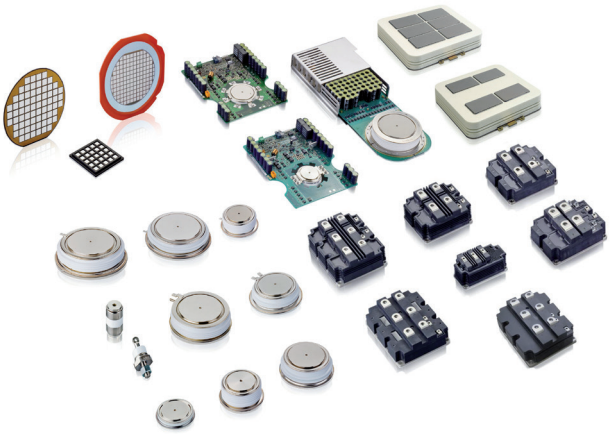
Application note 5SZK 9107-00

Operation of pressure contact IGCTs

The operation of the pressure contact IGCT is classified according to IEC 60721-3-3 (Edition 2.2) set IE33.



Validity

GCTs with F-, H-, L-, housing and all gate units designed by ABB Switzerland Ltd. Semiconductors (gate unit part number with 5SXE 04-XXXX or higher), effective from delivery date September 2005.

Time limitation for operation

Within the context of this specification a useful life of 20 years is assumed. The time limitation of operational life however may be dominated by the applied functional load, which is not a topic of this generic specification.

Altitude

The altitude at which the equipment is normally to function does not exceed 2'000 m above sea level. NOTE – For installation at higher altitudes, it is necessary to take into account the reduction of the dielectric strength and of the cooling effect of the air. Equipment so used should be used according to an agreement between the manufacturer and the user.

Description of class IE33

IE33 applies to locations, continuously temperature-controlled, with heating cooling or humidification used where necessary to maintain required conditions, installed products exposed to some solar radiation, without particular risk of biological attacks, with normal levels of contaminants, sand and dust experienced in urban areas with industrial activities, with vibration of low significance, such as rooms for general use, workshops.[1]

Set of class IE33

Condition	Class
Climatic	3K3
Special climatic	3Z2, 3Z4
Biological	3B1
Chemically active substances	3C1[2]
Mechanically active substances	3S2
Mechanical	3M2

Climatic conditions

This class applies to temperature controlled enclosed locations. Installed products may be exposed to attenuated solar radiation and to movements of surrounding air due to draughts from air-conditioning system. They are not subjected to heat radiation, condensed water, precipitation, water from sources other than rain, or formation of ice. Heating or cooling is used to maintain the required conditions, especially where there is a large difference between them and the open-air climate.

Environmental parameter	Class 3K3
Low air temperature	+0 °C[3]
High air temperature	+45 °C[3,4]
Low relative humidity	5 %
High relative humidity	85 %
Low absolute humidity	1 g/m^3[3]
High absolute humidity	25 g/m^3[3]
Rate of change of temperature	0.5 °C/min
Low air pressure	70 kPa[5,6]
High air pressure	106 kPa
Solar radiation	N.A.[2]
Heat radiation	see special climatic conditions
Movement of surrounding air	N.A.[2]
Condensation	No
Precipitation	No
Rain intensity	No
Low rain temperature	No
Water from sources other than rain	No
Formation of ice and frost	No

Special climatic conditions[7]

Environmental parameter	Class 3Z2, 3Z4
Heat radiation	Heat radiation, e.g. in the vicinity of room heating
Movement of surrounding air	N.A.[8]

Biological conditions

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.[9]

Environmental parameter	Class 3B1
Flora	No
Fauna	No

Chemical conditions

This class applies to locations with normal levels of contaminants as experienced in urban areas with industrial activity scattered over the whole area, or with heavy traffic.

Environmental parameter	Class 3C1[10]
	Maximum value
Sea and road salts	No[11]
Sulfur dioxide	0.1 mg/m^3
	0.037 cm^3/m^3
Hydrogen sulfide	0.01 mg/m^3
	0.0071 cm^3/m^3
Chlorine	0.01 mg/m^3
	0.0034 cm^3/m^3
Hydrogen chloride	0.01 mg/m^3
	0.0066 cm^3/m^3
Hydrogen fluoride	0.003 mg/m^3
	0.0036 cm^3/m^3
Ammonia	0.3 mg/m^3
	0.42 cm^3/m^3
Ozone	0.01 mg/m^3
	0.005 cm^3/m^3
Nitrogen oxides (expressed in equivalent values of nitrogen dioxide)	0.1 mg/m^3
	0.052 cm^3/m^3

The figures given are maximum values, occurring over a 30 min period per day.
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 101.3 kPA. The table uses rounded values.

Mechanically active substances

This class applies to locations without special precautions to minimize the presence of dust or sand, but not situated in the proximity to dust or sand sources.[12]

Environmental parameter	Class 3S2
Sand	30 mg/m^3
Dust (suspension)	0.2 mg/m^3
Dust (sedimentation)	1.5 mg/m^{2}h

Mechanical conditions

This class applies to locations with vibration of low significance, e.g. for products fastened to light supporting structures subjected to negligible vibrations.[13]

Environmental parameter	Class 3M2
Stationary vibration, sinusoidal	
Displacement amplitude	1.5 mm
Acceleration amplitude	5 m/s^2
Frequency range	2-9 Hz, 9-200 Hz
Non-stationary vibration including shock	
Peak acceleration	40 m/s^2

1 See IEC 60721-3-3, Annex D, page 93
2 In deviation from set IE33, see IEC 60721-3-3, page 29
3 In deviation with class 3K3, see IEC 60721-3-3, page 23
4 For the dependence of the functionality from the temperature see data sheet figure «Max turn-off current for lifetime operation».
5 The operation at low air pressure due to high altitude is limited by the influence of cosmic ray.
6 During operation at low air pressure a sufficient air-cooling must be guaranteed.
7 See IEC 60721-3-3, page 25
8 The cooling of the IGCT must be guaranteed by air exchange. This air exchange is system specific implemented.
9 See IEC 60721-3-3, Annex A, page 55
10 In deviation from set IE33, see IEC 60721-3-3, page 29
11 In deviation from IEC 60721-3-3, page 27
12 See IEC 60721-3-3, Annex A, page 57
13 See IEC 60721-3-3, Annex A, page 57

Tests for Class 3K3[14]

Climatic conditions		Recommended IEC 60068-2 climatic tests		ABB Switzerland Ltd., Semiconductors tests	
Environmental parameter	Class 3K3	Test method	Severity	Test method	Severity
For the climatogramm see page 9		Dry heat 60068-2-2 Bb/Bd	+40 °C, 16 h	5SYS 7001-01[15]	+55 °C
		Cold 60068-2-1 Ab/Ad	+5 °C, 16 h	Qualification test for the gate unit 60068-2-1 Ab	+40 °C, 500 hrs
		Damp heat 60068-2-56 Cd	+30 °C, 85 % R.H., 96 h	Qualification test for the gate unit and gate unit connection to GCT Damp heat, 60068-2-67	+85 °C, 85 % R.H., 168 hrs
Low air temperature	+0 °[10] C	See above		See above	
High air temperature	+45 °C [16]	See above		See above	
Low relative humidity	5 %	See above		See above	
High relative humidity	85 %	See above		See above	
Low absolute humidity	1 g/m^3	See above		See above	
High absolute humidity	25 g/m^3	See above		See above	
Rate of change of temperature	0.5 °C/min	Test normally not required			
Low air pressure	70 kPa	Test normally not required			
High air pressure	106 kPa	Test normally not required			
Solar radiation	N.A.[10]				
Heat radiation		Test normally not required			
Movement of surrounding air	N.A.[6]	Test normally not required			
Condensation	No				
Precipitation	No				
Rain intensity	None				
Low rain temperature	None				
Water from sources other than rain	No				
Formation of ice and frost	No				

Tests for class 3C1

No tests is done.

Tests for class 3S2

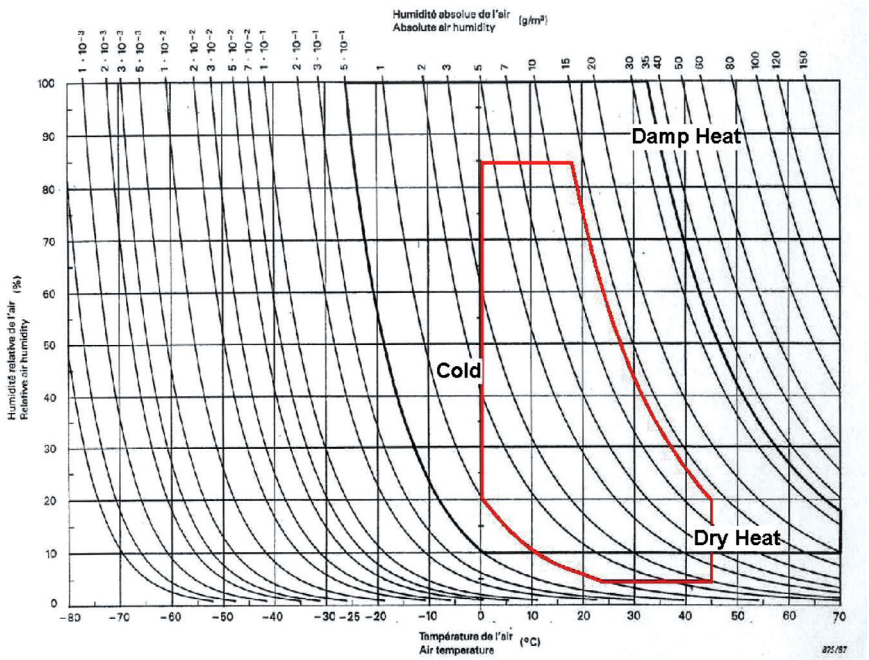
No tests will be done.

14 See IEC TR 60721-4-3, edition 1.1., page 22
15 Stress De-rating and Thermal Analysis SDTA Specification for IGCT Gate Units, ABB Switzerland Ltd, Semiconductors internal standard
16 In deviation from IEC 60721-3-3

Tests for Class 3M2

IEC 60721-3-3 dynamic conditions			IEC 60068-2 dynamic tests				ABB Switzerland Ltd., Semiconductors tests		
			Nearest IEC 60068-2		Recommended test		(The mechanical fastening and clamping is in accordance with 5SYA2036)		
Environment parameter	Unit	Class 3M2	Test method	Severity	Test method	Severity	Test method	Severity	
a) Stationary vibration sinusoidal			60068-2-6 Fc: Vibration sinusoidal		60068-2-6 Fc: Vibration sinusoidal		Procedure for vibration		
Displacement	mm	1.5		1.5	Note 1	0.75		0.35	
Acceleration	m/s^2	5.0		5.0		2.0			0.25
Frequency	Hz	2-9, 9-200		1-150	Note 2	1-150		10-57	57-150
Number of axes				3		3		3	3
Sweep cycles				5		5		5	5
Sweep rate	Oct/min							1	1
b) Shock			60068-2-27 Ea: Shock (halfsine)		60068-2-27 Ea: Shock (halfsine)		Procedure for shock		
Shock response spectrum		Type L							
Peak acceleration	m/s^2	40		50	Note 3	50		150	300
Duration	ms	22		30		6.0		6	6
Number of shocks/direction				3		3		3	3
Direction of shocks				6		6		6	6

Climatogramm for the class 3K3[17]



Revision history

Prepared	Checked 1	Checked 2	Approved	Date
Richter	Backlund	Setz	Schlegel	15.02.06

17 See Annex B, The climatogram is changed with respect to the high air temperature of 45 °C.

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