Technical Explanations

Control Solenoids in explosion-proof execution G XX E

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1. Terms, Definitions, Explications

1.1 Electrical Equipment

All objects serving totally or partly to the application of electric energy. Objects for generation, transmission, distribution, storage, measuring, controlling, transformation and consumption of electric energy as well as objects for telecommunication belong to this.

Electrical equipment for explosion-proof areas is classified in::

Group I: Electrical equipment for mine workings with firedamp explosion risk

Group II: Electrical equipment for all explosive areas without mine workings with firedamp explosion risk

Furthermore another classification in so-called categories is made, where category 1 and category 2 are used for groups I and II. Category 3 refers only to group II:

Category 1: highest degree of protection, thus very high degree of safety

Category 2: increased degree of protection, thus high degree of safety

Category 3: normal degree of protection, thus normal degree of safety

With the classification in categories, also an attribution to the application area is made (underground, gas-explosive areas, areas with combustible dust) where the equipment is used:

Group I: **M1, M2** (mining)
Group II: **1G, 2G, 3G** (gas)
1D, 2D, 3D (dust)

(see point 2)

1.2 Explosive Atmosphere

Mixture of air and combustible gases, steams, mists or dusts under atmospheric conditions in which the combustion process has transferred on the whole unburnt mixture after effected ignition.

Atmospheric conditions mean :
- Temperature from -20°C up to +60°C
- Pression from 0,9 bar up to 1,1 bar
- Air with oxygen content of approx. 21%

1.3 Explosive Area

Zone where the atmosphere may become explosive due to the local and operational conditions.
Generally explosive areas are classified in zones according to frequency and duration of potentially explosive atmosphere whereas a differentiation is also made between combustible gases, steams and mists, as well as combustible dusts
:

Danger areas gas / steam: **Zone 0**
Zone 1
Zone 2
Danger areas dust: **Zone 20**
Zone 21
Zone 22

(see point 2)

1.4 Flashpoint Temperature

The lowest temperature at which a combustible gas or a combustible liquid can generate a suitable quantity of steam at its surface under special testing conditions so that with an effective ignition source an ignition of the steam-air-mixture might become possible.

1.5 Ignition Temperature – Temperature Class

The ignition temperature of a combustible material is the lowest temperature at which the combustible material just ignites in connection with air.
By means of fixed proceedings (EC/EN 60079-4 respectively IEC/EN 61241-2-1) the ignition temperature of any substances is determined so they can be classified in temperature classes. (see point 3)

Temperature classes	Ignition temperature ranges of mixtures [°C]	Max. admissible surface temperature elekof electrical equipment [°C]
T1	> 450	450
T2	> 300 ... ≤ 450	300
T3	> 200 ... ≤ 300	200
T4	> 135 ... ≤ 200	135
T5	> 100 ... ≤ 135	100
T6	> 85 ... ≤ 100	85

Table 1.5 Temperature classes and respective temperature ranges

1.6 Explosion Subgroups

Classification of combustible gases and steams within group II according to their ratio of min. ignition current related to methane or according to their border gap width.
The value of the MESG (Maximum Experimental Safe Gap) is very important for constructions with protection class „flameproof enclosures“. The value of the MIC (minimum ignition current) is very important for constructions with protection class „intrinsic safety“. (See point 3)

Explosion subgroup	Minimum ignition current related to methane (MIC:CH4)	Maximum experimental safe gap (MESG)	Hazardousness
IIA	> 0,8	> 0,9 mm	low
IIB	0,45 ... 0,8	0,5 ... 0,9 mm	average
IIC	0 ... 0,45	< 0,5 mm	high

Table 1.6 Explosion subgroups and their classification

1.7 Protection Classes

Designation for actions which assure that an ambient explosive mixture of gas, air, mist or dust may not lead to an ignition due to different protection principles. (see point 4)

All protection classes of the same category are equal concerning safety!

Protection principle	Electrical equipment of categories 1G, 2G, 3G	Electrical equipment of categories 1D, 2D, 3D
Protection principle ensures that an ignition source may not incur	Increased safety „e“ Not sparking devices „nA“	–
Protection principle ensures that an ignition source may not become effective	Intrinsic safety „i“ Energy limited electric circuits „nL“	Intrinsic safety „iD“
Protection principle prevents the explosive atmosphere from reaching the ignition source	Pressurized enclosures „p“ Simplified pressurized enclosures „pz“ Encapsulation „m“ Oil immersion dans „o“ Hermetically sealed devices Encapsulated/sealed equipment „nC“ Protection against explosive gases and dusts „nR“	Protection by enclosures „tD“ Pressurized enclosures „pD“ Encapsulation „mD“
Protection principle allows ignition but prevents the flame propagation by means of the housing	Flameproof enclosures „d“ Powder filling „q“ Enclosed control unit „nC“ Not ignitable part „nC“	–

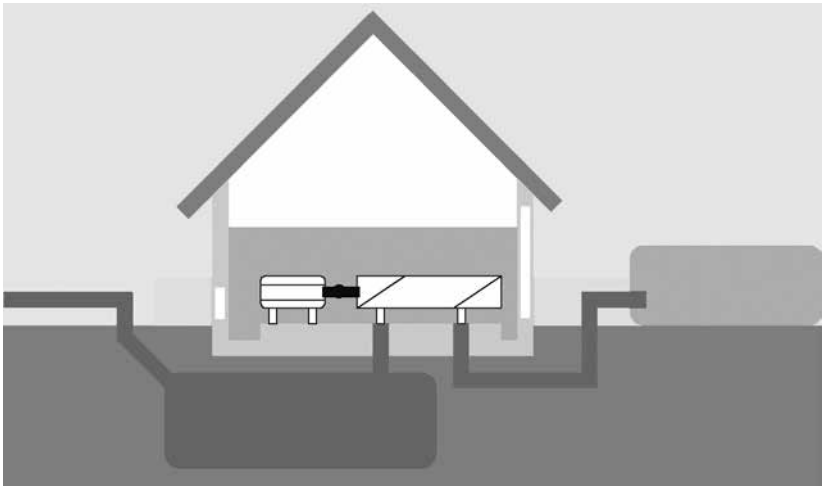
Table 1.7 Protection principle and protection types

1.8 Protection Class

Describes the degree by an enclosure.

Die IP-Schutzart stellt
- protection against contact
- foreign body protection. (see point 6.4)
- protection against ingress of water

2. Classification of explosive areas and coherence with electrical equipment



Due to the classification of electrical equipment in different groups and categories and due to the division of the explosive areas into different zones the equipment can be categorized in relevant explosive areas where they may be applied.

For the European community the definition of zones is standardized in regulation 1999/92/EG.

Abbildung 2.1 Zoneneinteilung beispielhaft dargestellt

	Rating of explosion hazard		**Necessary marking of the applicable equipment**	
			Device group	**Category**
	Operation at explosion hazard	**Mining**	I	**M1**
	Cut-off at explosion hazard	**Mining**	I	**M1** or **M2**
Zones for danger by gas / steams	Zone where explosive atmosphere as mixture of air, combustible gases, steams or fogs is always, for long periods or often existing	**Zone 0**	II	**1G**
	Zone where at normal operation an explosive atmosphere as mixture of air, combustible gases, steams or fogs may form from time to time	**Zone 1**	II	**2G** or **1G**
	Zone where at normal operation an explosive atmosphere as mixture of air, combustible gases, steams or fogs may normally not form or even temporarily	**Zone 2**	II	**3G, 2G** or **1G**
Zones for danger of combustible powder	Zone where an explosive atmosphere in form of a cloud of combustible dust contained in the air exists always, for a long time or often	**Zone 20**	II	**1D**
	Zone where an explosive atmosphere in form of a cloud of combustible dust contained in the air exists from time to time at normal operation	**Zone 21**	II	**2D** or **1D**
	Zone where at normal operation an explosive atmosphere in form of a cloud of combustible dust contained in the air does not form normally or even temporarily	**Zone 22**	II	**3D, 2D** or **1D**

Table 2.1 Definition of zones and applicable equipment

3. Ignition Temperature – Temperature Class

3.1 Safety-related identification numbers of combustible gases and steams for determination of temperature class and explosion subgroup

Temperature class / temperature of mixtures	IIA	IIB	IIC	Applicability of material with temperature class
T1 **> 450 °C**	Acetone Ammoniac Benzol – pure Acetic acid Ethyl acetate Ethyl chloride Carbon monoxide Methane Methanol Methylene chloride Naphthaline Phenol Propane Toluol	City (illuminating-)gas Acrylon nitrile	Hydrogene	**T1**
T2 **> 300 °C ... ≤ 450 °C**	Ethyl alcohol i-amy acetate n-butane n-butyl alcohol Cyclohexane Acetit anhydride	Ethylene Ethylene oxide	Ethine (Acetylene)	**T2**
T3 **> 200 °C ... ≤300 °C**	Benzins – generally diesel fuel kerosine heating oil DIN 51603 n-hexane	Ethylene glycol Hydrosulphide		**T3**
T4 **> 135 °C ... ≤ 200 °C**	Acetaldehyde	Ethyl ether		**T4**
T5 **> 100 °C ... ≤135 °C**				**T5**
T6 **> 85 °C ... ≤ 100 °C**			Carbon disulphide	**T6**
Applicability of material with explosion subgroup	**IIA**	**IIB**	**IIC**	

Fig. 3.1 Examples for classification of different gases and steams in temperature classes and explosion subgroups

3.2 Dust deposit: Max. admissible surface temperatures

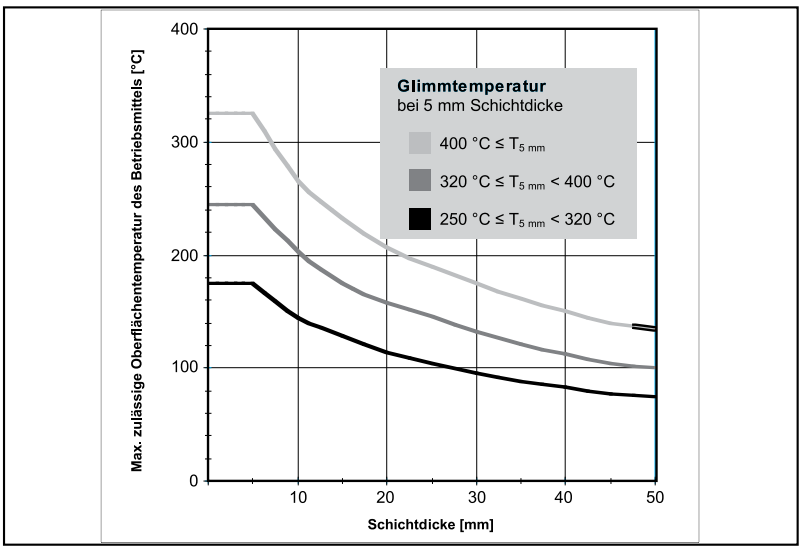


Fig. 3.2
Reduction of the max. admissible surface temperature with increasing layer thickness of the dust layer (IEC/EN 61241-14)

4. Protection class of electrical equipment of group II

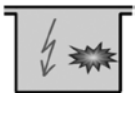
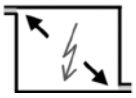
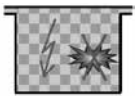
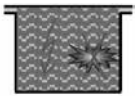
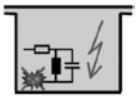
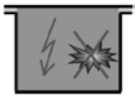
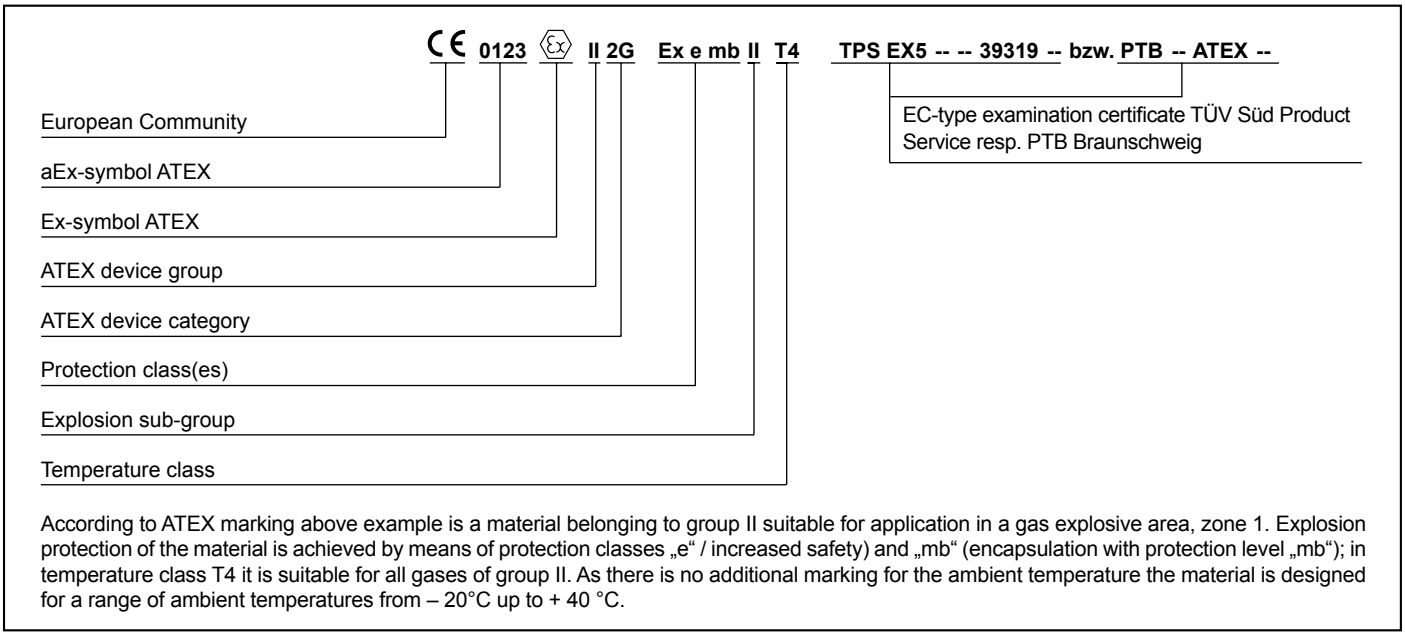
Protection class	Gases / steams	Dusts	Marking	Principle and constructive measures	Application examples
Flameproof enclosures flameproof enclosures 	I		**d**	The components which may ignite an explosive atmosphere are incorporated in an enclosure which withstands the pressure resulting from an explosion of an explosive mixture inside.. Technologically necessary gap and notches are designed concerning length and tightness that a transmission of the explosion on the explosive atmosphere surrounding the enclosure is avoided.	**Control solenoids with built-on switch**, transformers, control and switch devices, engines and generators with collector and collector rings, variable resistors, lamps etc. **Control solenoids in particularly solid execution**
Pressurized enclosures pressurized enclosures 	I	I	**p pD**	The enclosure of electrical materials is filled with an ignition protection gas (air, inert or other suitable gas) which is kept under overpressure compared with the ambient atmosphere. So the ambient atmosphere may not penetrate in the enclosure. Possibly the overpressure will be maintained by an ongoing purging with ignition protection gas.	Large-scale machines, measuring stations, switch and control units, analysis devices, large-scale engines, heating devices etc. No importance for control solenoids
Powder filling powder filling 	I		**q**	The filling of an enclosure with fine-grained fill effects that at occurrence of an electric arc in the enclosure an explosive atmosphere surrounding the enclosure will not be ignited. No ignition may occur either by increased temperature on the enclosure surface.	**Control solenoids**, switching devices, power supply units, electronic components
Oil immersion oil immersion 	I		**o**	The parts of electrical equipment from which an ignition of explosive atmosphere may come are dipped so deeply in a protection liquid (mostly insulating oil) that gases and vapours upside the liquid and outside the enclosure may not be ignited by electric arcs or similar.	Large transformers, switching devices, starting resistances and complete run-up controls. Rarely applied for control solenoids.
Increased safety increased safety 	I		**e**	The possibility of inadmissibly high temperatures and emerging sparks or electric arcs inside and at external parts of electrical equipment are avoided by additional measures and a higher degree of safety.	**Control solenoids,** transformers, accumulators, lamps, squirrel-cage motors, installation materials, terminal and junction boxes
Intrinsic safety intrinsic safety 	I	I	**ia, ib, ic, iaD, ibD**	Intrinsic materials contain only electric circuits which comply with the requirements for intrinsic circuits. Intrinsic circuits are realized when energy and switching capacity are so low that no spark or thermal effect occurs which may cause (at normal operation and under certain error conditions) an ignition of explosive atmosphere of the subgroups IIA, IIB or IIC resp. of a dust-air-mixture.	**Measuring / monitoring information systems or devices often applied for control solenoids Sensors and actors**
Protection class n type of protection n	I		**nC, nA, nR, nL**	Protection is achieved by different constructive actions which are limiting or avoiding the penetration of external atmosphere in enclosures or which are limiting the energy of electric circuits in that way that no sparks, electric arcs or inadmissibly high temperatures occur which may ignite the explosive atmosphere.	**Control solenoids**, contact systems, batteries, material with low energy etc.
Encapsulation encapsulation 	I	I	**ma, mb maD, mbD**	The parts of the electrical material which could ignite an explosive atmosphere by sparks or heating are embedded in a moulding mass. So the explosive atmosphere may not be ignited. This is made by an overall coating of the components with a suitable moulding mass.	**Printed boards with** circuits, relays, switch arrangements, often applied for control solenoids
Schutz durch Gehäuse protection by enclosures		I	**tD**	The enclosure is so tight that no combustible powder may penetrate inside. The surface temperature of the external enclosure is limited.	**Control solenoids,** control systems, diverse materials

Table 4.1 Protection classes for electrical equipment of group II

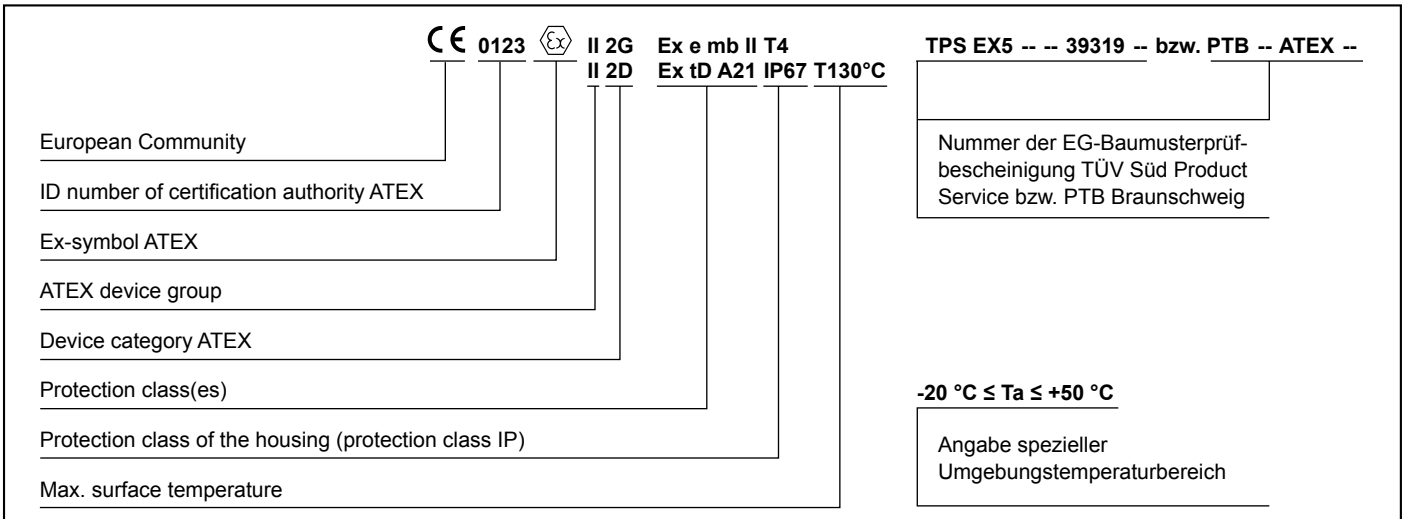
5. Marking / Designation examples

5.1 ATEX-Marking



According to ATEX marking above example is a material belonging to group II suitable for application in a gas explosive area, zone 1. Explosion protection of the material is achieved by means of protection classes „e“ / increased safety) and „mb“ (encapsulation with protection level „mb“); in temperature class T4 it is suitable for all gases of group II. As there is no additional marking for the ambient temperature the material is designed for a range of ambient temperatures from – 20°C up to + 40 °C.

Fig. 5.1.1 Marking example for explosion proof electrical material according to ATEX, suitable for gas explosive areas



According to ATEX marking above example is a material which is identical – concerning device group, device category, protection class, explosion sub-group, temperature class etc. - with the example in fig. 5.1.1 for application in gas explosive areas.

As per marking it is additionally a material belonging to group II for application in an area with danger by combustible dusts, zone 21. Explosion protection is here achieved by means of protection class “tD” (protection by enclosures) whereas the marking “A21” signifies that the material is designed according to procedure “A” (see IEC/EN 61241-1) and may be applied in zone 21. The enclosure is protected according to IP protection class IP 67; its max. surface temperature is 130°C.

The additional marking of the ambient temperature means that the material is designed for a range of ambient temperatures from – 20 °C up to + 50 °C.

Fig. 5.1.2 Marking example for explosion proof electrical material according to ATEX, suitable for dust explosive areas

6. Explosion Protection at

6.1 Certificats and Audits

For many years has been working in the field of explosion-proof electromagnetic actuators and sensors.

Since 2000 a valid certification of the QS-system according to annex VII of the **directive no. 94/9/CE (ATEX 95)** has existed for devices and protection systems destined for the use in explosive areas.

ATEX

is certified for **devices of group II** in the **categories 2G** and **2D** in **protection classes „e“, „m“, „d“, „i“, „mD“, „tD“, „iD“** zertifiziert.

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

PTB

(1) EG-Baumusterprüfbescheinigung

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - **Richtlinie 94/9/EG**

(3) EG-Baumusterprüfbescheinigungsnummer

PTB 03 ATEX 2098 X

(4) Gerät: Ventilmagnet Typ GBRE 022 AMX...

(5) Hersteller: Magnet-Schultz GmbH & Co.KG

(6) Anschrift: Allgäuer Straße 30, 87700 Memmingen, Deutschland

TÜV SÜD Product Service

(1) EG – Baumusterprüfbescheinigung

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen – **Richtlinie 94/9/EG**

(3) EG-Baumusterprüfbescheinigungsnummer

EX5 07 01 39319 010

(4) **Gerät:** **Ventilmagnete**

FHESE 035... ... / FHEPE 035... ... ...

(5) **Hersteller:** **Magnet-Schultz GmbH & Co. KG**

(6) **Anschrift:** **Allgäuerstr.30, 87700 Memmingen**

On the base of that ATEX certification a multitude of approvals (EC-type examination certificate) issued by TÜV Süd Product Service (TPS) and the Physikalisch Technischen Bundesanstalt, Braunschweig (PTB – federal institute for physics and technology in Braunschweig) are already existing for electromagnetic devices for diverse applications.

IEC IECEx

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx TPS 08.0002X issue No.:0 Certificate history:

Status: Current

Date of Issue: 2008-06-26 Page 1 of 3

Applicant: **Magnet-Schultz GmbH & Co. KG**
Allgäuer Str. 30
D-87700 Memmingen
(GERMANY)
Germany

To facilitate the worldwide approvals the QA system of has been also audited for IECEx since 2008.

Up to now this certificate (Quality Assembly Report – QAR) comprises the **protection classes „e“, „mb“, „tD“**.

The enlargement of the Quality Assessment Report with other protection classes is possible on request by test and approval (Test Report – TR) of other devices.

The Quality Assessment Report – QAR as well as the Certificate of Conformity – CoC can be seen and printed on the homepage of IECEx (www.iecex.com).

6.2 Constructive Assembly of Control Solenoids in Different Protection Classes

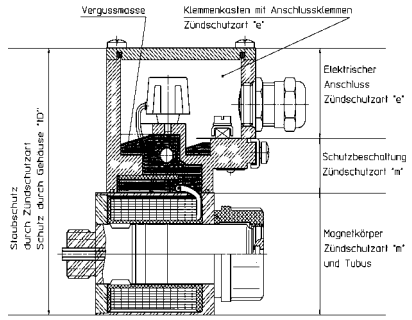


Figure 6.2.1: DC solenoid **GRCE045** protection class **Increased safety („e"), encapsulation („m")** and **protection by enclosures („tD)** for categories **II 2G** and **II 2D**

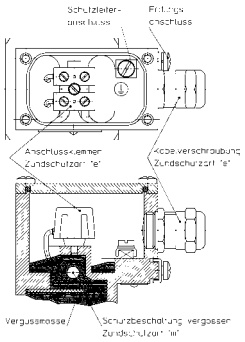


Figure 6.2.2: Terminal in protection class **increased safety („e")**

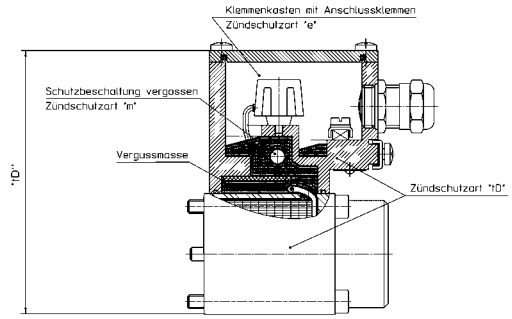


Figure 6.2.3: Proportional solenoid **GAAE045** in protection class **Increased safety („e"), encapsulation („m")** and **protection by enclosures („tD")** for categories **II 2G** and **II 2D**

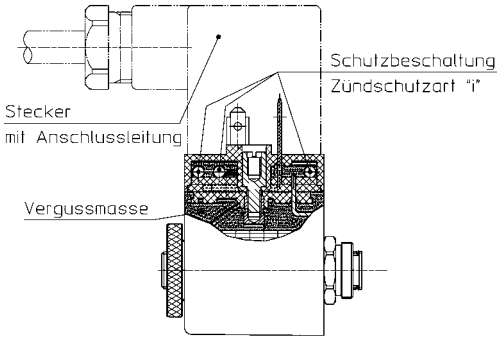


Figure 6.2.4: Valve solenoid **GBXE022** in protection class **intrinsic safety („i"** and **„iD")** for categories **II 2G** and **II 2D**

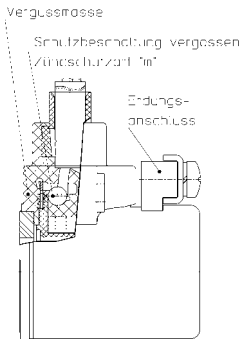


Figure 6.2.5: Magnetic body **FHMPE037** in protection class **encapsulation („m")**

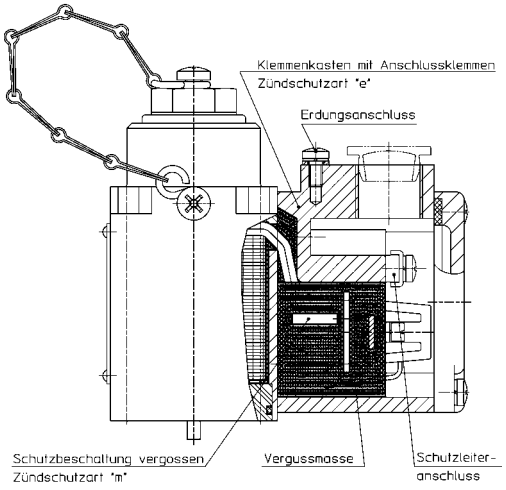


Figure 6.2.6: DC solenoid **GAAE050** in protection class **increased safety („e")** and **encapsulation („m")**

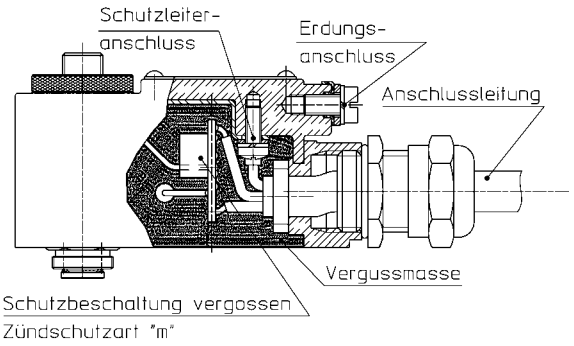


Figure 6.2.7: Valve solenoid **GBRE022** in protection class **encapsulation („m")** for the categories **II 2G** and **II 2D**

6.3 Ambient Temperatures, Battery Assembly

Generally control solenoids for explosive areas are designed for the use in an ambient temperature range of -20°C up to +40°C. In this case an additional identification of the ambient temperature T_a is not necessary.

If the control solenoid is designed for the application in a different temperature range, this is regarded as special design and the ambient temperature range is indicated by a special identification.

Generally the influence of vicinal heat sources as e.g. for battery assembly of solenoids / valves (see fig. 6.3.1 and fig. 6.3.2),has to be considered.

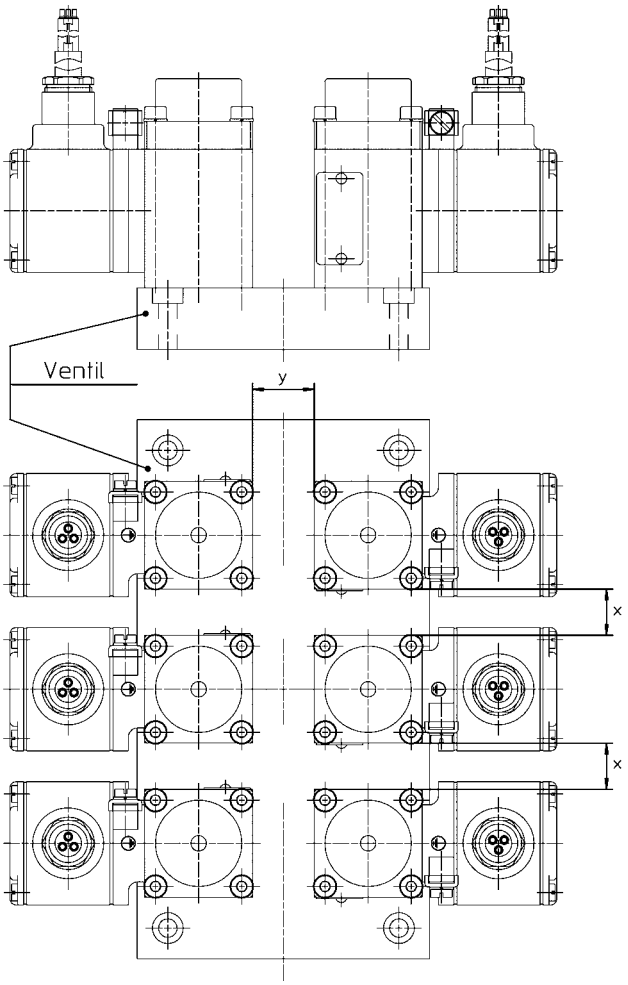


Figure 6.3.1: Example for battery assembly of pneumatic valve solenoids with distances x and y

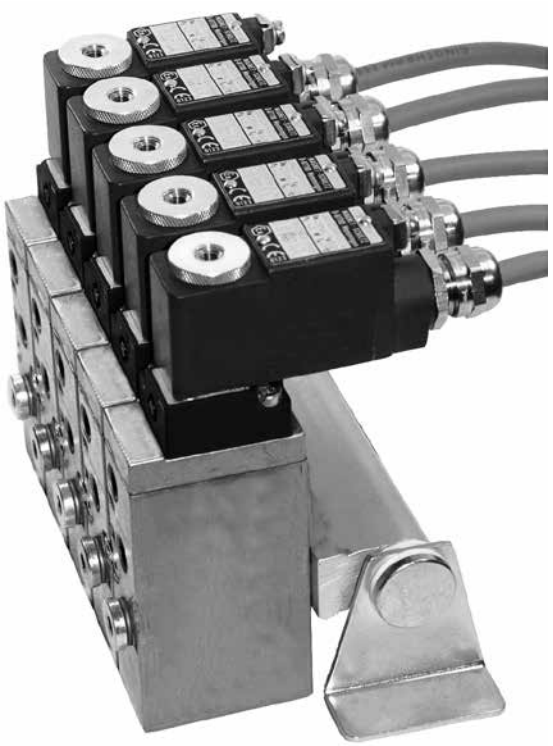


Figure 6.3.2: Battery assembly of pneumatic solenoids in explosion-proof design on a valve line

If an arrangement of several devices is made by a battery assembly in accordance to the distances x and y, the devices may have negative thermal influences against each other. In such cases please contact us indicating the present case of application:

- Dimensions
- Denomination of the distances x, y
- Duty cycle of the different solenoids
- Temperature at the area of application
- Temperature of medium (hydraulic oil, air, etc.)

6.4 Protection Class According to IEC/EN 60529, Corrosion Protection, Mechanical Strength

Besides the protection classes described under point 4 the IP protection classes according to IEC/EN 60529 (VDE 0470-1) are relevant for explosion-proof control solenoids for
• protection against contact
• protection against foreign objects
• protection against ingress of water
concerning operational safety.

Explosion-proof MSM control solenoids are designed among others for a protection class of min. IP54 for G (gas explosive areas) resp. IP65 for D (areas with combustible dust) according to IEC/EN 60529 (VDE 0470-1).

In order to execute the solenoids in explosion-proof design by preventive means – in addition to the requested protection type – also with
• adequate corrosion protection
• sufficient mechanical strength
• eventually higher protection class

concerning the requirements of the area of application, it is necessary to indicate in inquiries or orders - in addition to the requested protection type according to IEC/EN 60529 (VDE 0470-1) – detailed information about
• mechanical strength
• influence of water
• influence of aggressive media

and similar information about the area of application as e.g.:

• unprotected installation outside
• installation in a control cabinet
• assembly on a deck of ship
• relative humidity
• etc.

6.5 Limitation of Over-voltage

Inductance (inductance – L) causes high voltage peaks when switching off DC control solenoids.

In order to exclude these phenomenon and for safety reasons explosion-proof DC control solenoids are provided with a protective circuit which is integrated in the solenoid and situated in parallel to the exciter coil.

(see fig. 6.5.1 and fig. 6.5.2)

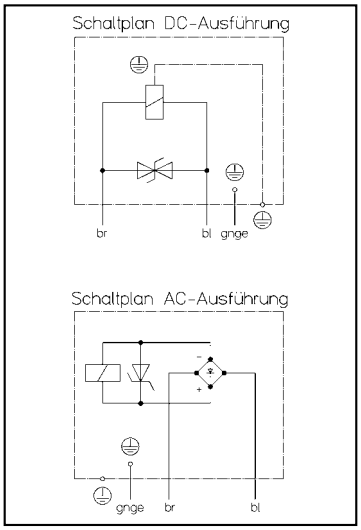


Fig. 6.5.1:
Wiring diagram for

- DC version with protective circuit bidirectional diode
- AC version with protective circuit diode and rectifier

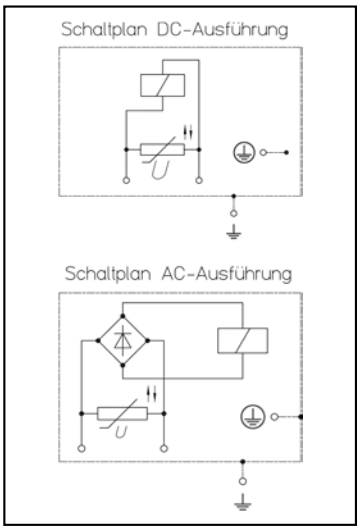


Fig. 6.5.2:

Wiring diagram for

- DC version with protective circuit varistor
- AC version with protective circuit varistor and rectifier

If no protective circuit exists the over-voltage has to be limited externally with appropriate means.

7. Production and Test of Explosion-proof Control Solenoids

In -manufacturing the production of individual parts for the solenoids, the assembly and the test according to the relevant regulations and standards are only carried out by particularly skilled and qualified workers.

All individual parts which are important for the explosion protection are checked with a testing accuracy of 100%. By means of construction and test prescriptions details for a realisation of a safe explosion protection are reliably verified.

After a successful detailed conformity inspection each device is separately marked and the test results of the individual parts and of the finished devices are accurately recorded in detailed test reports.

For -ATEX executions of explosion-proof control solenoids an instruction manual is delivered with each device for category 2. This instruction manual contains information about ambient conditions, installation and starting up as well as information about assembly and detailed technical data. It has to be respected by the user in any case!

MAGNET-SCHULTZ

SPEZIALFABRIK FÜR ELEKTROMAGNETISCHE AKTUATOREN UND SENSOREN

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Betriebsanleitung **BA924707.923681**

791329 Stand: 25.01.2008

Magnetkörper FHEPE 045 924707

mit Tubus FHTP 045 923681

Proportionalmagnet

GRCE 045 AEM A01

Explosionsschutz RL 94/9/EG (ATEX 95)	CE 0123 Ex II 2G Ex e mb II T4 II 2D Ex tD A21 IP65 T130°C
in Übereinstimmung mit den Normen:	EN 60079-0: 2004 EN 60079-7: 2003 EN 60079-18: 2004 prEN 61241-0: 2005 EN 61241-1: 2004
EG-Baumusterprüfbescheinigung:	TPS EX5 06 04 39319 009
Schutzart nach IEC/EN 60529:	IP65
Schutzklasse nach DIN VDE 0580:	I

Seite 1 von 4

Figure 7.1: Example, ATEX operating manual

EG-KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITÉ

DC 012459

Wir (Name des Anbieters) We (Supplier's Name) Nous (Nom du Fournisseur)	**MAGNET-SCHULTZ GmbH & Co.** Fabrikations und Vertriebs KG
Anschrift Address Address	Allgäuer Straße 30 D – **87700 Memmingen** Germany
erklären in alleiniger Verantwortung, dass das Produkt: declare under sole responsibility, that the product: déclarons sous notre seule responsabilité, que le produit:	
Bezeichnung Name Nom	Proportionalmagnet proportional solenoid électro-aimant proportionnel
Type, Modell Type, Model Type, Modèle	FHEPE 045 924707 + FHTP 045 923681 (+ MSM 923681 P) **GRCE 045 AEM A01**
mit zusätzlicher Kennzeichnung with additional marking avec additionnelle marque	TPS EX5 06 04 39319 009 CE 0123 Ex II 2G Ex e mb II T4 II 2D Ex tD A21 IP65 T130°C

den Vorschriften der **EG - Richtlinie 94/9/EG** und deren Änderungsrichtlinien entspricht.
corresponds to the regulations of the EC - Directive 94/9/EC and its amendments.
correspond aux arrêté de la C.E.E. directive 94/9/CEE.

Die Anforderungen der Normen The requirements of the standards Les exigences des normes	**EN 60079-0: 2004** **EN 60079-7: 2003** **EN 60079-18: 2004** **pr EN 61241-0: 2005** **EN 61241-1: 2004**
werden erfüllt. will be met. sont satisfaites.	**DIN VDE 0580: 2000**

MAGNET-SCHULTZ GmbH & Co. KG

Memmingen, _____
Ort und Datum der Ausstellung
Place and Date of Issue
Lieu et date d'établissement

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Manager Quality Assurance
Direction Garantie de Qualité

Diese Erklärung entspricht EN 45014 | This Declaration corresponds to EN 45014 | Cette Déclaration correspond à EN 45014

Figure 7.2: Example, ATEX declaration of conformity

Additionally a manufacturer's CE certificate of conformity is delivered for and joint to each delivery lot (devices for category 2 and category 3). This certificate of conformity proves that the respective -control solenoid is conform to the underlying EC-Type Examination Certificate (devices for category 2) resp. to the manufacturer's examinations (devices for category 3) and that it fulfills the requirements of the respective standards and the prescriptions of the EC directive 94/9/CE.

According to directive 1999/92/CE the instruction manual and / or the certificate of conformity have to be respected by the raiser / user and have to be joined to the explosion protection document for documentation.

-IECEx executions of explosion-proof control solenoids are also delivered with a correspondent instruction manual.

The correspondent certificate of conformity (CoC) and the Quality Assessment Report (QAR) are stored on the homepage of IECEx (www.iecex.com) where they can be seen and printed if required.

8. Regulations, Standards and Provisions

For the constructive development, design and test of explosion-proof control solenoids the following points 8.1 up to 8.17 are taken into consideration according to table 7.1.

8.1	**IEC / EN 60079-0** (VDE 0170-1)	Electrical equipment for gas explosive areas **- General requirements**
8.2	**IEC / EN 60079-1** (VDE 0170-5)	Electrical equipment for gas explosive areas **- Flameproof enclosures**
8.3	**IEC / EN 60079-2** (VDE 0170-301)	Electrical equipment for gas explosive areas **- Pressurized enclosures**
8.4	**IEC/EN 60079-5** (VDE 0170-4)	Explosive atmosphere **- Equipment protection by powder filling**
8.5	**IEC / EN 60079-6** (VDE 0170-2)	Explosive atmosphere **- Equipment protection by oil immersion**
8.6	**IEC / EN 60079-7** (VDE 0170-6)	Explosive atmosphere **- Equipment protection by increased safety**
8.7	**IEC / EN 60079-11** (VDE 0170-7)	Explosive atmosphere **- Equipment protection by intrinsic safety**
8.8	**IEC / EN 60079-15** (VDE 0170-16)	Electrical equipment for gas explosive areas **- Construction, test and marking of protection class „n“ apparatus**
8.9	**IEC / EN 60079-18** (VDE 0170-9)	Explosive atmosphere **- Equipment protection by encapsulation**
8.10	**IEC / EN 61241-0** (VDE 0170-15-0)	Electrical equipment for application in areas with combustible powder **- General requirements**
8.11	**IEC / EN 61241-1** (VDE 0170-15-1)	Electrical equipment for application in areas with combustible dust **- Protection by enclosures**
8.12	**IEC / EN 61241-4** (VDE 0170-15-4)	Electrical equipment for application in areas with combustible **- Protection class « pD »**
8.13	**IEC / EN 61241-11** (VDE 0170-15-11)	Electrical equipment for application in areas with combustible dust **- Protection by intrinsic safety**
8.14	**IEC / EN 61241-18** (VDE 0170-15-18)	Electrical equipment for application in areas with combustible dust **- Protection by encapsulation**
8.15	**IEC / EN 60079-14** (VDE 0165-1) **IEC / EN 60079-17** (VDE 0165-10-1) **IEC / EN 61241-14** (VDE 0165-2) **IEC / EN 61241-17** (VDE 0165-10-2)	Planning and installation as well as test and maintenance of electrical equipment in gas explosive areas and / or areas with combustible dust
8.16	DIN VDE 0580	General regulations for electromagnetic devices
8.17	IEC / EN 60529 (VDE 0470-1)	Protection classes by enclosures

Table 8.1: Regulations, standards and provisions

9. -Actuators in Explosion-proof Execution

As reputable and potential manufacturer of explosion-proof solenoids is able to provide a wide and manifold programme for control solenoids in different protection classes according to the effective regulations.

Fig. 9.1: Single-acting solenoids type GTCE for electromechanic applications

Ⓔx II 2G EEx em II T4/T5

Fig. 9.2: Single-acting solenoids type GMCE for electromechanic applications

Ⓔx II 2G EEx m II T4

Fig. 9.3: Shotbolt lock units pull or push type GSCE for electromechanic applications

Ⓔx II 2G EEx m II T4

Fig. 9.4: ON/OFF and proportional solenoids type GHPE 037... / GRCE 037... for hydraulic applications

Ⓔx II 2G EEx m II T4
Ⓔx II 2D IP65 T130°C

Fig. 9.5: Proportional solenoids type GREE 035 AMX A01... for hydraulic applications

Ⓔx II 2G EEx m II T4

Fig. 9.6: ON/OFF and proportional solenoids type GHPE ... / GRCE ... for hydraulic applications

Ⓔx II 2G Ex e mb II T4
Ⓔx II 2D Ex tD A21 IP65 T130°C

Fig. 9.7: ON/OFF and proportional solenoid Type GAAE ... / GRFE ... for hydraulic applications

Ⓔx II 2G Ex e mb II T4
Ⓔx II 2D Ex tD A21 IP65 T130°C

Fig. 9.8: Valve solenoid Type GBRE 022 AMX… for pneumatic applications

Ⓔx II 2G EEx m II T5
Ⓔx II 2D IP65 T95°C

Fig. 9.9: Valve solenoid in intrinsically safe version Type GBXE 022 AIA A01… for pneumatic applications

Ⓔx II 2G EEx ia IIC T6
Ⓔx II 2D Ex iaD IP65 T80°C

Further information can be taken from our brochure « ATEX 95 explosion-proof actuators ». Please ask the support of our responsible technical office when required.

-Technical Explanations

G XX	DC solenoids
G XX E	Explosion-proof control solenoids
G XX 2. Zusatz	DC proportional solenoids
G XX V	DC shotbolt lock units
W XX	AC solenoids
P XX	DC or AC ON/OFF solenoids for pneumatic applications
H XX	DC or AC ON/OFF solenoids for hydraulic applications
Y XX	Vibrators