IECEx certification of Non-Electrical Ex Equipment

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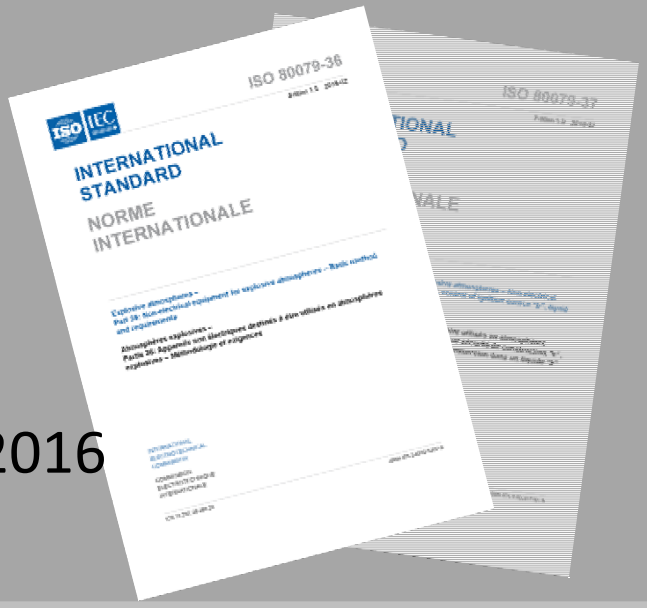
Brief history of Non-Electrical Ex Equipment standards

In 2008, during the SC31M Plenary meeting it was decided to create an Ad-Hoc Group which will deal on the production of a standard covering Non-electrical equipment and components – Ignition hazard assessment, application of IEC 60079-0 for mechanical equipment " on the basis of EN 13463-1.

It was also decided to draft the requirements for Non-electrical equipment in two parts:

- ISO 80079-36: Basic method and requirements
- ISO 80079-37: Non electrical type of protection constructional safety 'c', control of ignition source 'b', liquid immersion 'k'



These standards were published on February 2016

Scope of Non-Electrical Equipment standards

The 80079-36 standard specifies:

- the basic method and requirements for
- design, construction, testing and marking of
- non-electrical Ex equipment, Ex Components, protective systems, devices and assemblies of these products that have
- their own potential ignition sources and are intended for use in explosive atmospheres.

Hand tools and manually operated equipment without energy storage are excluded from the scope of the 80079-36 standard.

IECEx Certification for Non-Electrical Equipment

In September 2016, the ISO 80079-36 and ISO 80079-37 standards were adopted by IECEx for the certification of Non-Electrical Equipment.

- It is defined in the Operational Document OD 280
- The application shall be submitted by the manufacturer with an ignition hazard assessment based on the requirements of ISO 80079-36 and -37
- It is requested that manufacturer make personnel with knowledge of the product available to assist the ExCB/ExTL personnel review the ignition hazard assessment
- Provide equipment as required for testing and assessment

Combination of Electrical and Non-Electrical Equipment

The manufacturer applying for certification has the following options:

- Certification of just the electrical equipment
- Certification of just the non-electrical equipment
- Certification of both electrical and non-electrical equipment

Only the relevant standards covered by the certification can be shown.

The description of the equipment must be clear. What parts of the equipment are covered by the certification:

- “Motor pump set” is Electrical and Non-Electrical Equipment
- “Motor for motor pump set” is only Electrical Equipment
- “Pump which can be motorized” is only Non-Electrical Equipment

Examples of Non-Electrical Equipment

- Non-Electrical Equipment could be:
  - couplings,
  - pumps,
  - gearboxes,
  - brakes,
  - hydraulic and pneumatic motors
  - and any combination of devices to realize a machine, fan, engine, compressor, assemblies, etc.

Assessment Procedure

The ignition hazard assessment procedure can be divided into the following steps:

1. Identification of ignition hazards (analysis of the ignition hazards and their causes),
2. Preliminary ignition hazard estimation and evaluation (estimation of the ignition hazards determined in step 1 regarding the frequency of their occurrence and comparison with the target EPL),
3. Determination of measures (determination of protective measures, if necessary, to reduce the likelihood of an ignition hazard according to step 2),
4. Finally ignition hazard estimation and categorization (estimation of the ignition hazards regarding the frequency of occurrence after including protective measures determined in step 3),
5. Determination of the EPL, Temperature classification, Gas and Dust Group.

Step 1: Identification of Ignition Hazards

Possible Ignition Sources	Equipment Related Yes/No	Reason
Hot surfaces	Yes	Inside and outside - Gas compression, vane friction, particle ingress
Mechanical sparks	Yes	Particles could produce hot-spots
Flames, hot gases	Outside No Inside Yes	Inside compression temperature to be measured - gas temperature directly at exhaust
Electrical sparks	No	Not present
Stray electric currents and cathodic corrosion protection	No	Not present
Static electricity	Yes	Vanes, lipseal, exhaust filter, float valve
Lightning	No	Not present
Electromagnetic waves	No	Not present
Ionising radiation	No	Not present
High frequency radiation	No	Not present
Ultrasonic	No	Not present
Adiabatic compression	Yes	Inside chamber
Chemical reaction	Yes	Possible with process fluid/gas

Example with a non-metallic enclosure

In order to understand the process of the different steps about the assessment in accordance with ISO 80079-36 we are going to proceed with a very simple example:

– the non-metallic enclosure

Step 1: Identification of Ignition Hazards

	1	
	Ignition hazard analysis	
	a	b
No.	Potential ignition source	Description of the basic cause (Which conditions originate the ignition hazard?)
1	electrostatic discharge	parts of non metallic material with a surface resistance exceeding 1 GΩ

Step 2: First assessment

	1		2				
	Ignition hazard analysis		**Assessment of the frequency of occurrence without application of an additional measure**				
	a	b	a	b	c	d	e
No.	Potential ignition source	Description of the basic cause (Which conditions originate the ignition hazard?)	during normal operation	during expected malfunction	during rare malfunction	not relevant	Reasons for assessment
1	electrostatic discharge	parts of non metallic material with a surface resistance exceeding 1 GΩ		X			no charging during normal operation; material is an outer part of the casing; charging could be done by a person (operator)

Malfunction definition

- Malfunction (ISO 80079-36 §3.3.1):
  situation where equipment or components do not perform their intended function with respect to explosion protection
- Expected malfunction (ISO 80079-36 §3.3.2):
  disturbance or equipment malfunction which normally occur in practice
- Rare malfunction (ISO 80079-36 §3.3.3):
  type of malfunction, which may happen, but only in rare instances.

Step 3: Determination of protective measures

3		
Measures applied to prevent the ignition source becoming effective		
a	b	c
Description of the measure	References (standards, technical rules, experimental results known from literature)	Technical documentation (evidence including relevant features listed in column)
largest area less than 2500 mm^2	ISO 80079-36, 5.7.5 c), 6.4.2 and 6.4.3	- specifications of the material - (6.4.2); - parts list, pos. Z; - drawing No. Y

Step 4: Concluding estimation and categorization

After applying the measure, the categorization has to be done as follow:

4					
Frequency of occurrence incl. all measures					
a	b	c	d	e	f
during normal operation	during expected malfunction	during rare malfunction	No need for futher consideration	resulting EPL in respect of this ignition hazard	necessary restrictions
			X	Ga Da	
		X		Gb Db	
	X			Gc Dc	
X				*	

* If after applying the measure, the source of ignition remain available during normal operation then the equipment can't be used in explosive atmosphere

Step 4: Concluding estimation and categorisation

3			4					
Measures applied to prevent the ignition source becoming effective			**Frequency of occurrence incl. all measures**					
a	b	c	a	b	c	d	e	f
Description of the measure	References (standards, technical rules, experimental results known from literature)	Technical documentation (evidence including relevant features listed in column)	during normal operation	during expected malfunction	during rare malfunction	No need for futher consideration	resulting EPL in respect of this ignition hazard	necessary restrictions
largest area less than 2500 mm^2	ISO 80079-36, 5.7.5 c), 6.4.2 and 6.4.3	- specifications of the material - (6.4.2); - parts list, pos. Z; - drawing No. Y				X	Ga Da	IIB IIIC

Second example with a ball bearing

During its life a bearing has negligible heating during normal operation.

Usually a bearing is designed according ISO 281 for a specified lifetime.

Under these conditions, a malfunction is generally agreed as a rare incident.

The maximum surface temperature is determined under the most adverse conditions (110 °C).

It is important to note that the maintenance of the equipment is part of the safety.

- in this case it would be requested to the user (in the instructions) to change the bearing before the end of the lifetime.

Step 1: Identification of Ignition Hazards

	1	
	Ignition hazard analysis	
	a	b
No.	Potential ignition source	Description of the basic cause (Which conditions originate the ignition hazard?)
2	hot surface	hot surface of a ball bearing

Step 2: First assessment

	1		2				
	Ignition hazard analysis		**Assessment of the frequency of occurrence without application of an additional measure**				
	a	b	a	b	c	d	e
No.	Potential ignition source	Description of the basic cause (Which conditions originate the ignition hazard?)	during normal operation	during expected malfunction	during rare malfunction	not relevant	Reasons for assessment
2	hot surface	hot surface of a ball bearing		X			bearing has negligible heating during normal operation

Step 3: Determination of protective measures

3		
Measures applied to prevent the ignition source becoming effective		
a	b	c
Description of the measure	References (standards, technical rules, experimental results known from literature)	Technical documentation (evidence including relevant features listed in column)
The bearing is calculated according to ISO 281 for a specified lifetime. A malfunction is generally agreed as a rare incident under these conditions. The maximum surface temperature is determined under the most adverse conditions (110 °C)	ISO 80079-37 "c"	- test report no. … about the thermal type test

Step 4: Concluding estimation and categorisation

4					
Frequency of occurrence incl. all measures					
a	b	c	d	e	f
during normal operation	during expected malfunction	during rare malfunction	No need for futher consideration	resulting EPL in respect of this ignition hazard	necessary restrictions
		X		Gb Db	T4

Third example: the breakdown of a bearing

In a mixer, a stirrer is placed inside a vessel. A bearing ensure the good rotation of the stirrer in the vessel.

The breakdown of the bearing of an EPL Gb equipment could cause grinding of a stirrer in a vessel (zone 0); the distance between the stirrer and the vessel may be unacceptably reduced.

Step 1: Identification of Ignition Hazards

	1	
	Ignition hazard analysis	
	a	b
No.	Potential ignition source	Description of the basic cause (Which conditions originate the ignition hazard?)
3	mechanical spark	breakdown of the bearing of an EPL Gb equipment (gear) could cause grinding of a stirrer in a vessel (zone 0); the distance between the stirrer and the vessel may be unacceptably reduced

Step 2: First assessment

2				
Assessment of the frequency of occurrence without application of an additional measure				
a	b	c	d	e
during normal operation	during expected malfunction	during rare malfunction	not relevant	Reasons for assessment
		X		A breakdown of the bearing needs to be considered as a rare malfunction (for EPL Ga equipment), because this is not considered in EPL Gb equipment. Therefore, mechanical grinding cannot be excluded inside the vessel.

Step 3: Determination of protective measures

3		
Measures applied to prevent the ignition source becoming effective		
a	b	c
Description of the measure	References (standards, technical rules, experimental results known from literature)	Technical documentation (evidence including relevant features listed in column)
The shaft feed through is designed with an additional emergency bearing to avoid contact between stirrer and vessel (sleeve bearing in EPL Gb; EPL of the gear remains unchanged) In addition the failure of the bearing will be controlled by a temperature monitoring and limiting system (ignition prevention type "b1"). Limiting temperature < 155 °C.	Clause 4, ISO 80079-37, 6.1 and 8.1	- test report no. … about the thermal type test - Instructions of the monitoring system (purchased from an external supplier)

Step 4: Concluding estimation and categorisation

4					
Frequency of occurrence incl. all measures					
a	b	c	d	e	f
during normal operation	during expected malfunction	during rare malfunction	No need for futher consideration	resulting EPL in respect of this ignition hazard	necessary restrictions
			X	Ga Da	T3

Step 5: Determination of the EPL, T°C and Groups

The results of the assessment will be to summarize for all sources of ignition identified in step 1: EPL, Temperature classification, Gas and Dust Group for the equipment.

	4					
	Frequency of occurrence incl. all measures					
	a	b	c	d	e	f
No	during normal operation	during expected malfunction	during rare malfunction	No need for futher consideration	resulting EPL in respect of this ignition hazard	necessary restrictions
1				X	Ga Da	IIB IIIC
2			X		Gb Db	T4
3				X	Ga Da	T3
4			X		Gb Db	IIC
5			X		Gb Db	IIB
Resulting EPL including all existing ignition hazards:					Gb Db	IIB IIIC T3

Marking of non-electrical Ex equipment

In accordance with the draft ISO 80079-36 the marking of a Non-Electrical equipment would be:

– SOCIETE FR,	= name
– AB 5	= type of equipment
– Ex h IIB T3 Gb	= marking according to Ex symbol, the letter "h", equipment group II, (subgroup IIB), temperature class T3, EPL Gb
– Ex h IIIC T155°C Db	= marking according to Ex symbol, the letter "h", equipment group III, (subgroup IIIC), maximum surface temperature T155°C, EPL Gb
– Ser. No. 32567	= serial number
– IECEx INE 16.0012X	= certificate number with special conditions

Thank you

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