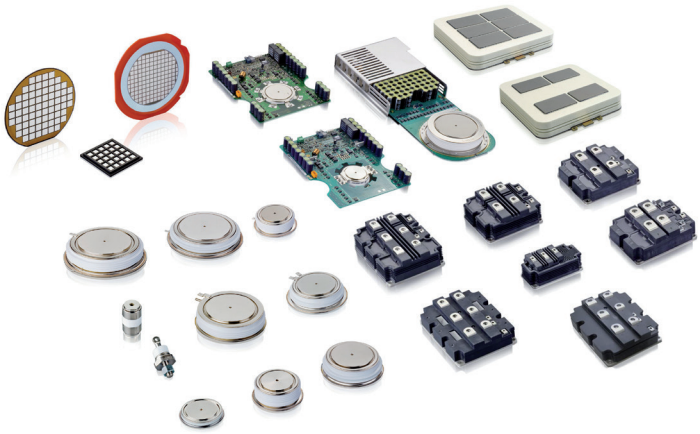
Application Note 5SZK 9105-00

Transport of diodes, PCTs and GTOs Environmental specification

The transportation of the hermetic pressure contact Diodes, PCTs and GTOs is classified according to IEC 60721-3-2 set IE23.



Time limitation for transportation

For the transportation by lorries, trailers and train within Europe a transportation duration of maximum 10 days shall not be exceeded. For an intercontinental transport including a transport by ship and by airplane a transportation duration of maximum 30 days shall not be exceeded.
The specification as described in this document is only valid for devices as produced and packed by ABB Switzerland Ud, Semiconductors.

Description of class IE23

This set includes transportation in all kind of lorries and trailers; in areas with weil developed road systems, by train with specially designed shock-reduced buffers and by ships, if by air only in heated, pressurized holds; with risk of mould growth and attacks by animals except termites; in areas with normal industrial activities excluding those with large quantities of chemical pollutants; excluding sand desert areas[1].

Set of class IE23

Condition	Class
Climatic	2K4[2]
Biological	282
Chemically active substances	2C2
Mechanically active substances	282
Mechanical	2M2

Climatic conditions[3]

This class covers transportation in unventilated enclosures including weatherprotected transportation in cold temperature climate. Transportation by air only in heated, pressurized holds is included. The high air temperatures are limited to those within the general open-air climates. The conditions of humidity of the worldwide open-air climates are not more severe than in the general open-air climates and therefore, such a limitation is not made for the humidity conditions. The product may be moved between cold outdoor and warm indoor conditions. It may be exposed to direct solar radiation. Outdoor exposure does not include subjection to sea waves.[4]

Environmental parameter	Class 2K4
Low air temperature	-40°C
High air temperature, air in unventilated enclosures	+70°C
High air temperature, air in ventilated enclosures or outdoor	+40°C
Change of temperature, airfair	-40°C / +30°C
Change of temperature air/water	+40°C / +5°C
Relative humidity, not combined with rapid temperature changes	95% / +45°C
Relative humidity, combined with rapid temperature changes: airfair at high relative humidity	95% -40°C / +30°C
Absolute humidity, combined with rapid temperature changes: airfair at high relative humidity	60g/m^3 +70°C / +15°C
Low air pressure	70kPa
Change of air pressure	No
Movement of surrounding medium, air	20m/s
Precipitation, rain	No
Precipitation, solar	1120W/m^2
Heat radiation	600W/m^2
Water from sources other than rain	1m/s
Wetness	No

Biological conditions

This class includes areas and conditions where mould growth, attacks of animals except termites may occur.[5]

Environmental parameter	Class 2B2
Flora	Presence of mould, fungus, etc
Fauna	Presence of rodents or other animals harmful to products, excluding termites.

Chemical conditions

This class covers transportation, where the product is placed indoors in such a way that it is protected from salt mist. This class also includes outdoor transportation except sea transport on open decks of ships. Transportation also takes place in areas with normal industrial activities, excluding those where large quantities of chemical pollutants are emitted.[6]

Environmental parameter	Class 2C2	
Sea salts	No conditions of salt mist	
Sulfur dioxide	1.0mg/m^3	(0.3mg/m^3)
	0.37cm^3/m^3	(0.11 cm^3/m^3)
Hydrogen sulfide	0.5mg/m^3	(0.1mg/m^3)
	0.36cm^3/m^3	(0.071cm^3/m^3)
Hydrogen chloride	0.5mg/m^3	(0.1mg/m^3)
	0.33cm^3/m^3	(0.066cm^3/m^3)
Hydrogen fluoride	0.03mg/m^3	(0.01mg/m^3)
	0.036cm^3/m^3	(0.012cm^3/m^3)
Ammonia	3.0mg/m^3	(1.0mg/m^3)
	4.2cm^3/m^3	(1.4cm^3/m^3)
Ozone	0.1mg/m^3	(0.05mg/m^3)
	0.05cm^3/m^3	(0.025cm^3/m^3)
Nitrogen Oxides (expressed in equivalent values of nitrogen dioxide)	1.0mg/m^3	(0.5mg/m^3)
	0.52cm^3/m^3	0.26cm^3/m^3)

The figures given are maximum values, occurring over a 30min period per day.
The figures within brackets are the expected long-term mean values.
The values given in cm^3/m^3 have been calculated from the values given in mg/m^3 and refer to 20°C and 101.3kPA. The table uses rounded values.

Mechanically active substances

This class covers outdoor transportation, as well as indoor, where sweeping of dusty floors is taken into account. Transportation in sand desert areas is not included.[7]

Environmental parameter	Class 2S2
Sand in air	0.1g/m^3
Dust (sedimentation)	3mg/(m^2 h)

Mechanical conditions

This class covers mechanical loading as well as transportation in aircraft, in all kinds of lorries and trailers in areas with well-developed road systems. It also includes transportation by trains with specially designed shock reducing buffers and by ships.[8]

1 see IEC 60721-3-2, Annex B, page 41
2 This class is only valid with restrictions described in the paragraph for Climatic conditions
3 The description of the climatic conditions deviate from the original description of the standard.
4 see IEC 60721-3-2, Annex A, page 35, 36
5 see IEC 60721-3-2, Annex A, page 37
6 see IEC 60721-3-2, Annex A, page 38, 39
7 see IEC 60721-3-2, Annex A, page 35

Environmental parameter	Class 2M2		
a) Stationary vibration sinusoidal			
Displacement	3.5mm		
Acceleration		10m/s^2	15m/s^2
Frequency range	2-9Hz	9-200Hz	200-500Hz
b) Stationary vibration random			
Acceleration spectral density	1.0 m^2/s^3	0.3 m^2/s^3	
Frequency range	10-200Hz	200-2000Hz	
c) Non-stationary vibration including shock			
Shock response spectrum type I	100m/s^2		
Peak acceleration			
Shock response spectrum type II	300m/s^2		
Peak acceleration			
d) Free fall			
Mass less than 20kg	1.2m		
Mass 20kg to 100kg	1.0m		
Mass more then 100kg	0.25m		
e) Toppling			
Mass less than 20kg	Toppling around any of the edges		
Mass 20kg to 100kg	Toppling around any of the edges		
Mass more then 100kg	No		
f) Rolling and pitching			
Angle	±35°		
Period	8s		
g) Acceleration steady state	20m/s^2		
h) Static load	10kPa		

8 see IEC 60721-3-2, Annex A, page 39

Revision history

Prepared	Checked 1	Checked 2	Approved	Date
Stiasny	Backlund		Schlegel	10.04.04

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