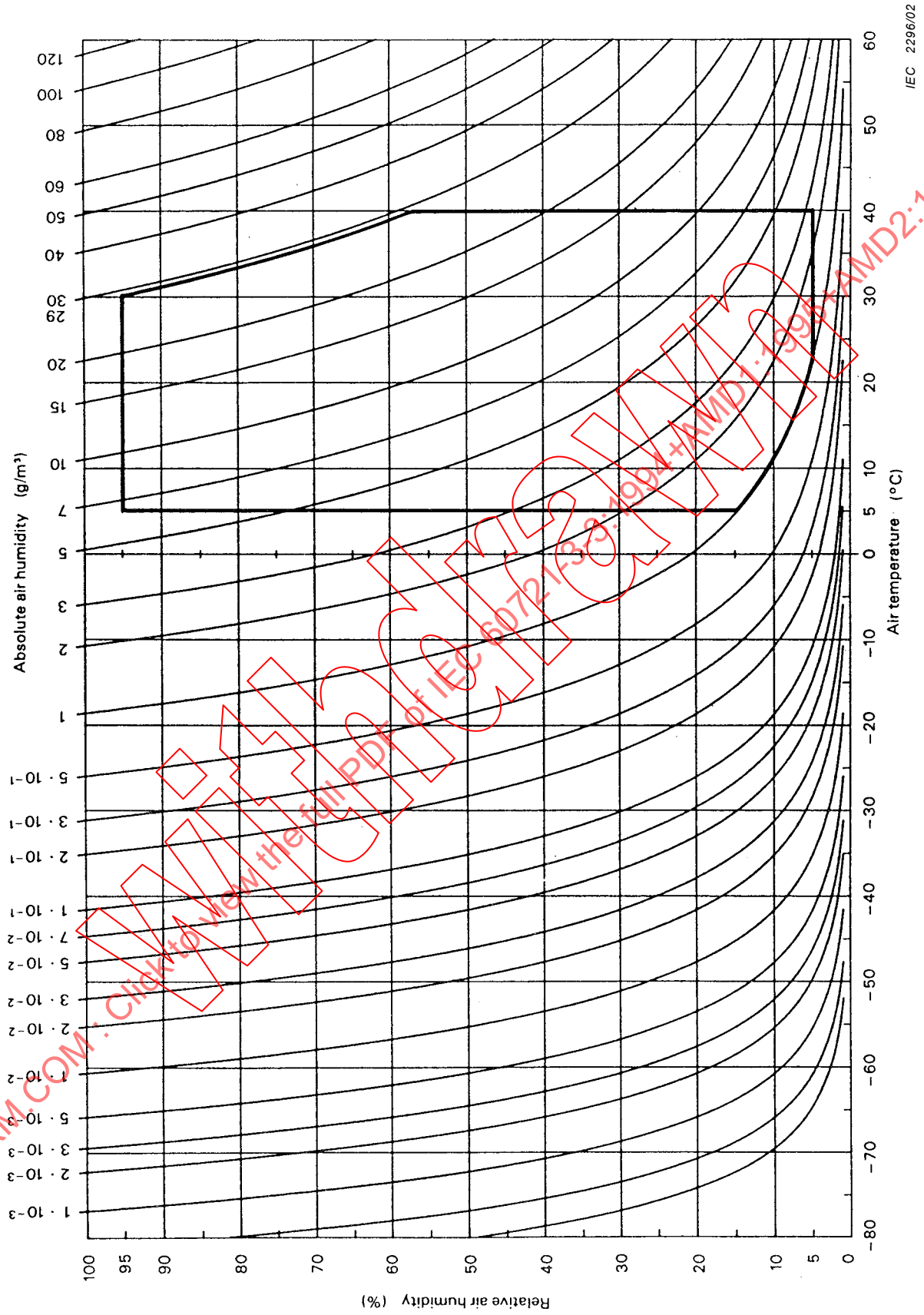


Figure B.4 – Climatogram for class 3K4

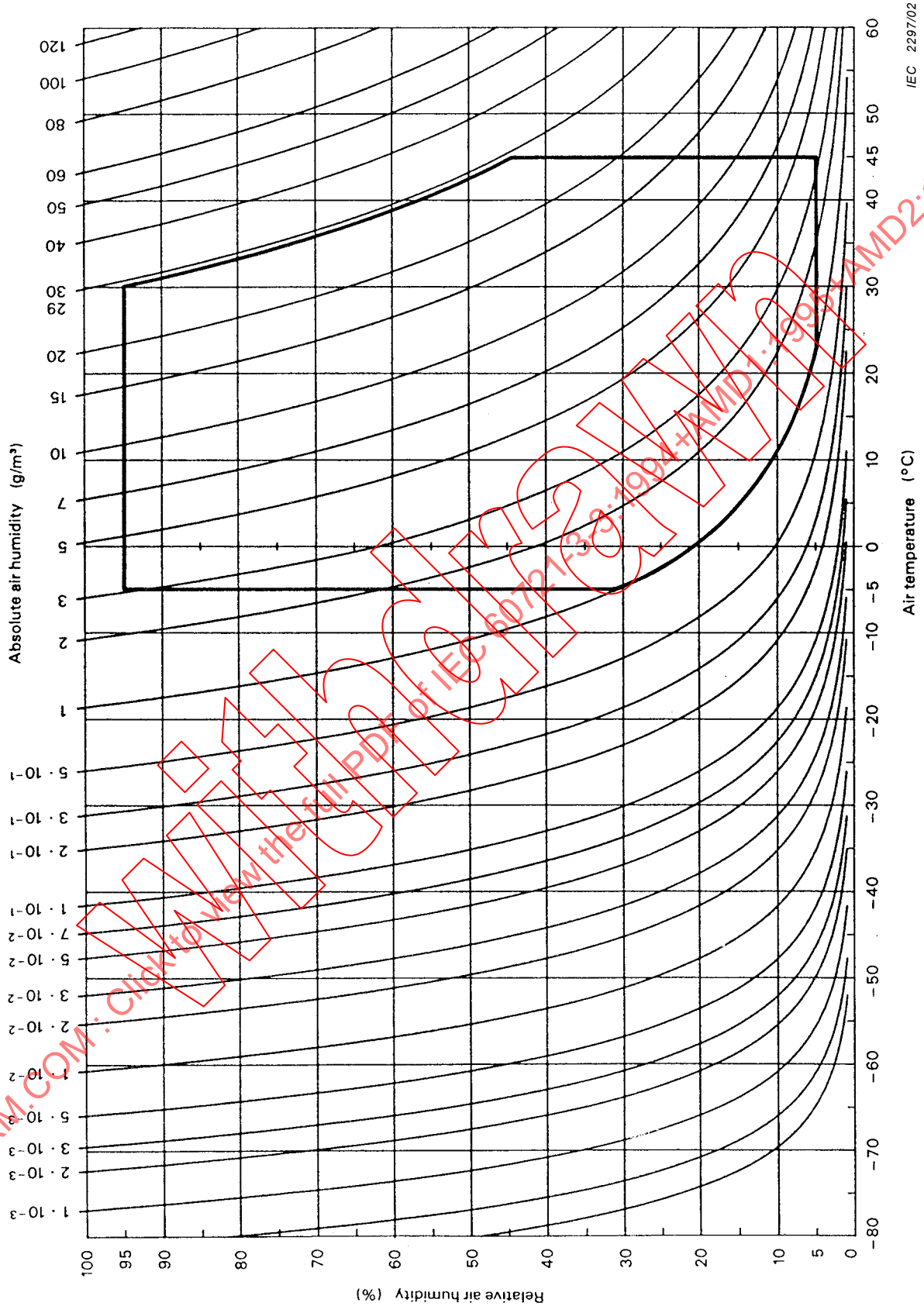


Figure B.5 – Climatogram for class 3K5

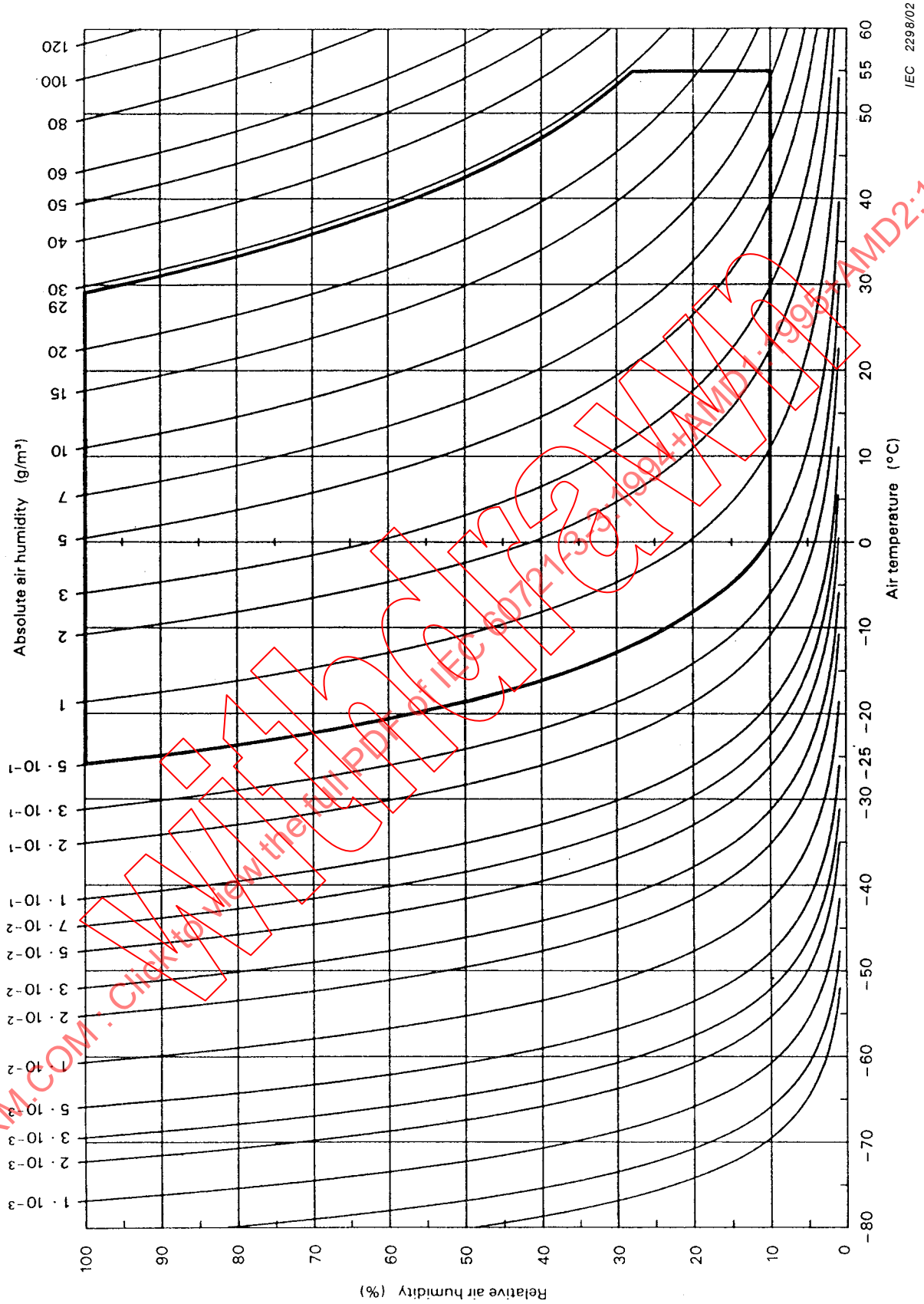


Figure B.6 – Climatogram for class 3K6

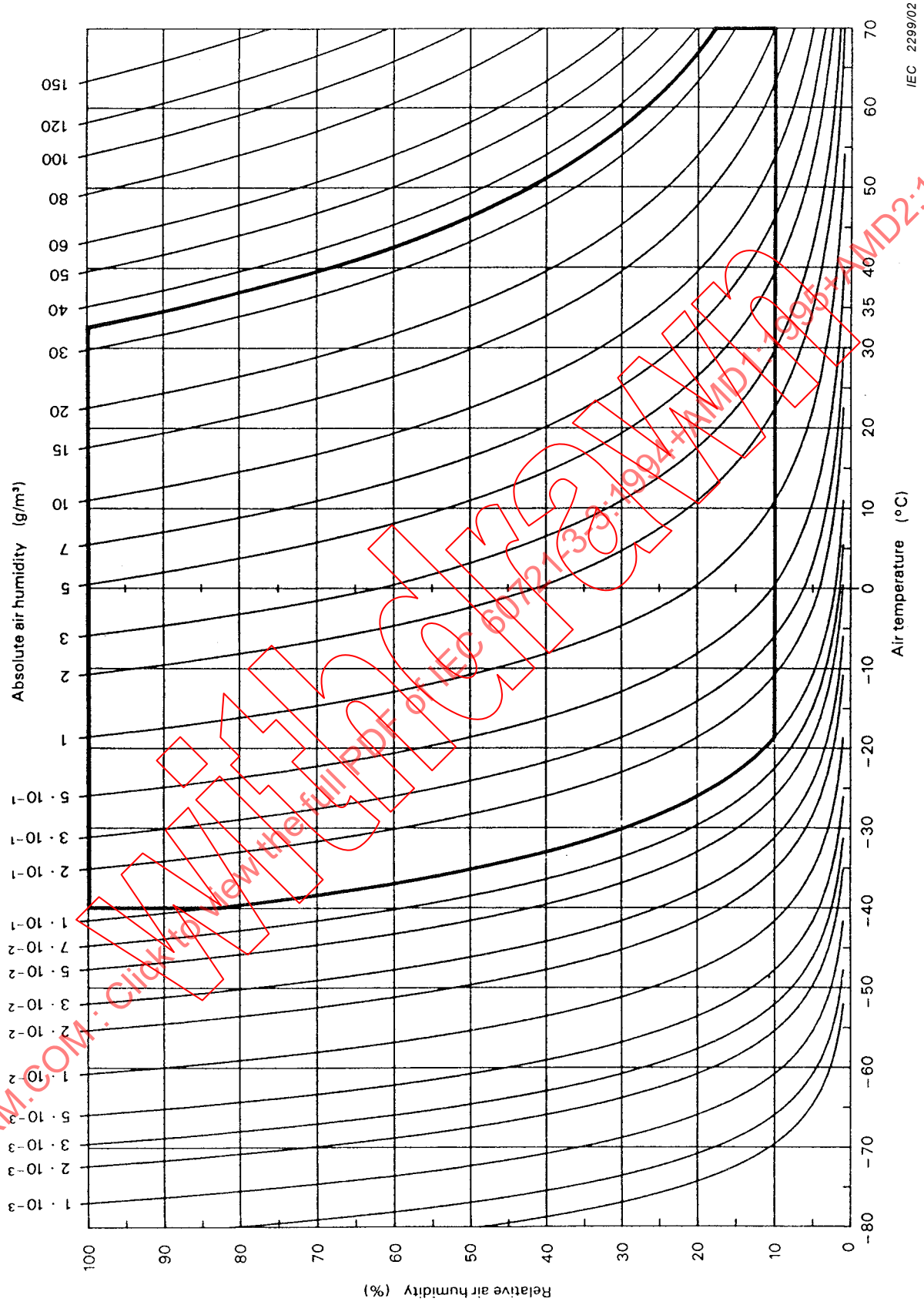


Figure B.7 – Climatogram for class 3K7

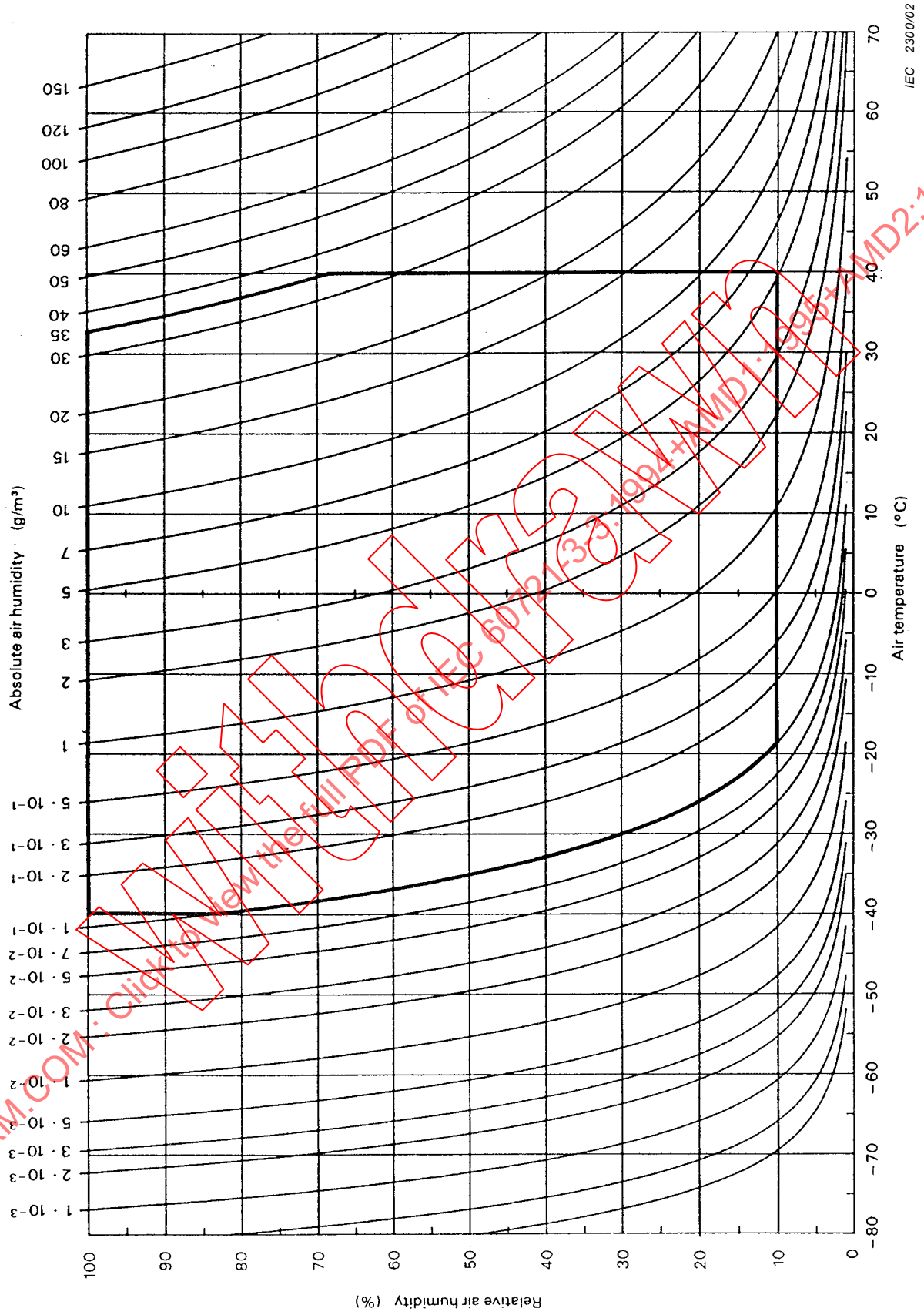


Figure B.8 – Climatogram for class 3K7L

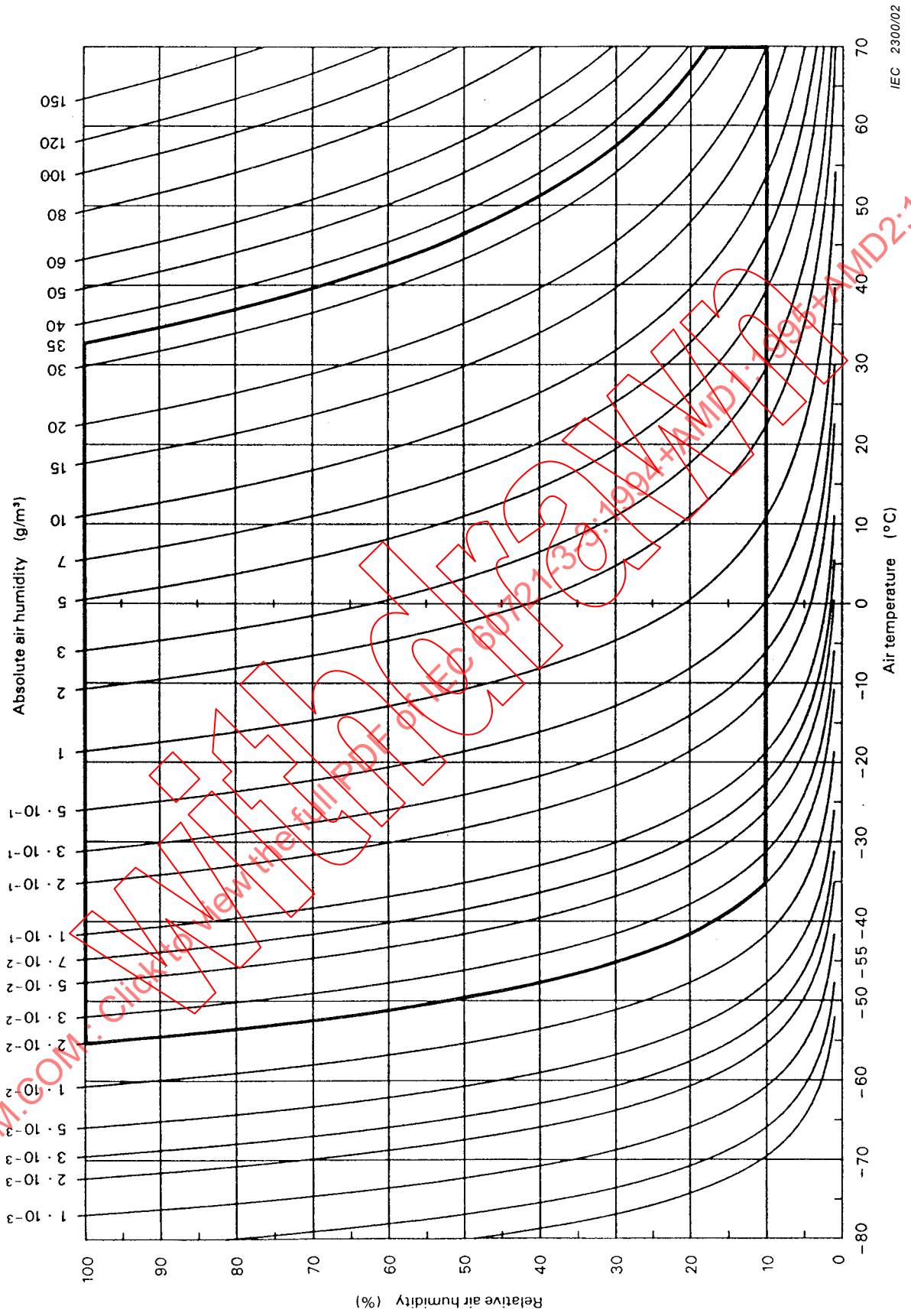


Figure B.9 – Climatogram for class 3K8