

Dust Explosion Protection

Current standardization work on explosion protection for electrical installations with hazards by combustible dust

by H. Greiner

The last detailed report on the standardization work regarding the dust explosion protection appeared in this magazine in the 2001 [1], 1998 [2] and 1994 [3] issues. This report concentrated on the current changes and supplements to the standard for dust explosion protection and provides some background information. In the context of the ATEX directives, the release of the two European standards EN 50281-1-1: 1998 and EN 50281-1-2: 1998 was an important date; since then, the standardization work has been concentrated at the IEC level. The preliminary work of IEC SC 31H/WG3 with its very active convenor R. Wigg (Australia) will probably be completed in 2004 and will then be transferred to the standardization work of CENELC.

Subject	IEC	EN
General Requirements	61241-0	prEN 61241-0
Protection by Enclosures Type of Protection ,tD'	61241-1 (61241-1-1)	50281-1-1 in the future EN 61241-1
Selection and installation	61241-14 (61241-1-2)	50281-1-2 in the future EN 61241-14
Inspection and Maintenance	61241-17	prEN 61241-17
Testing Methods:		
Minimum Ignition Temperature	61241-20-1 (61241-2-1)	50281-2-1
Electrical Resistivity of Dust in Layers	61241-20-2 (61241-2-2)	61241-2-2 (50281-2-2)
Minimum Ignition Energy	61241-20-3 (61241-2-3)	50281-2-3 in future at CEN
Minimum explosible concentration	61241-2-4	50281-2-4 in future at CEN
Classification of Areas	61241-10 (61241-3)	50281-3
Type of Protection ,pD'	61241-2 (61241-4)	
Type of Protection ,iD'	61241-11	
Type of Protection ,mD'	61241-18	

1. Structure of the standard for dust explosion protection

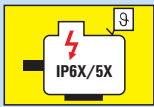
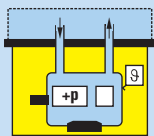
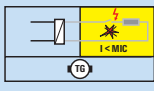

The numbering system at IEC is currently undergoing wide-ranging changes. Adjusting the structures to match the numbering systems of the standards for gas and dust explosion protection are prerequisites for a future merging.

The future numbers are stated first in the ,IEC' column of Table 1, and existing standards (if there are any) are placed in parentheses. The European standards highlighted in colour are currently mandatory in the framework of the ATEX directives.

2. Types of dust explosion protection

When the work was started in the former IEC SC31H/WG1, it was assumed that dust explosion protection for electrical apparatus is achieved mainly by tight enclosures and limitation of the surface temperature. This simple protection concept offers itself as →

Table 2: Types of protection for use in the presence of combustible dust

Symbol	Principle	Type of Protection	Current Status at IEC	Future Status at IEC	Status at CLC
tD		IP-enclosures Tightness and temperature limitation	IEC 61241-1-1	IEC 61241-0 IEC 61241-1	EN 50281-1-1
pD		Pressurization	IEC 61241-4 (2001-03)	IEC 61241-2	
iD		Intrinsic safety	31H/143/CD	IEC 61241-11	
mD		Encapsulation (moulded compound)	31H/144/CD	IEC 61241-18	

→ a solution because it is easier to seal an enclosure from dust with little added design and construction work, in contrast to trying to seal it from gases and vapours. For this reason, the degree of protection IP played an important role right from the start in dust explosion protection [4].

In the additional work of IEC SC31H/WG3 there was a strong international tendency then to introduce additional protection concepts taken from gas explosion protection. In light of the majority conditions in the WG and the wide international acceptance of the drafts, the Germans working on the standard needed to limit their work at a minimum to obtain, an optimal adaption to the corresponding standards of gas-types of protection. The symbols originally intended for dust explosion protection (dust ignition protection or ‚DIP‘) had to be replaced by ‚tD‘, ‚pD‘, ‚iD‘ and ‚mD‘, where the ‚D‘ stands for the ‚dust ignition protection‘ versions. There are currently four types of dust protection according to Table 2:

2.1 Dust ignition protection type ‚tD‘

According to general opinion, this will be the most important version in Europe for equipment used in electrical power engineering.

On the basis of EN 50281-1-1, some of the requirements placed on electrical machines and other equipment for use in Zones 21 and

22 are treated in this section. Electrical power engineering equipment is not permitted in Zone 20. This excerpt cannot and should not

Tab. 3: Summary of the requirements for rotating electrical machines, type of protection ‚tD‘

Requirement	Cat. 2 – Zone 21	Cat. 3 – Zone 22
Dust tightness of the enclosure	IP6X	IP5X
Percentage of magnesium in the enclosure material	≤ 6%	≤ 6%
Thermal properties of non-metallic enclosures	like »e«	like »n«
Insulation resistance of enclosures, fan guards	≤ 10 ⁹ Ω	≤ 10 ⁹ Ω
Insulation resistance of the fan wheel for all speeds	≤ 10 ⁹ Ω	≤ 10 ⁹ Ω
External connection for equipotential bonding	like »e«	like »n«
Dust tightness of entries	IP6X	IP5X
Degree of protection of the external fan	like ‚e‘	like ‚e‘
Protective cover for V1 (air inlet on top)	like ‚e‘	
Fan and cover construction and mounting	like ‚e‘	like ‚e‘ / ‚n‘
Clearances in the ventilation system	like ‚e‘	
Percentage of magnesium in the material of the fan	≤ 6%	≤ 6%
Clearance and creepage distances of connecting parts	IEC 60664	IEC 60664
Certification by notified body required	Yes	No
CE conformity to Directive 94/9/EC	CE	CE
Conformity to standards	Ex	Ex
Surface temperature in °C (not temperature class)	T ... °C	T ... °C

Table 4: Summary of requirements for other electrical equipment

Requirement	Cat. 1+2 - Zone 20+21	Cat. 3 - Zone 22
Protection from dust entering enclosure	IP6X	IP5X
Protection from dust ingress at entries	IP6X	IP5X
Propagating brush discharges must be avoided	Insulation resistance $\leq 10^9 \Omega$ Breakdown voltage $\leq 4 \text{ kV}$ Thickness of insulation $\geq 8 \text{ mm}$	
Laser radiation	0,5 mW/mm ² continuous 0,1 mJ/mm ² pulse	
Ultrasonic	0,1 W/cm ² / 10 MHz continuous 0,2 mJ/cm ² pulse 0,1 W/cm ² average value	
External connection for equipotential bonding	like »e«	like »n«
Plugs, sockets and connectors	Separation with no voltage applied; Exception: to 10A, 250 V; there IP6X is sufficient for separation; Dust may not fall into opening	
Luminaires	Light source with cover; Lock or warning label No low pressure sodium lamps	
Clearance and creepage distances of connecting parts	IEC 60664	IEC 60664
Certification required	Yes	No
CE certification, conformity to Directive 94/9/EC	CE	CE
Conformity to standards	Ex	Ex
Surface temperature in °C, (not temperature class)	T ... °C	T ... °C

Table 5: Measures for avoiding propagating brush discharges

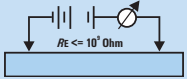
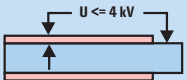
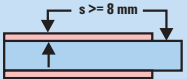
Insulation resistance $\leq 10^9 \Omega$. Resistance against electrostatic discharge to earth through or across the surface of insulation, measured to the method described in HD 429 S1 with an effective area of the circular electrode of 20 cm ²	
Breakdown voltage $\leq 4 \text{ kV}$ measured across the thickness of the insulating material to the method described in EN 60243-1	
Thickness $\geq 8 \text{ mm}$ of the external insulation on metal parts. External plastic layers of 8 mm and greater on metal parts, such as measurement probes or similar components, make propagating brush discharges unlikely to occur. When evaluating the minimum thickness of the insulation to be used or specified, it is necessary to allow for any expected wear under normal usage.	



Figure 4: Brush discharge with a relatively low ignition energy (ignition possible when gas is present)



Figure 5: Propagating brush discharge with a relatively high ignition energy (ignition possible when dust is present)

be a replacement for studying the standard. The requirements are based mainly on EN 50014 : 2000 Electrical apparatus for potentially explosive atmospheres; General Requirements, on EN 50019 Increased safety ,e' and on EN 50021 : 1999 Electrical apparatus for potentially explosive atmospheres; Type of protection ,n'. Some requirements are discussed in more detail in the following section (Table 3 and 4).

2.2 Electrostatic discharge

The prevention of ignition hazards caused by electrostatic discharges in Zone 21 is particularly important for dust explosion protection. Explosive dust/air mixtures may require a higher ignition energy than gases, but dust particles moving at high speeds (e.g. when moved pneumatically) can also lead to especially high charges.

The requirements were worked out by German electrostatic experts for the national standard and were then taken over without any changes in the international standard.

Propagating brush discharges must be prevented. This can be achieved through the use of plastic with at least one of the measures listed in Table 5:

Figures 4 and 5 should make clear the visual difference between a brush discharge and a propagating brush discharge. The acoustic differences between the results of the experiment are also impressive [5], [6].

2.3 Type of Protection ,pD'

This type of protection, based on Pressurized apparatus ,p', could become significant for protecting electrical cabinets in dust explosion hazard areas, for example. The requirements specified in IEC 61241-4 : 2001 are comparable for the most part to those in IEC 60079-2 : 2001. Equipment with type of protection ,pD' may only be used in Zones 21 and 22 (i.e. not in Zone 20).

The purging phase required for gas explosion protection is not permitted for dust explo- →

→ sion protection since an explosive atmosphere could result from the stirring up of deposited dust. In fact, Section 4.3 of the standard expressly requires that the interior of the equipment be cleaned and all dust that accumulated there after switching off the external ventilation be removed before switching on the pressurization system.

The measures to take when the pressurization equipment fails are graduated according to the zone and the existence of ignition sources during operations (Section 7.5 of the standard, Table 6).

2.4 Intrinsic Safety ,iD'

The current draft (CD) generally follows the structure and content of the 4th edition of IEC 60079-11 : 1999 for gas explosion protected apparatus with type of protection Intrinsic safety ,i'.

The final version should refer for the most part to the directly valid sections of Standard IEC 60079-11 without repeating the text of this standard. This corresponds to the procedure to be expected in practical applications in which the designs of apparatus for ,iD' are derived from existing and previously tested intrinsically safe apparatus.

The following basic requirements are named in the future Standard IEC 61241-11:

- The electrical circuits must fulfil the requirements of Group IIB according to IEC 60079-11 in order to prevent ignitable sparks.
- Normally, degree of protection IP6X or encapsulation is required to ensure that creepage distances air and are not affected by dust.
- Power limitations for equipment or their parts that are not protected by an enclosure or encapsulation (e.g. for non-isolated sensors). This is intended to prevent that a dust layer ignites due to a direct transfer of power by conductive dust and to prevent ignition due to heat on the surface of components.

Table 6: Requirements on failure of pressurization

Zone	Type of apparatus in the enclosure	
	Ignition-capable apparatus	Apparatus with no sources of ignition in normal operations
20	,pD' not applicable	,pD' not applicable
21	Switching off according 7.5.1.1	Alarm according 7.5.1.2
22	Alarm according 7.5.1.2	Internal pressurization not required

- Limitation of the temperature of all outer surfaces of apparatus or their parts whose power limits exceed the limits according to IEC 61241-0. The surface can be formed by a normal enclosure or an encapsulation.

The additional dust-specific requirements placed on intrinsically safe apparatus for Group IIB still need to be specified and will be specified based on the results of the current CD inquiries presented to the national committees. Furthermore, it appears that the current draft still needs to clarify, if the requirements of type of protection ,tD' are fulfilled for intrinsically safe apparatus in a dust-tight enclosure so that the requirements of type of protection ,iD' can be ignored.

2.5 Encapsulation ,mD'

Dust protection by encapsulation ,mD' according to IEC 61241-18 is to be based primarily on type of protection ,m' according to IEC 60079-18. It is currently undergoing revision. The further path for the draft of IEC 61241-18 will therefore be determined by the development of the new IEC 60079-18 standard.

However, the question posed at the beginning of this project, which was ignored by the majority internationally, still remains, i.e. why a 30 page standard for ,mD' needs to be created for the encapsulation and whether or not an encapsulation could be handled in the framework of protection type ,tD', that is, by applying the criteria of the IP degree of protection and by limiting the surface temperature.

3. Classification of dust hazardous areas in zones

The zone classification was controversial and was discussed for years between CEN, CENELEC and IEC (see also [2] and [3]). The controversy has been decided upon in the common drafts of IEC 61241-10 and EN 50281-3 in favour of the Europeans. The definition at IEC now matches the European explosion protection directives 94/9/EC and 99/92/EC and Standard EN 1127-1. Table 7 illustrates the complicated starting point for this standardization work.

Although the path to this solution already appeared several years ago, the IEC definition, which is out of date in the meantime, was written into some of the last IEC Standards. This must be taken into account when applying this standard. The definition of the zones of dust explosion hazardous areas are **identical** in

and are different in

- IEC 61241-3 Classification of areas where combustible dusts are or may be present (1997)
- IEC 61241-4 Type of protection ,pD' (2001)
- IEC 61241-1-1 Specification for apparatus (1999)
- IEC 61241-1-2 Selection, installation and maintenance (1999)

Due to these differences in the (currently still) valid standards, the definition currently valid and to be valid in the future from EN 1127-1 are repeated in the following (Table 8). The ,Notes' important for practical application of the standard unfortunately cannot be found in all standards.

Unfortunately, the German suggestion to avoid repeating the zone definition in the apparatus standards and to refer to the expected standard IEC 61241-10 ,Classification of areas where combustible dusts are or

may be present' was ignored. The following regulations specify the responsibilities for zone classification:

- Directive 1999/92/EC, Article 7 (1), The employer shall classify places where explosive atmospheres may occur in zones in accordance with Annex I.
- EN 50281 - 3 Classification of areas where combustible dusts are or may be present: 4.3 Area classification procedure for explosive dust atmospheres: ,Because this standard is to cover a wide range of circumstances, no exact identification of necessary measures can be given for each individual case. It is important, therefore that the recommended procedure should be carried out by personnel having knowledge of the principles of area classification, the process material used, the plant involved and its functions.'

3.1 Classification according to the housekeeping

The cleanliness of the working area is very important in dust explosion protection because, in contrast to gases, a series of releases that are individually under the explosion limit can lead to hazardous accumulations of dust.

When applying the new classification in dust explosion hazardous areas according to IEC 61241-10 and EN 50281-3, the level of housekeeping is quantified and is also used to classify the areas (Table 9):

3.2 Transition from two to three zones

According to the generally valid principle of ,preserving' in the standard, it will not be necessary to change properly approved equipment and systems that are also still in operation to the new zones.

For instance in the German relevant safety →

Country	Standard	Zone / Division		
AS	AS 2430.2 : 1986	Class II		
GB	BS 6467 : 2 : 1988	Z	Y	
DE	VDE 0165 : 1991	10	11	
USA	NEC 500-6 : 2002	Div. 1	Div. 2	
EU	EN 50281-3 : 2002	20	21	22
INT	IEC 61241-10 : 2003	20	21	22

- EN 1127-1 Explosion prevention and protection: Basic concepts and methodology
- EN 50281-3 Classification of areas where combustible dusts are or may be present
- EN 50281-1-2 Selection, installation and maintenance
- IEC 61241-10 Classification of areas where combustible dusts are or may be present (currently a draft)

have the same meaning in

- Directive 1999/92/EC
- Directive 94/9/EC

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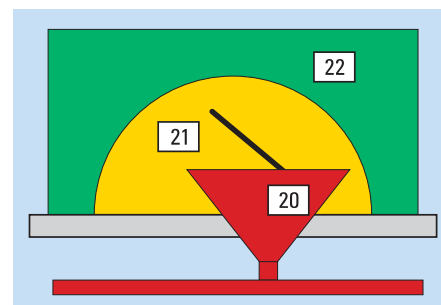


Figure 6: Example of the classification into dust explosion hazard areas according to IEC 61241-10

- Zone 20 Inside the hopper of a bag emptying station
- Zone 21 Immediate surroundings (radius of 1 m) around the manhole
- Zone 22 Area outside of Zone 21 due to accumulations of dust

Table 8: Zone definitions

Zone 20	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently. NOTE: In general these conditions, when they occur, arise inside containers, pipes and vessels etc.
Zone 21	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally. NOTE: This zone can include, among others, areas in the immediate vicinity of e.g. powder filling and emptying points and areas where dust layers occur and are likely in normal operation to give rise to an explosive concentration of combustible dust in mixture with air.
Zone 22	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only. NOTE: This zone can include, among others, areas in the vicinity of equipment, protective systems, and components containing dust, from which dust can escape from leaks and form dust deposits (e.g. milling rooms, in which dust escapes from the mills and then settles).

→ regulation (Betriebssicherheitsverordnung, 27.09.2002), the transposition of the Directive 99/92/EC into German law, it says in §27: 'The continued operation of an installation in hazardous areas, authorised for operation before 01 January 2003 is permitted. An authorisation granted according to the regulations valid up to this date is considered a valid authorisation in the sense of this regulation'.

On the other hand, the same regulation states in §7 that the equipment must meet the requirements of Directive 94/9/EC and may only be operated in the zones in which they are suitable according to their apparatus group and category.

This question will arise in time once the installations are considerably modified or extended. For new systems it is of interest to the manufacturer as well as the user how the previous need for apparatus for the two-zone system will be transferred to a need for appa-

ratus for the new Zones 20, 21 and 22, especially since the apparatus for Zone 21 needs to be certified by a notified body (Figure 7).

4. Selection and installation

The future standard IEC 61241-14 is based primarily on the installation standards for gas explosion protection, IEC 60079-14, and uses the dust-specific elements from IEC 61241-1-2 (EN 50281-1-2),

We would like to point out a few selected changes and additions to EN 50281-1-2:

4.1 Determination and use of a surface temperature for dust layers > 50 mm

According to the previously valid specifications in Section 6.3 of EN 50281-1-2 laboratory investigation of the affected apparatus is to be conducted using the concerning dust, if layers of dust that are unusually thick are

Table 9: Housekeeping and explosion hazard

Level of housekeeping	Thickness of a dust layer	Duration of presence of a dust layer	Fire or explosion risk
Good	Zero or negligible	Not present	None
Fair	Not negligible	Shorter than the length of 1 shift	None
Poor	Not negligible	Longer than the length of 1 shift	Fire hazard and Zone 22 if clouds are created

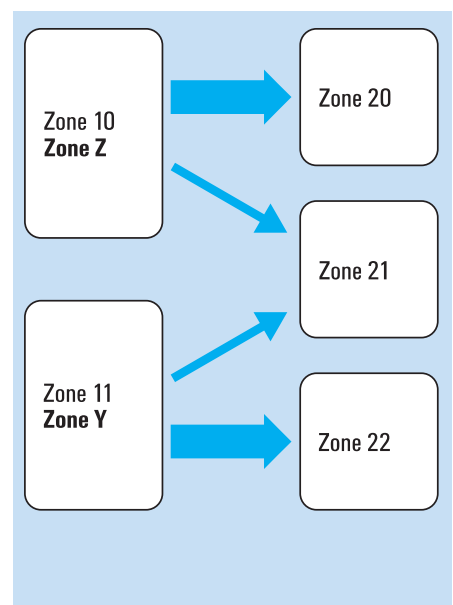


Figure 7: New structure of classified area
Zone Z and Y had been used in former BS 6467:Part2:1988

present (see Annex A of the standard as well as [2] and [7]).

In future, the manufacturer will be able to determine and specify a surface temperature T_L under a thickness of layer L designed to reflect typical applications as an option for the manufacturer in the context of the type test (Figure 8).

The following is planned for Section 5.2 of IEC 61241-0:

‘In addition to the maximum surface temperature required in 5.1, the maximum surface temperature may be stated for a given depth of layer, T_L , of dust surrounding all sides of the apparatus.’

The following is specified in 23.4.5.2 to determine the temperature T_L :

‘If the requirements of 5.2 apply, then the electrical apparatus to be tested shall be mounted and surrounded by a layer depth L as stated by the manufacturer’s specification. The measurement for the maximum surface temperature shall be made according to 23.4.5.1 using a dust having a thermal conductivity of no more than 0.003 kcal/m. °C.h.’

The user must observe Section 6.3.3.4 of installation standard 61241-14:

‘Where the apparatus is marked T_L for a layer depth, the ignition temperature of the combustible dust, at layer depth L , must be applied in place of T_{5mm} . The maximum surface temperature of the apparatus T_L shall be at least 75 K lower than the ignition temperature of the combustible dust, at layer depth L .’

Tables of ignition temperature of a dust layer that are based on layer thicknesses differing from the standard value of 5 mm are generally not available. The user must therefore contract a laboratory test or a recognised computer calculation for the affected dust. An ignition temperature of a dust layer reduction factor for increasing thicknesses of the layer of dust cannot be specified generally; depending on the type of dust, the ignition temperature can drop 50 to 60% below the value for a thickness of 5 mm [8]. This specification should never replace a laboratory test: it is only intended to point out the hazards that can

Table 10: Required dust tightness

Classified area	Degree of protection
Zone 20 Zone 21 Zone 22 with conductive dust	IP6X
Zone 22	IP5X

arise when the reduced ignition temperature is not taken into account.

According to the old concept for excessive dust accumulations, equipment and relevant dust must be subjected to laboratory testing. The report of the results then contains all instructions relevant to safety. According to the new concept, the dust still needs to be tested, but the investigation is only initiated if the numbers on the label can be correctly interpreted by the user. The corresponding documentation is very important in terms of safety.

4.2 IP Degree of protection and zone classification in areas with conductive dust

In the currently valid standard the presence of conductive dust requires a classification as Zone 21 and therefore indirectly leads to degree of protection IP6X, even when the criteria relevant to the zone classification would result in a classification as Zone 22. These specifications are based on the North American practice and were also taken over in EN via the IEC.

In Table 1 of the future Standard IEC 61241-14 (here Table 10), the German proposal submitted numerous times was finally approved and the additional hazards resulting from this conductivity are prevented through improved tightness while being permitted to stay in the same zone. It can be assumed that this table will also replace Table 1 in EN 50281-1-2. →

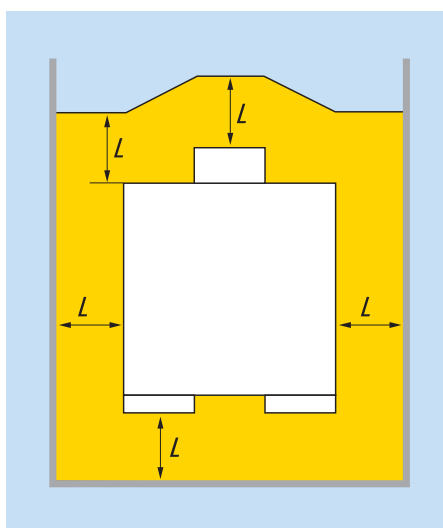


Figure 8: Determination of the maximum surface temperature T_L under a surrounding layer of dust of thickness L in mm. The example selected by the author shows that the specifications of the standard can be interpreted differently, especially when examining a complex outside configuration of equipment

→ **4.3 Optional marking according to temperature class T1...T6 eliminated**

In the first two editions of IEC 61241-1-1 the maximum surface temperature of the apparatus could be specified as a temperature value or in the form of a temperature class T1...T6 based on the gas explosion protection standards. This option was not added to EN 50281-1-1 upon request by the German experts and will now also be eliminated in IEC 61241-0.

Since this seemingly close analogy to gas explosion protection may also arise again in the future, the German position is justified in the following:

The temperature class is first associated with a range of ignition temperatures. Competent tables with ‚safety characteristics‘ are made up accordingly. It is justifiable for gases and vapours in terms of safety to also assign this classification the significance of a maximum allowable surface temperature. Table 1 in EN 60079-14 is an example of this parallel arrangement.

The unevaluated transferral of this common perception from gases and vapours to dust hides the danger that the necessary safety margin between the surface temperature and the ignition temperature (2/3' or ,75 K') will not be observed. Even when this hazard is pointed out in the standard, the on-site technician only sees its abbreviated form on a label (without any of the explanatory information). He would then have to interpret an identical abbreviation (e.g. T3) differently for gases than for dust. The standardization body should avoid, if possible, placing additional stumbling blocks in front of the user, which in this case would also affect safety.

4.4 Alternative ‚Practice B‘

The regulations of UL (Underwriters Laboratories; UL 674) have been valid in the USA since 1929, and the regulations of CSA (Canadian Standards Association; C 22.2 No. 145) are valid in Canada. These specifications, which have been proven over the course of decades, needed to be treated with due respect in the

work of IEC SC 31H. ‚Practice B‘ in IEC 61241-1-1 and IEC 61241-1-2 take these facts into account. In order to do justice to the strong North American influence at the start of the IEC standardization work, the European practice (Practice A) was standardised in IEC 1241-1-1 in parallel to the North American practice (Practice B). Practice B was eliminated in EN 50281-1-1. The new drafts for the IEC 61241 series were developed in parallel to those of CENELEC; they will contain both versions as ‚Procedure A and B‘ in the forthcoming EN 61241 series of standards (Table 11).

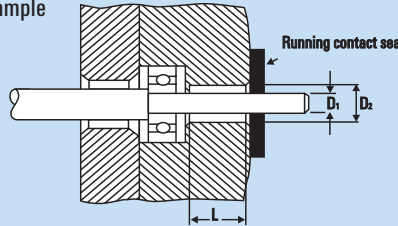
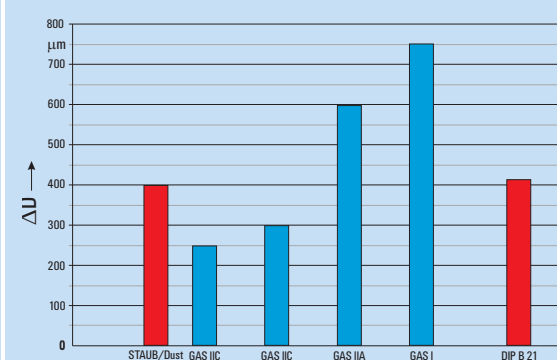
5. Dust protection test IP5X of rotating electrical machines

Degree of protection is an important element of dust explosion protection. Testing and assessment are based on IEC 60529 and the identical standard EN 60529 [4]:

IP5X (dust-protected): The talcum powder may not accumulate in such quantities or at such locations that, with any other kind of dust, would negatively affect the safety or proper operation of the equipment.

IP6X (dust-tight): No observable deposit-

Table 11: Comparison of important requirements for dust explosion protection type ‚tD‘ in the draft for IEC 61241-1

Feature	Practice A (Europe)	Practice B (US)
Dust tightness	IP6X / IP5X	Sealing gap between metal surfaces on the shaft bushing, for example 
Design details	Not specified	Specified based on principle ‚d‘ (column DIP B 21) but only to achieve tightness, not as an ignition barrier 
Testing of tightness	Like IP	6 cycles in dust chamber, each cycle consisting of 6 hours on rated load / 6 hours cool-down period
Temperature test	No dust layer	With a dust layer of 12.5 mm
Definition of ignition temperature of a dust layer	Based on a dust layer thickness of 5 mm	Based on a dust layer thickness 12.5 mm

sof dust are permitted inside the enclosure.

In IEC 61241-1, 8.2.1.3 it is expressly required to also check rotating electrical machines according to this higher level standard. In the special standard for electrical machines, IEC/EN 60034-5 : 2000, Table 4, it is incomprehensibly and unjustifiably permitted to view any test dust that penetrates the machine as not conductive, not combustible, not explosive and not chemically aggressive in the assessment. A result as shown in Figure 9 would then be permissible?!

A change to the specifications in IEC 60034-5 has been applied for. Until this application goes through the machinery of the responsible Maintenance Team, users and testers are well advised to question any specifications like 'IP5X according to IEC 60034-5 or EN 60034-5.'



gap 0.05 mm, without gasket, standard talcum powder

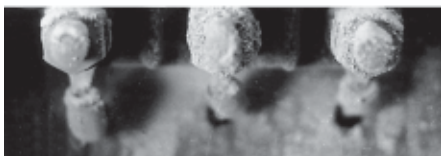


Figure 9: Results after a dust test that could be judged 'permissible' according to the incomprehensible specifications in IEC 60034-5 : 2000

Literature

- [1] Wolnarek, D.:
Dust explosion protection
Ex-Magazine No. 27/2001, page 23
- [2] Greiner, H.:
Current Standardization Situation for
explosion protected electrical Apparatus
for the Use in the Presence of combustible
Dust
Ex-Magazine No. 24/1998, page 30
- [3] Greiner, H.:
Standardization Work on Dust Explosion
Protection
Ex-Magazine No. 20/1994
- [4] Greiner, H.:
Degrees of IP protection
Publication SD 101 E by Danfoss Bauer
GmbH
- [5] Glor, M. et al.
Static Electricity Ignition hazards on
protection measures
Published by ISSA No. 2017 E
- [6] Lüttgens, G., et al.:
Statische Elektrizität, Zündgefahren und
Schutzmaßnahmen
(*Static electricity; Ignition hazard and
Methods of Protection*)
Expert Praxislexikon; Expert Verlag
Renningen (2000)
- [7] Greiner, H.:
Explosionsschutz bei Drehstrom-Getriebe-
motoren
(*Explosion protection of geared motors*)
Sonderdruck SD 302 der Fa. Danfoss
Bauer GmbH, D-73726 Esslingen
- [8] Hensel, W.; John, W.:
Die Schichtdickenabhängigkeit der
Glimmtemperatur
(*Influence of layer thickness of the igni-
tion temperatur of a dust layer*)
VDI-Fortschrittbericht Nr. 244, VDI-Verlag,
Düsseldorf (1991)
- [9] Fachausschuss 'Chemie' der BGZ,
Explosionsschutz-Regeln,
(*Explosion Protection Rules*)
BGR 107, Ausgabe 7/2000