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IK Code: Impact protection in accordance with the IEC 62 262 standard

White Paper IE 2

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Damage to enclosures can restrict the function of the equipment installed within or even render it non-functional. Accordingly, in addition to IP protection (protection against dust, contact and water), enclosures must also have an adequate level of protection against external mechanical forces. The IK Code is the relevant protection category that indicates the degree of shock resistance or impact strength of an enclosure. This white paper provides the reader with basic information on the subject.

Contents

1 Introduction

Damage to enclosures can impair the function of the equipment installed within (e.g. the control systems of machines) or even, in the worst case, render it non-functional. Accordingly, in addition to IP protection (protection against dust, contact and water), enclosures must also have an adequate level of protection against external mechanical forces.

Figure 1: Deformed enclosure following the application of force

The IK Code is the appropriate protection category for indicating the degree of impact resistance or impact resistance of an enclosure. The IK Code classification is verified using a standardised test procedure in accordance with the IEC 62 262 standard.

However, in laboratory tests, it may not be possible to verify the degree of impact resistance of all parts of an enclosure but only for those points that are explicitly tested. In practice, critical points that are problematic in achieving a high IK code are often not tested. IK Codes can vary, depending on the manufacturer's understanding of quality and the standards that it applies. In the following sections, the reader is provided with some fundamental information on the IK Code and a description of the IEC 62 262 standard. An insight is also given into how IK Code testing is performed and the current testing practice of Rittal GmbH & Co KG in Herborn.

2 The fundamentals

Housings and enclosures are used all over the world under the most varied conditions and they must meet the toughest possible safety requirements. Protection category tests play an important role: here, testing is performed to find out the extent to which external influences such as foreign bodies and water can penetrate enclosures.

The IP (International Protection) protection category according to IEC 60 529, as well as the protection category test as per UL50E or NEMA 250, which are important for the North American region, are used. The requirements for empty enclosures for low-voltage switchgear and controlgear assemblies are defined in the IEC 62 208 product standard.

Figure 2: Stress on the enclosure

Besides the IP protection category, the IK Code as per IEC 62 262 is also of significance. This standard defines the classification of the impact resistance of an enclosure, i.e. the degree of mechanical stress or energy impact on the enclosure from the outside. IEC 62 208 states that empty enclosures must retain the IP protection category, as well as the insulation capability and the functions of the housing and its interior. The enclosure should be of good quality, especially where the risk of damage from pallet trucks, forklifts and the like can be expected.

However, not only the conditions set out in the standard must be considered, but also the room for manoeuvre that the standard allows in the laboratory test for the IK Code. Both the robust and the sensitive areas of the enclosure can be tested. Depending on the test, the IK Code will be fulfilled to a greater or lesser extent. For details of a practical laboratory test, see the section on “Tests at Rittal”, page 11.

3 Description of the IEC 62 262 standard

The IEC 62 262 standard describes how impact protection tests are carried out on enclosures. It is used to determine the guaranteed protection against external stresses (damage or impact/energy effects on the enclosure) to safeguard the equipment. The equipment protected must not exceed a rated voltage of 72.5 kV. The IK Code is indicated on a scale from 00 to 10 (from low to high) and is prefixed by the letters “IK”. Example: “IK05”. If protection higher than IK10 is achieved, the designation is “IK10+”, regardless of the additional energy influence, whereby the standard recommends a value of 50 J (joules).
The international standard IEC 62 262 is based on the European EN 50 102 standard, the contents of which are identical. The EN 50 102 standard is also the German VDE 0470 Part 100 standard.
As shown in the following table, each IK Code number indicates a specific energy that can be applied to the enclosure without affecting the functions and the protection against dust and/or water:

IK Code	IK00	IK01	IK02	IK03	IK04	IK05	IK06	IK07	IK08	IK09	IK10
Impact energy [J]	a)	0.14	0.2	0.35	0.5	0.7	1	2	5	10	20

a) Unprotected, in accordance with this standard

Table 1: Classification of the impact energy

Among other things, it is important that the impact protection specified by the manufacturer of the empty enclosure must ensure that the IP protection category (protection against contact/foreign bodies and water) specified by the manufacturer is maintained. It is possible to specify a lower IP protection category with a higher IK Code. In contrast, it is not allowed to specify a high IK Code when the IP protection category suffers as a result.

Example:
If, following the impact test on an enclosure with impact energy as per IK08, the IP 66 protection is complied with but only IP 54 at IK10, then the specification must not read “IP 66 when tested to IK10”. The combined IP and IK protection category always applies. In this case, the correct description would be “IP 66 when tested to IK08”.

The IK Code relates to the entire enclosure. If individual components such as the side panels of modular enclosures have a different IK Code, this fact must be listed separately.

The IP protection category designations for foreign bodies and protection against water in accordance with IEC 60 529 are identified by the first two digits. The first digit indicates the protection against contact and foreign bodies while the second indicates protection against water.

Digit	Protection against contact	Protection against foreign bodies
0	No protection	No protection
1	Protection against large body parts (diameter of 50 mm and more)	Large foreign bodies (diameter of 50 mm and more)
2	Finger protection (diameter of 12 mm and more)	Medium-sized foreign bodies (diameter of 12.5 mm and more; up to 80 mm in length)
3	Tools and wires (diameter of 50 mm and more)	Small foreign bodies (diameter of 2.5 mm and more)
4	Tools and wires (diameter of 1 mm and more)	Granular foreign bodies (from 1 mm diameter)
5	Wire protection (like IP 5) dust-proof	Damaging dust deposits
6	Wire protection (like IP 5) dust-proof	No ingress of dust

Table 2: IP protection categories, protection against contact and foreign bodies[1]

Digit	Protection against water
0	No protection
1	Protection against vertically dripping water
2	Protection against water dripping at an angle (up to 15°)
3	Protection against falling spray water at up to 60° from the vertical
4	Protection against spray water from all sides
5	Protection against water jets (nozzle) from any angle
6	Protection against powerful water jets (flooding)
7	Protection against temporary immersion
8	Protection against permanent immersion
9	Protection against high-pressure water

Table 3: IP protection categories and protection against water[1]

4 The impact protection laboratory test

The impact protection test (classification for the protection category against external mechanical stress) for empty enclosures as per IEC 62 208 is carried out according to the IEC 62 262 test standard. The following test conditions must be met:

1. Source: Federal Institute for Physics & Technology

4.1 Positioning

The enclosure must be appropriately fastened during the test, in the same way that it is used under everyday conditions. This means, for example, that the enclosure may not be tested when freely suspended, as it then is not fixed securely and this is not how it is normally used. Fixing it to the floor or a wall corresponds to the conventional place of use and the requirements of the standard.

Figure 3: Enclosure in the test laboratory

4.2 Conducting the impact protection test

An impact test is performed on each surface that is exposed during normal use. In the case of an enclosure that is less than 1 m long on the surface to be tested, three stresses (damage to, or impact/energy effects on the enclosure) are applied, and five in total if the enclosure is more than 1 m long. No more than three stresses may be applied near the same point. However, all the impacts must be evenly distributed over the object. This means that the surface may not be tested arbitrarily but must rather follow a certain symmetry.

4.3 Test area on the enclosure

Parts on the enclosure such as hinges, locks, etc are excluded from the test. Not only must the IP protection category be retained after the test, but the insulation capability, the ability of the door to open and close and the ability of the cover to be mounted or removed must also be guaranteed. The reliability of equipment (e.g. maintenance of clearances and creep-

age distances) must continue to be guaranteed when testing (partially) equipped enclosures as low-voltage switchgear and controlgear assemblies as per IEC 61 439-1.

The test results will differ, depending on which parts of the enclosure have been subjected to an impact test. The most sensitive areas of the housing can be tested most intensively with a maximum load applied up to three times at nearby points. However, there is no specification on this and impact-resistant and shock-resistant points that are less critical may be checked just as easily. Accordingly, a lower or higher specification of the IK Code may be the result. The result of the impact protection test can be influenced by the manufacturer within this variable framework. The relevant positions can be selected and are subject only to those criteria mentioned in 4.2. In other words, there is no requirement for the enclosure to be subjected to an impact protection test at particularly impact-sensitive points.

4.4 Climatic conditions for the tests

– Temperature range	15 °C to +35 °C
– Air pressure	86 kPa to 106 kPa (860 mbar to 1060 mbar)
– Altitude	0 to 2000 m

Conclusion:
When performing an impact protection test in accordance with IEC 62 262, a certain amount of latitude is permitted. Therefore, specifying an IK Code is not always 100 % meaningful. The accuracy of the laboratory test, as well as the points to be tested on the enclosure vary from one case to another and are partly at the discretion of the manufacturer. For example, a test conducted on more sensitive points will have a completely different effect than a test carried out on impact-resistant and shock-resistant points.

5 Test values and tools

The following table shows the values for the various energies that are required for the protection category to be tested. Moreover, the required testing tools and their characteristics are defined.

IK Code	IK00	IK01 to IK05	IK06	IK07	IK08	IK09	IK10
Energy [J]	*	**< 1**	**1**	**2**	**5**	**10**	**20**
R [mm]	*	10	10	25	25	50	50
Material	*	Polyamide[1]		Steel[2]			
Mass [kg]	*	0.2	0.5	0.5	1.7	5	5
D [mm]	*	20	25	35	60	80	100
f [mm]	*	10	4	7	10	20	20
r [mm]	*	–	2.5	–	6	–	10
l [mm]	*	57.5	120	60	65	110	63
Pendulum hammer	*	yes	yes	yes	yes	yes	yes
Spring hammer	*	yes	yes	yes	no	no	no
Vertical drop hammer	*	no	no	yes	yes	yes	yes
Height of drop [m]				0.408	0.300	0.204	0.408

* no protection
[1] R 100, Rockwell hardness as per ISO 2039/2
[2] Fe 490-2, Rockwell hardness as per ISO 10152

Table 4: Information relevant to testing

As can be seen from the table, the IK Code is checked with three different hammers. Depending on the type of stress, a specific type of hammer may or must be selected.

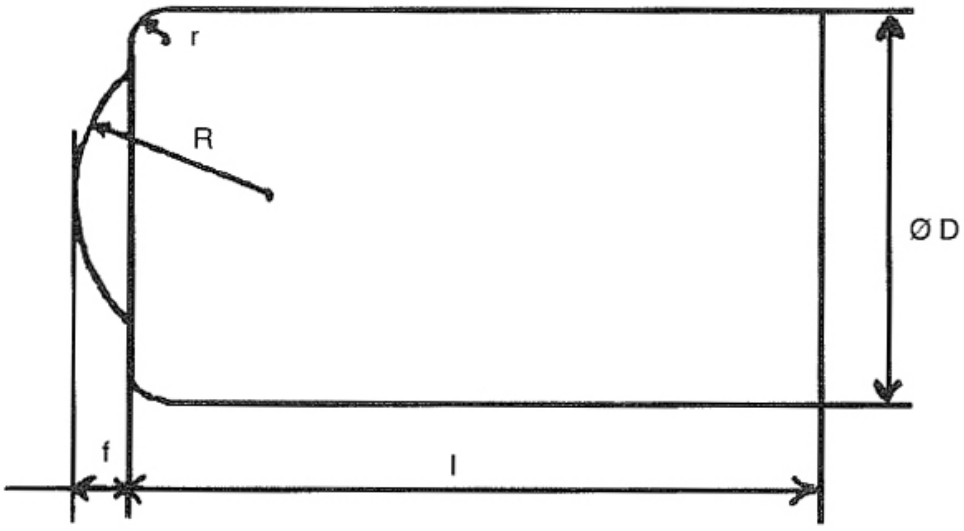

Figure 4: Dimensions of the test tools

6 Tests at Rittal

Rittal has its own accredited laboratory. To determine the IK Code, the impact-critical points on the enclosure are checked, following the logic that “a chain is only as strong as its weakest link”. Testing is usually performed on the edge fold of an enclosure. Although this is where the material is most stable, it is here that the seal is located, which can weaken the IP protection category if the edge of the enclosure is deformed from the impact. It is not only important to have a high impact resistance, but also to maintain the enclosure’s functions.

Figure 5: Effects of an IK test

Accordingly, when testing (partially) configured enclosures as low-voltage switchgear and controlgear assemblies as per IEC 61 439-1, the safety space, e.g. to allow for clearance and creepage distances, must also be maintained. Dents should thus be kept as small as possible or should not occur at all.
This most intensive way of testing adherence to the IK Code as per IEC 62 262 is to test the enclosure under worst-case conditions.
Specifying a high IK Code on an enclosure can therefore quickly lead to misunderstandings since the conduct of a laboratory test is always subject to the examiner’s subjectivity. It is thus possible to consider different intensities of testing within one IK specification.

7 Directory of figures, tables and sources

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IEC 62 262:2002 “Degrees of protection provided by enclosures for electrical equipment against external mechanical impact (IK Code)“

IEC 62 208:2011 “Empty enclosures for low-voltage switchgear and controlgear assemblies:

OTC 60 529:2013 “Protection categories provided by enclosures (IP code)”

IEC 61 439-1: 2011 “Low-voltage switchgear and controlgear assembly”

German Federal Institute for Physics & Technology (PTB): IP protection rating http://www.ptb.de/cms/fachabteilungen/abt3/exschutz/ex-grundlagen/ip-schutzartkennzeichnung.html

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