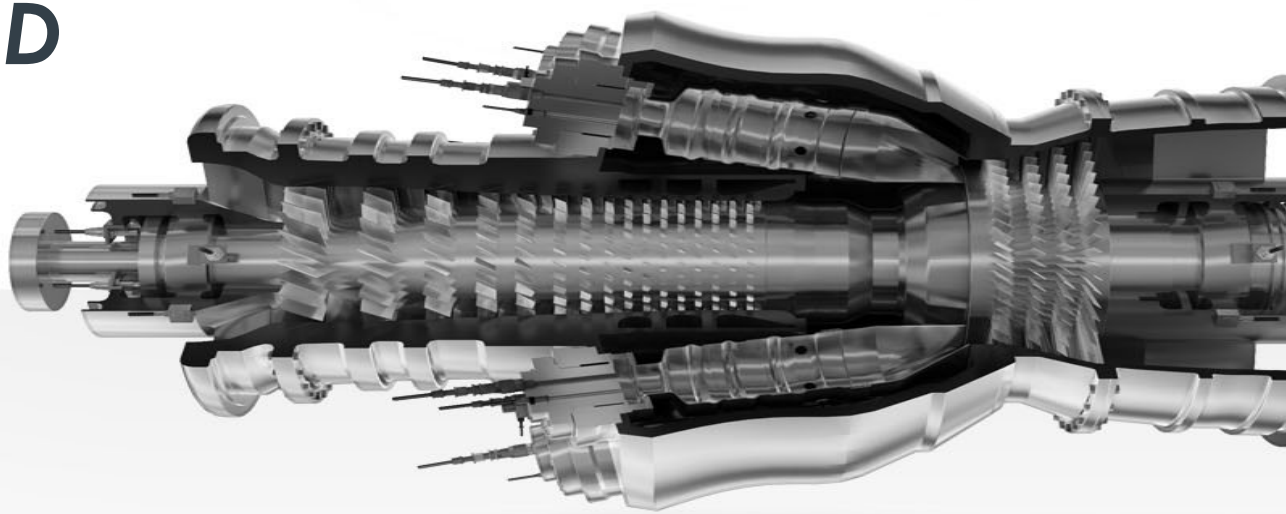
MEGGiTT

Enabling the Extraordinary
To Fly To Power To Live

EX/ATEX CERTIFICATION

MEANING, REGULATIONS AND OUR RESPONSIBILITIES



vibro-meter

Product Lines & Market solutions

Pascal Kornatko, Ex/ATEX manager, Fribourg

March 23, 2022

MEGGITT

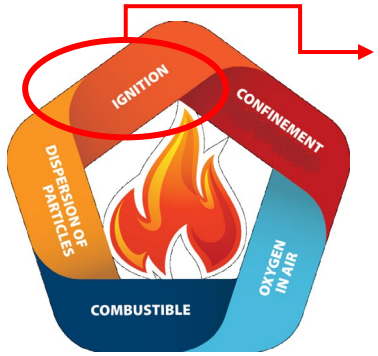
WHAT MEANS EX/ATEX?
…AND WHAT FOR…

- Wording
- Principle of explosion
- Ignition sources
- Zoning introduction
- Explosive substances
- Take away (intermediate)

Ex/ATEX certification: meaning, regulations and our responsibilities

What means Ex/ATEX (and what for)

- Wording
  - "ATEX" stands for "ATmosphère EXplosive" (Explosive atmosphere in English), with reference to European standard
  - "Ex" stands for Explosive atmosphere…all other the world (Except Europe ☺)
  - It basically characterizes/defines an environment favoring the explosion phenomena.
- Principle of explosion
  - An explosion is defined as "a rapid increase in volume and release of energy in an extreme manner"
  - From ignition to catastrophic consequences:



Meggitt devices

Confinement limits

Real engine test…

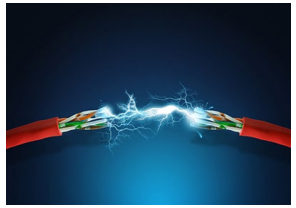
Propagation

Wood mill explosion, Bosley (UK), July 2015

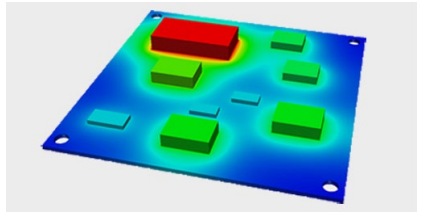
Ex/ATEX certification: meaning, regulations and our responsibilities

What means Ex/ATEX (and what for)

- Ignition sources
  - Electrical energy
    - Sparks can be generated by dielectric rupture
    - …or by mechanical switching (e.g. relays)
    - …or electrostatic discharges (material, grounding, …)



  - Thermal energy
    - Excessive temperature are essentially generated by components

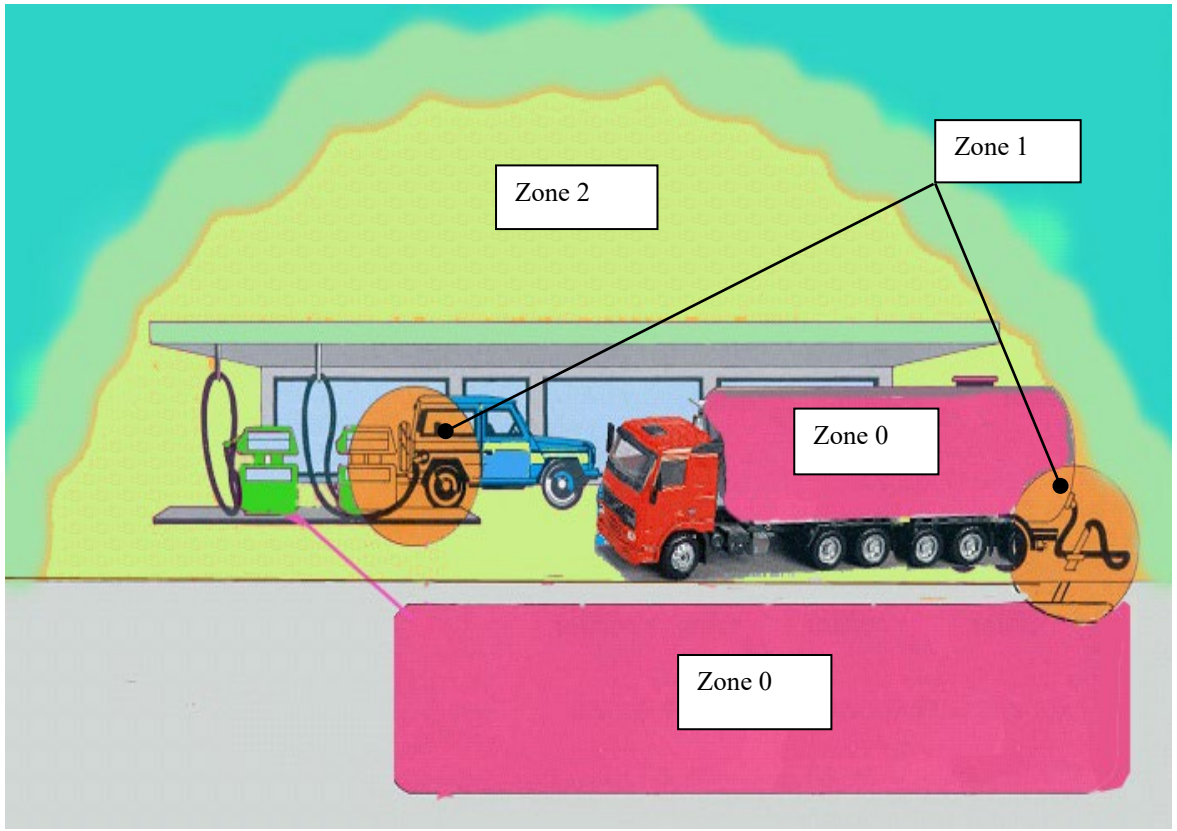


  - Optical energy
    - An optical beam, when focused, can heat up any material or substance

Ex/ATEX certification: meaning, regulations and our responsibilities

What means Ex/ATEX (and what for)

- Environment zoning introduction



- **Zone 0**

  Area in which an explosive atmosphere is permanently present

- **Zone 1**

  Area in which an explosive atmosphere is likely to occur during normal operation

- **Zone 2**

  Area in which an explosive atmosphere is not likely to occur during normal operation

→ Zoning simply defines the probability of our equipment to be exposed to "threats"

Ex/ATEX certification: meaning, regulations and our responsibilities

What means Ex/ATEX (and what for)

- Family of “flammable/explosive substance”
  - Dusts are explosive substances

    Dust and many fine powders, are intrinsically combustible

  - And obviously gasses

    …by nature…

Ex/ATEX certification: meaning, regulations and our responsibilities

Intermediate take-away

- The Explosive atmosphere is by nature our environment
  - Oxygen and flammable substances will almost always be present, especially for sensors
- Our equipment shall not be ignitors
  - This is the only domain we can act on
- Thus, our equipment shall not be a source of:
  - Electrical arcs/sparks;
  - Excessive temperature;
  - Uncontained light energy.
- Our equipment shall be protected according to their intended environment usage:
  - Dust or gas (or both);
  - Hazard probability of exposure (zone).

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THE REGULATIONS

Overall

Certification process

Meggitt implications

Specific requirements

Ex/ATEX certification: meaning, regulations and our responsibilities

The regulations

- Overall
  - ATEX EEC certification
    - According to "Directive 2014/34/EU", Feb. 26, 2014 (latest)
    - Only valid for EEC (European Economic Community)

  - IECEx certification
    - According to IEC 60079-0, Dec. 2017
    - Supposed to be valid for other countries out of EEC

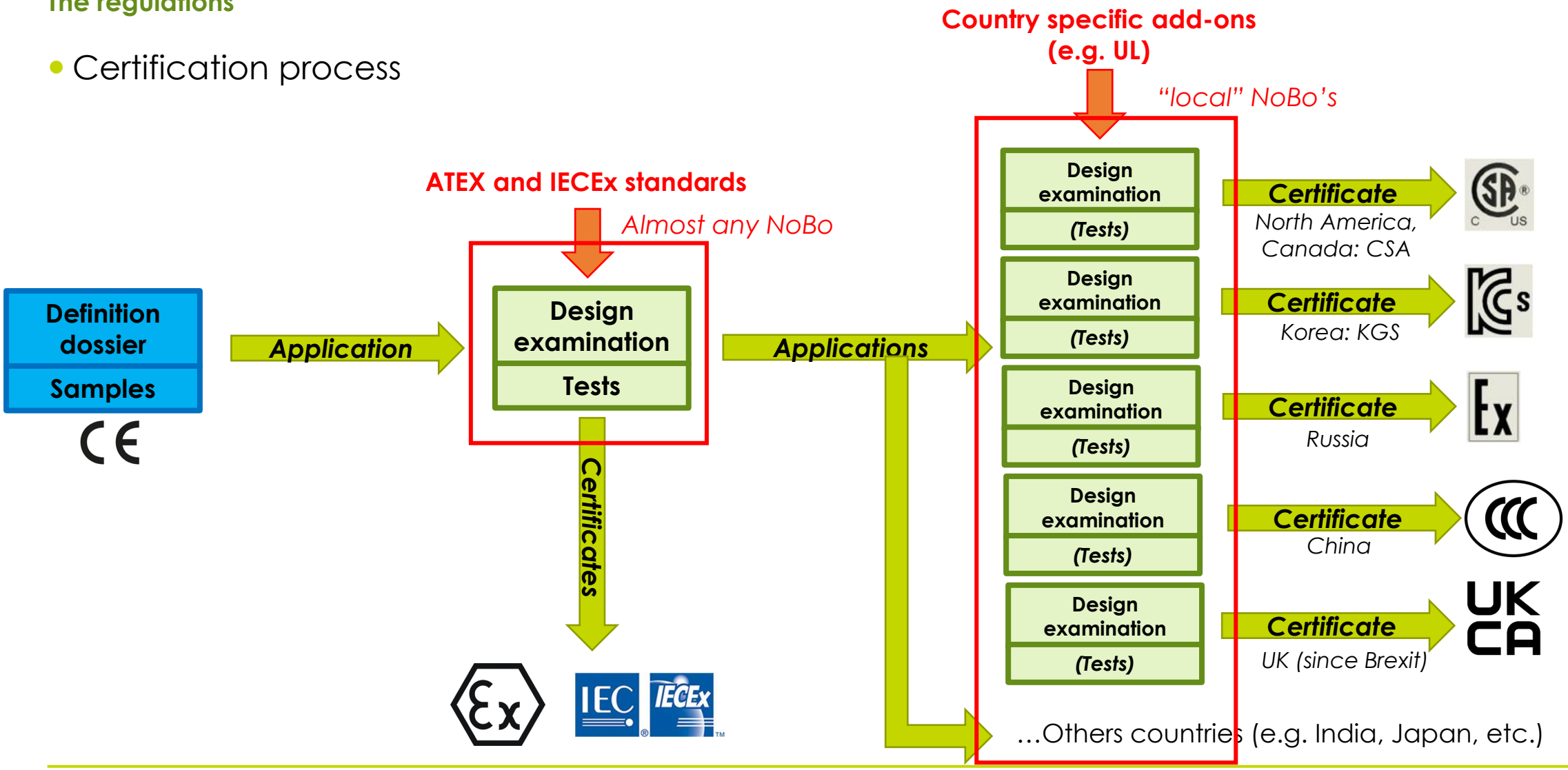
    …but not really in facts…

- But having an ATEX and IECEx certification is not sufficient to allow us selling our products all over the world…

Ex/ATEX certification: meaning, regulations and our responsibilities

The regulations

- Certification process



Ex/ATEX certification: meaning, regulations and our responsibilities

The regulations

- Certifying a product is one thing
  - Each single certification granted has to be visible on the product itself

*Illustration on IPC707: around 70*20mm sticker*

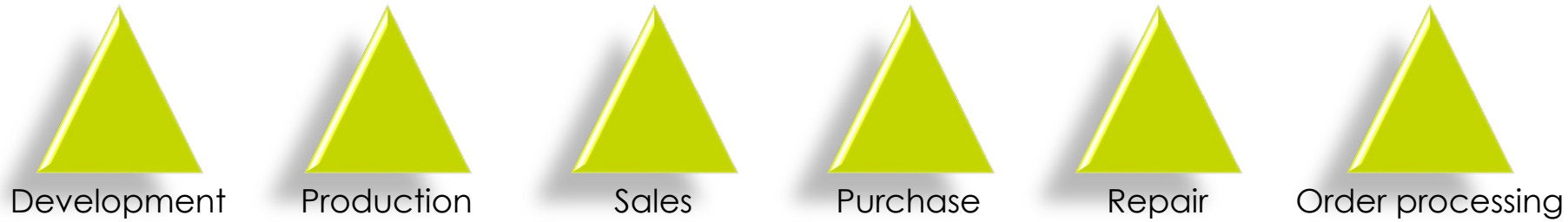
- There is "side effects" as an ATEX/Ex product manufacturer/seller
  - We have to have a quality process ensuring that every single device produced is identical to the one(s) tested by the NoBo(s)
  - We have to comply with applicable regulation from Supply Chain up to Distribution channels, guaranteeing that every single people along the process is aware of Ex/ATEX rules
  - We are audited by every single NoBo that has granted an Ex/ATEX certification on any product, on a regular basis (e.g. quarterly for CSA, more generally on a yearly basis)
  - The audits are based on IEC 80079-34 (somehow "ISO 9001^{++}"), incorporated in our MQP-1001 (Quality Assurance programme for ATEX/Ex products)

  → All above also applies to any of our sub-contractors (e.g. TTe)

Ex/ATEX certification: meaning, regulations and our responsibilities

The regulations

- Specific requirements
  - Each trade body or department at Meggitt SA is in charge of certain responsibilities when it comes to an Ex product



Ex/ATEX certification: meaning, regulations and our responsibilities

Intermediate take-away

- There is one certification process per geographical area we intend to sell our product
- The entry points are:
  - The CE conformity statement (for ATEX products only).
  - The IECEx certification, which is used for other countries
- This is basically a pretty long and costly process to certify 1 single product in 1 geographical zone
  - Depending on complexity, lead time for 1 certification is basically 3-6 months, and a cost of 20-30k$
- Each certification has to be visible on the product when installed
- Meggitt and its sub-contractors are periodically “probed” through audits and deep inspections

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THREAT CLASSES AND PROTECTION MODES

Explosion groups

Equipement Protection Level – EPL categories

Equipment Protection Modes – PM

Gas temperature classification

Matching EPL/PM with Zones

Ex/ATEX certification: meaning, regulations and our responsibilities

Threat classes and protection modes

- Threats according to the application, "explosion groups":
  - Group I: mining (only fire damp, methane), more generally "underground"
  - Group II: Gases and vapors or Dust, more generally "surface"

- Explosion groups for gas threat:

	Explosion group (marking)		
	IIA	**IIB**	**IIC**
Low ignitability, typical gas: propane	x		
Medium ignitability, typical gas: ethylene		x	
High ignitability, typical gas: hydrogen			x

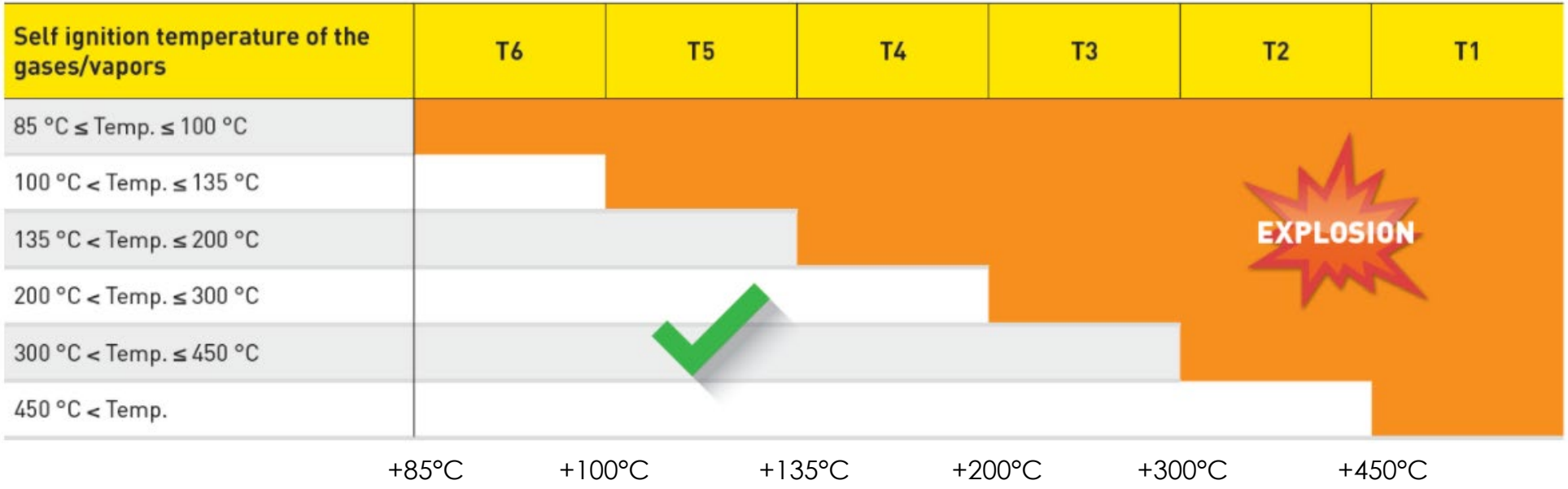
- Explosion groups for dust threat:

	Explosion group		
	IIA	**IIB**	**IIC**
Flammable fibres	x		
non-conductive dust		x	
Conductive dust			x

Ex/ATEX certification: meaning, regulations and our responsibilities

Threat classes and protection modes

- Each gas family has its own self ignition temperature
- The Ex/ATEX standard classes gas across 6 temperature classes:



- The surface temperature of any equipment mounted in Ex zone shall never reach the self ignition of the specified gas(ses)

Ex/ATEX certification: meaning, regulations and our responsibilities

Threat classes and protection modes

- EPL categories of equipment/systems
  - The EPL category fits the probability of threat occurrence, previously called the "Zone" it intends to be mounted in;
  - There is 3 EPL levels:

Marking	Equipment Protection level	Category	EPL denomination
Ga, Da	The device shall behave safely, even in case of 2 independant & simultaneous failure	1	Very high level of protection
Gb, Db	The device shall behave safely in case of a single failure	2	High level of protection
Gc, Dc	The device shall behave safely in normal operating conditions, without failure presence	3	Normal protection

→ The highest the probability of occurrence is, the highest the EPL level shall be: e.g. for a Zone 0, a very high of protection is required (EPL Ga, Da)

Ex/ATEX certification: meaning, regulations and our responsibilities

Threat classes and protection modes

- Protection modes of equipment/systems
  - The Protection Mode (PM) represents the way the protection is achieved;
  - There is many PM as per EN-60079-x:

Code	With reference to	Principle	Type of protection
d	EN 60079-1	Prevents transmission of the explosion outside	Flameproof enclosure
p	EN 60079-2	Positive pressure device	Pressurised apparatus
q	EN 60079-5	Prevents transmission of explosion outside	Powder filling
o	EN 60079-6	Parts immersed in oil to isolate from explosive atmosphere	Oil immersion
e	EN 60079-7	Prevents high temperature and sparks	Increased safety
i	EN 60079-11	Low current/voltage supply	Intrinsic safety
n	*EN 60079-15*	*Prevents transmission of explosion outside, restricted to Zone 2*	*nA: non-sparking* *nC: contact protected* *nR: restricted breathing*
m	EN 60079-18	Encapsulated	Molding
op	EN 60079-28	Prevents optical radiation to leak in explosive atmosphere	Hardenered path, interlock
t	EN 60079-31	Dust explosion proof	Explosionproof enclosure

→ Not all PM (Protection Modes) represents the same EPL (Equipment Protection Level) and thus, there is an association between PM and Zone

Ex/ATEX certification: meaning, regulations and our responsibilities

Threat classes and protection modes

- Allowable PM/EPL by Zone

Protection mode	Protection category	Resulting protection code	Protection type	EPL (Equipement Protection Level)	Suitable for:					
					Gasses, mists, vapors			Dust		
					Zone 0	Zone 1	Zone 2	Zone 20	Zone 21	Zone 22
d	1	da	Flameproof enclosure	Ga	x	x	x			
d	2	db	Flameproof enclosure	Gb		x	x			
d	3	dc	Flameproof enclosure	Gc			x			
e	2	eb	Increased Safety	Gb		x	x			
e	3	ec	Increased Safety	Gc			x			
i	1	ia	Intrinsic Safety	Ga or Da	x	x	x	x	x	x
i	2	ib	Intrinsic Safety	Gb or Db		x	x		x	x
i	3	ic	Intrinsic Safety	Gc or Dc			x			x
p	1	pxb	Pressurized Apparatus	Gb or Db		x	x		x	x
p	2	pyb	Pressurized Apparatus	Gb or Db		x	x		x	x
p	3	pzc	Pressurized Apparatus	Gc or Dc			x			x
m	1	ma	Molding Protection	Ga or Da	x	x	x	x	x	x
m	2	mb	Molding Protection	Gb or Db		x	x		x	x
m	3	mc	Molding Protection	Gc or Dc			x			x
o	2	ob	Oil Immersion	Gb		x	x			
o	3	oc	Oil Immersion	Gc			x			
op	1	op is	Increase Safety	Ga or Da	x	x	x	x	x	x
op	2	op sh	hardenered path and interlock	Gb or Db		x	x		x	x
op	3	op pr	hardenered path	Gc or Dc			x			x
q	2	qb	Powder Filling	Gb		x	x			
t	1	ta	Explosionproof enclosure	Da				x	x	x
t	2	tb	Explosionproof enclosure	Db					x	x
t	3	tc	Explosionproof enclosure	Dc						x

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HOW TO "DECODE" AN EX PRODUCT MARKING

CE and NoBo identification

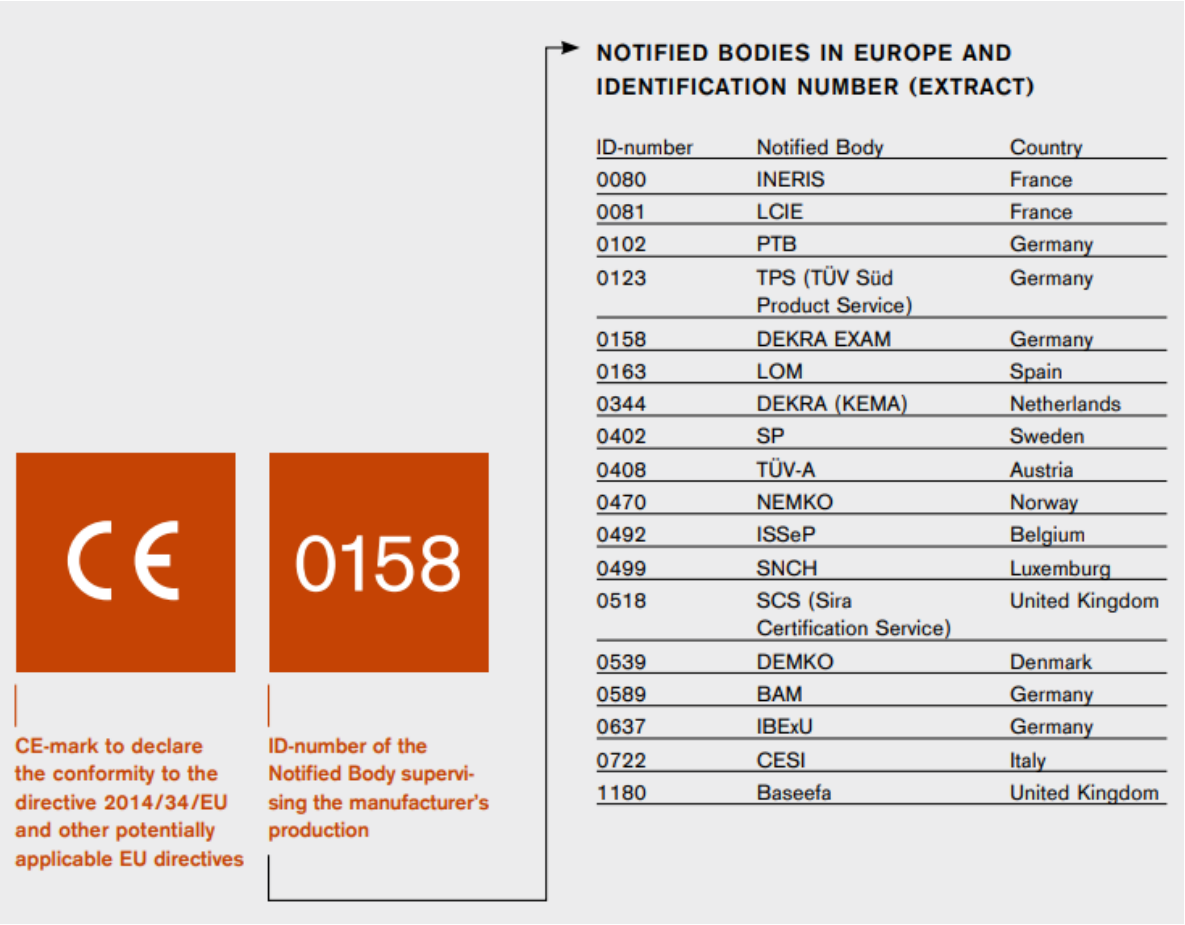
ATEX marking

IECEx marking

Ex/ATEX certification: meaning, regulations and our responsibilities

How to “decode” an Ex product marking

- CE and NoBo identification (only for ATEX)



NOTIFIED BODIES IN EUROPE AND IDENTIFICATION NUMBER (EXTRACT)

ID-number	Notified Body	Country
0080	INERIS	France
0081	LCIE	France
0102	PTB	Germany
0123	TPS (TÜV Süd Product Service)	Germany
0158	DEKRA EXAM	Germany
0163	LOM	Spain
0344	DEKRA (KEMA)	Netherlands
0402	SP	Sweden
0408	TÜV-A	Austria
0470	NEMKO	Norway
0492	ISSeP	Belgium
0499	SNCH	Luxemburg
0518	SCS (Sira Certification Service)	United Kingdom
0539	DEMKO	Denmark
0589	BAM	Germany
0637	IBExU	Germany
0722	CESI	Italy
1180	Baseefa	United Kingdom

Ex/ATEX certification: meaning, regulations and our responsibilities

How to “decode” an Ex product marking

- ATEX marking

Type approved acc. 2014/34/EU

Area of operation: Equipment group and device category

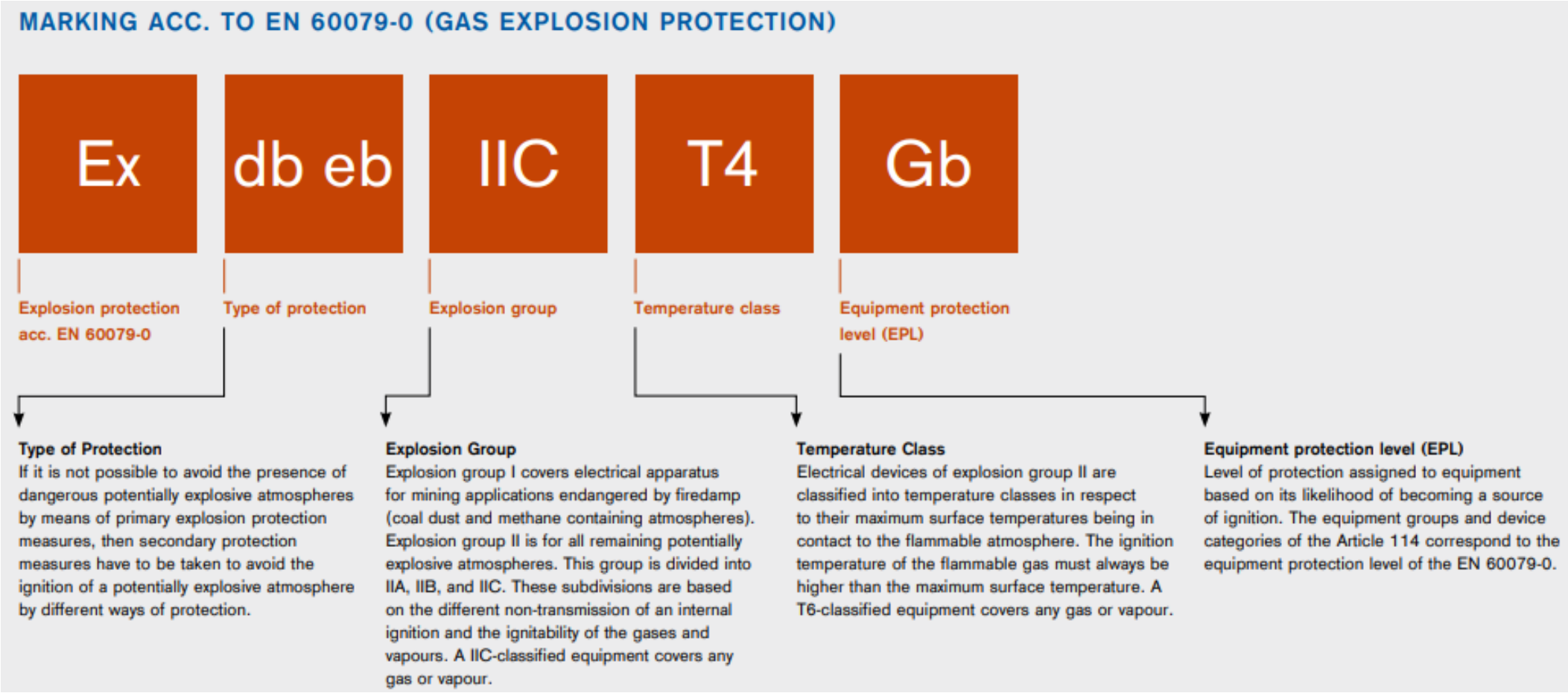
DEVICE CATEGORY, EQUIPMENT PROTECTION LEVEL AND ZONES

Device category acc. to 2014/34/EU	Equipment Protection acc. to IEC 60079-0	Degree of protection	Use of equipment acc. 1999/92/EC
Gases, vapours and mists			
II 1G	Ga	Very high level of protection, sufficient safety in case of two faults	to be used in zones 0, 1 and 2
II 2G	Gb	High level of protection, sufficient safety to handle frequent device malfunction or one fault	to be used in zones 1 and 2
II 3G	Gc	Normal level of protection, sufficient safety during normal operation	to be used in zone 2 only
Dust			
II 1D	Da	Very high level of protection, sufficient safety in case of two faults	to be used in zones 20, 21 and 22
II 2D	Db	High level of protection, sufficient safety to handle frequent device malfunction or one fault	to be used in zones 21 and 22
II 3D	Dc	Normal level of protection, sufficient safety during normal operation	to be used in zone 22 only
Mining			
I M1	Ma	Very high level of protection and a high degree of safety	Equipment may be kept energised in case of explosion risk
I M2	Mb	High level of protection and a high degree of safety	Equipment must be de-energised in case of explosion risk

Ex/ATEX certification: meaning, regulations and our responsibilities

How to “decode” an Ex product marking

- IECEx marking (also valid for ATEX)



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ADD-ON AND TIPS

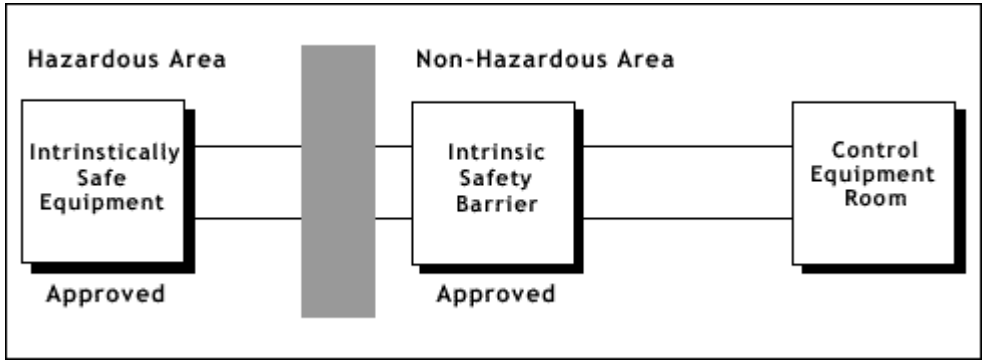
Safety barriers

Loop calculation

Ex/ATEX certification: meaning, regulations and our responsibilities

Add-on and tips

- Safety barrier
  - Role: protects a field device installed in a hazardous area by limiting the energy put out by the device just enough to reduce the risk of igniting flammable gases
  - Field implementation:



  - The safety barrier is mandatory with intrinsically safe (code “ia” or “ib” or “ic”) equipment: other protection modes (e.g. “eb”) do not require it.
  - The safety barrier is only required where the IS equipment is installed in whatever zone (0, 1 or 2).

Ex/ATEX certification: meaning, regulations and our responsibilities

Add-on and tips

- Loop calculation
  - Applies to: intrinsically safe ("ia", "ib" or "ic") equipment
  - Objective: ensure that equipment and wiring which are incapable of releasing sufficient electrical or thermal energy under normal ("ic") or abnormal conditions ("ia" or "ib").
  - Achieved by: limiting the energy available to, and stored or generated by, the electrical equipment in the hazardous location to a level below that which can ignite the hazardous atmosphere.
  - Criteria to apply:

Parameter	Condition	Comment
Voltage	$U_O \leq U_I$	U_O is the output voltage of the IS equipment outside the hazardous location[NOTE], U_I is the maximum input voltage of the IS equipment inside the hazardous location.
Current	$I_O \leq I_I$	I_O is the output current of the IS equipment outside the hazardous location[NOTE], I_I is the maximum input current of the IS equipment inside the hazardous location.
Power	$P_O \leq P_I$	P_O is the output power of the IS equipment outside the hazardous location[NOTE], P_I is the maximum input power of the IS equipment inside the hazardous location.
Capacitance	$C_O \geq C_I + C_{cable}$	C_O is the output capacitance of the IS equipment outside the hazardous location[NOTE], ($C_I + C_{cable}$) is the total capacitance of the equipment inside the hazardous location.
Inductance	$L_O \geq L_I + L_{cable}$	L_O is the output inductance of the IS equipment outside the hazardous location[NOTE], ($L_I + L_{cable}$) is the total inductance of the equipment inside the hazardous location.

NOTE: if required, the condition has to be cascaded within the hazardous location (e.g. from conditioner to the sensor)

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FAQ

Ex/ATEX certification: meaning, regulations and our responsibilities

FAQ

- In case of modification of an already certified product, are we forced to go through the complete certification process?
  - YES if this is a new PNR which is created, even if 99% derived from a certified product: a certificate is attached to a PNR/set of PNRs
  - NO if there is no PNR change compared to the certificate, and we demonstrate that the modification does not affect the protection mode. We nevertheless have to trace this analysis for further audit.

- What happens if we fail an Audit?
  - This is (hopefully) quite rare….
  - As any audit, there is a ranking in Non-Conformance(s): Major, Minor and observation(s)
  - The failure is attached to the site: if a Major non-conformance is raised, it generally affects all ATEX/Ex products
  - Failing an Audit will only affect the countries related to the geographical area the NoBo is covering
  - Failing an IECEx audit will affect all countries and certification (e.g. CSA)
  - We can still produce and sell product, as long as the NoBo supervises every single stage of the production flow, for each single product produced
  - …until the NoBo assesses that we have recovered a nominal process control…

Ex/ATEX certification: meaning, regulations and our responsibilities

FAQ

- Is self certification possible (without passing through a NoBo)?
  - Yes, but only for Zone 2 (EPL 3) and only according to ATEX (European) certification
  - In all cases, an international Ex certification requires a NoBo to be involved
  - For ATEX Zone 2, Meggitt issues a "Declaration of Conformance", which relies on the analysis of the protection level as part of the "Dossier Technique"

- In case of any doubt:

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- Delegation:
  - In Fribourg, for production and repair, some people are allowed to agree and signed derogation and product non-conformance on ATEX/Ex products, as long as not affecting its EPL
  - A special training is required (15 minutes)

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THANK YOU!

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BACKUP SLIDES

Specific requirements

Explosion Groups (Gas)

Ex/ATEX certification: meaning, regulations and our responsibilities

Requirements for Development

- All production drawings and documents as well as some development documents relating to an Ex product must bear the following stamp (Ref: MSS-CH-PRO-007):

- PCR (Product Change Request)

  All PCRs referring to a modification of an Ex product must be validated by the Ex manager.

- Every person dealing with Ex products or components, must have received an awareness course with the signed proof which is sent to the Quality department and updated the skills matrix.

Ex/ATEX certification: meaning, regulations and our responsibilities

Requirements for Production

- All production drawings and documents related to an Ex product must carry the following stamp:

- No derogation is allowed for manufacturing of an Ex product:

  In some specific cases and depending on the modification, after approval of the Ex responsible, a derogation may be granted if it does not affect the Ex safety function of the product

- Production Permits:

  All Production Permits relating to an Ex product must obtain the approval of the Ex Manager

- Every person dealing with Ex products or components, must have received an awareness course with the signed proof which is sent to the Quality department and updated the skills matrix.

Ex/ATEX certification: meaning, regulations and our responsibilities

Requirements for Sales

- Any **quotation** of an Ex product must contain the link of the document PL-1511:
  https://meggittsensing.com/wp-content/uploads/Ex-products-register-PL-1511.pdf
  Document PL-1511 lists all of our Ex products with the details of their markings according to the different certifications.

- Any **order** of an Ex product must be submitted in writing with the accurately defined Ex environment

- **Data sheet** and **user manuals** must contain Ex indications of the concerned product.

- Every person dealing with Ex products or components, must have received an awareness course with the signed proof which is sent to the Quality department and updated the skills matrix.

Ex/ATEX certification: meaning, regulations and our responsibilities

Requirements for Purchasing

- Any purchased Ex-certified material/component must have a copy of the Ex indications of the product as well as an EU declaration of conformity, which must be kept/archived

- All suppliers of Ex products or a part constituting our Ex products shall be classified in our ERP database

- Any changes on purchase of an Ex product must be approved by the Ex Manager.

- Every person dealing with Ex products or components, must have received an awareness course with the signed proof which is sent to the Quality department and updated the skills matrix.

Ex/ATEX certification: meaning, regulations and our responsibilities

Requirements for Repair

- No repair is allowed on an Ex product:

  In some specific cases and depending on the repair, after approval of the Ex responsible, a derogation may be granted if it does not affect the Ex safety function of the product

- Every person dealing with Ex products or components, must have received an awareness course with the signed proof which is sent to the Quality department and updated the skills matrix.

Ex/ATEX certification: meaning, regulations and our responsibilities

Requirements for Order Processing

- Any delivery of an Ex product must be accompanied by the following documents, in paper format:
  - EU declaration of conformity
  - Ex specific user manual

- Any other document can be attached as a USB key, CD or paper format.

- Every person dealing with Ex products or components, must have received an awareness course with the signed proof which is sent to the Quality department and updated the skills matrix.

Ex/ATEX certification: meaning, regulations and our responsibilities

Explosion groups (non-exhaustive list)

	Explosion group			Associated temperature class	
	IIA	IIB	IIC	Max temp.	Temp. Code
Ammomia	x	x	x	450 °C	T1
Methane	x	x	x	450 °C	T1
Ethane	x	x	x	450 °C	T1
Propane	x	x	x	450 °C	T1
City gas		x	x	450°C	T1
Acrylic		x	x	450°C	T1
Nitrile		x	x	450°C	T1
Hydrogen			x	450°C	T1
Ethanol	x	x	x	300 °C	T2
Cyclohexene	x	x	x	300 °C	T2
n-Butane	x	x	x	300 °C	T2
Ethylene		x	x	300 °C	T2
Ethylene oxyde		x	x	300 °C	T2
Acethylene			x	300 °C	T2
Petrol	x	x	x	200 °C	T3
Diesel fuel	x	x	x	200 °C	T3
Fuel oil	x	x	x	200 °C	T3
n-Hexane	x	x	x	200 °C	T3
Ethyl glycol		x	x	200 °C	T3
Carbon hydrogen		x	x	200 °C	T3
Acetal-dehyde	x	x	x	135 °C	T4
Ethyl ether		x	x	135 °C	T4
Carbon disulphide			x	85 °C	T6

Ex/ATEX certification: meaning, regulations and our responsibilities

Common Protection modes in Meggitt (Fribourg)

- Construction principles for intrinsically safe circuit (zones 0, 1 or 2):
  - Specially dimensioned clearance and creepage distance
  - Power control (overall)
  - (Over)Heating effects controlled
  - Respect of the temperature classes

- Construction principles for increased safety « e » equipment (Zones 1 or 2):
  - Use of high-quality insulation materials
  - Specially dimensioned clearance and creepage distance
  - Electrical connection which cannot become loose
  - Minimum protection level against penetration into enclosures IP54
  - Respect of the temperature classes
  - Conformity of cable entries

- Protection mode « op » circuit - applicable for zone 0 and/or 1 and/or 2 or outside zone:
  - LASER class 1 preferred (power related)
  - Low energy density beam
  - Ruggedized optical path
  - Interlock mechanism

Ex/ATEX certification: meaning, regulations and our responsibilities

Derogation authorized list (Fribourg), 1/2, MSS-CH-FO196

	Pascal Kornatko	François Favre	Carlo Pellegrinelli	Hans-Peter Aeby	Thierry Brasey	Adrien Mäder	Frédéric Kämpfer	Benoît Brodard
Création du Dossier Technique préliminaire pour l'appel d'offre	X		X	X				
Passer la commande pour l'organisme notifié ou l'organisme de certification	X		X					
Envoi du matériel pour les tests	X		X					
Création du Dossier Technique final	X		X	X				
Approbation du Dossier Technique final	X							
Informer le LCIE pour introduire l'attestation d'examen CE de type dans notre notification ainsi que le certificat de conformité dans notre QAR	X		X	X				
Création de la déclaration de conformité	X		X	X				
Approbation de la déclaration de conformité	X							
Approuver le dossier de production et contrôle du timbre Ex	X							
Ajouter les informations Ex dans les data sheet	X							
Ajouter les informations Ex dans les modes d'emploi	X							
Valider les propositions de modification (PCR) concernant la mécanique sans influence électrique et sans influence dimensionnelle sur les parties liées au test au choc	X		X	X				

Ex/ATEX certification: meaning, regulations and our responsibilities

Derogation authorized list (Fribourg), 2/2, MSS-CH-FO196

	Pascal Kornatko	François Favre	Carlo Pellegrinelli	Hans-Peter Aeby	Thierry Brasey	Adrien Mäder	Frédéric Kämpfer	Benoît Brodard
Valider les fiches de non-conformité (FNC) concernant la mécanique sans influence électrique et sans influence dimensionnelle sur les parties liées au test au choc	X		X	X	X	X	X	
Valider les permis de produire concernant la mécanique sans influence électrique et sans influence dimensionnelle sur les parties liées au test au choc	X		X	X				
Mise à jour et contrôle dans SAP des indications Ex de vente (sales text)	X		X	X				
Valider les propositions de modification (PCR) concernant l'électronique	X			X				
Valider les fiches de non-conformité (FNC) concernant l'électronique	X			X				X
Valider les permis de produire concernant l'électronique	X			X				
Contact avec l'organisme notifié ou l'organisme de certification (généralité)	X		X	X				
Contact avec l'organisme notifié ou l'organisme de certification (spécifique pour un produit)	X							
Mise à jour du registre (PL-1511)	X		X					
Participe à la Revue de direction annuelle	X		X					
Approbation des autorisations de dérogation	X							
Liaison avec l'organisme responsable de la vérification du système de management de la qualité	X	X						

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Business legal entity, Business address

Legal entity registration information as appropriate

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