

"ATEX Application Guidelines for Equipment Manufacturers" ... a.k.a

ATEX in 15 Minutes

- ▶ Introduction
- ▶ 1. Key Documents for Understanding ATEX
- ▶ 2. ATEX / Machinery Directive Coordination
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ATEX “Equipment” Directive – 94/9/EC: Concerning equipment and protective systems intended for use in potentially explosive atmospheres (pxAtm). CONTAINS MFR’S RESPONSIBILITIES

ATEX “Workplace” Directive – 99/92/EC: Concerning the safety and health protection of workers potentially at risk from explosive atmospheres. CONTAINS EMPLOYERS RESPONSIBILITIES

EU Commission Guide to ATEX: Guidelines on the application of 94/9/EC.

----- All of the above are available from the EU ATEX website; <http://europa.eu.int/comm/enterprise/atex/index.htm> -----

EN 1127-1: Explosive atmospheres. Explosion prevention and protection. Part 1: Basic concepts and methodology. HARMONIZED UNDER MD & ATEX

EN 60079-10: Electrical apparatus for explosive gas atmospheres Part 10: Classification of hazardous areas. NORMATIVE TO EN 1127-1

EN 954-1: Safety of Machinery – Safety-related parts of control systems – Part 1: General principles for design. HARMONIZED UNDER MD

Machinery Directive & Related EU Commission Comments:

http://europa.eu.int/comm/enterprise/mechan_equipment/machinery/index.htm

SEMI draft document 3657 (blue ballot): Guideline for Equipment Used in or Containing A Potentially Explosive Atmosphere.

www.semi.org [SEMI International Standards][EH&S Committee] under “Informational (Blue) Ballots” heading]

Maintenance & Service too

If you have avoided the formation of a potentially explosive atmosphere (pxAtm) to the *satisfaction* of the Machinery Directive then even if a machine element contributes to this avoidance, it is not within scope of the ATEX Directive.

Satisfaction ~ proper consideration of foreseeable use, misuse, fluctuations of supply (ventilation), fault tolerance, etc...

Machinery Directive A2

If you sell 'machinery'...

Annex 1 - 1.5.7

You must design machinery to avoid the formation of explosive atmospheres.

If you can't...

You must design machinery to avoid the ignition of explosive atmospheres.

If you can't ...

You must design machinery to avoid the harm of explosions.

ATEX Directive

If you sell...

'Equipment', 'Devices'

'Protective Systems'

Or

'Components' for them

INTENDED for use in a **potentially explosive atmosphere,**

Here are the requirements...

If you have an identified pxAtm in your machine you must...

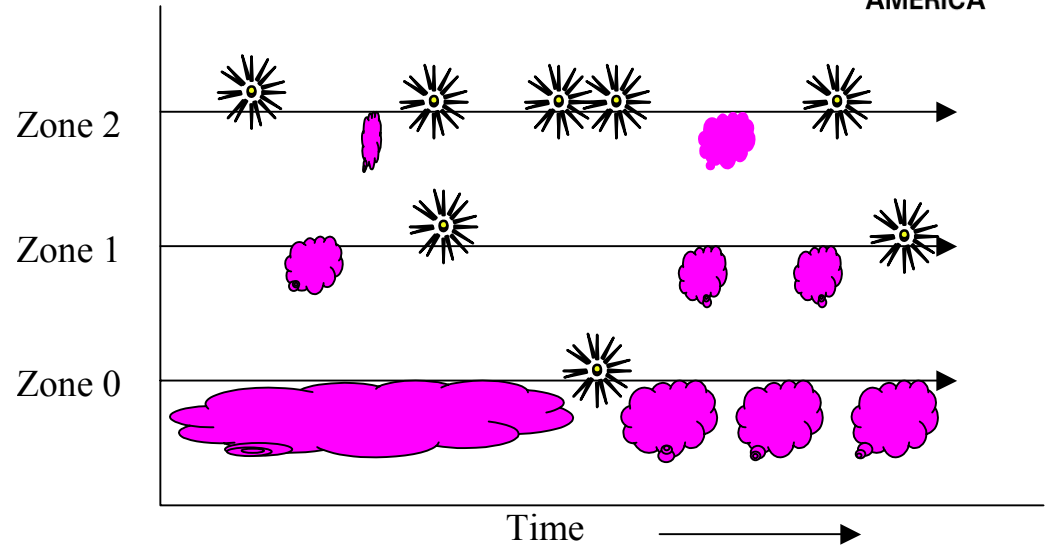
- 1.) Characterize how often it will be present and where ("zone the machine")
- 2.) And then ensure only 'equipment' of the correct **category** is in a particular zone type.

Typically SME is NOT INTENDED for use in a pxAtm

Zone / Category Coordination

Using Zones and Categories, the likelihood of an pxAtm being present is coordinated with the level of protections against ignition

Frequency rules of thumb have been developed, but sound engineering practice is also required.



Potentially Explosive Atmospheres are...	Level of protection... <i>(from ignition)</i> A6
[Zone 2]...unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.	[Cat 3] normal level of protection...during normal operation.
[Zone 1]...likely to occur	[Cat 2] high level of protection...even in the event of frequently occurring disturbances or equipment faults which normally have to be taken into account.
[Zone 0]...present continuously, for long periods or frequently.	[Cat 1] very high level of protection...even in the event of rare incidents

These are NOT SEMI 510 frequencies

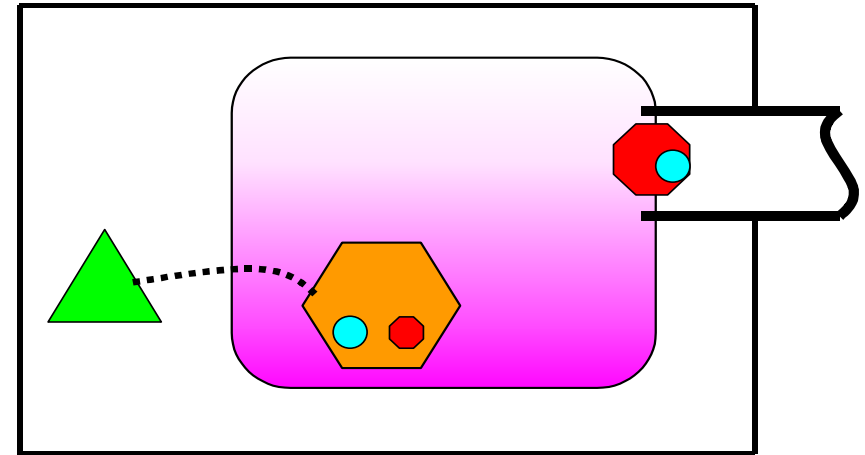
Items within Scope ^{A3,4,5}

E Equipment - Machines and other items that deal with energy or process materials that can cause ignition intended for use within a pxAtm

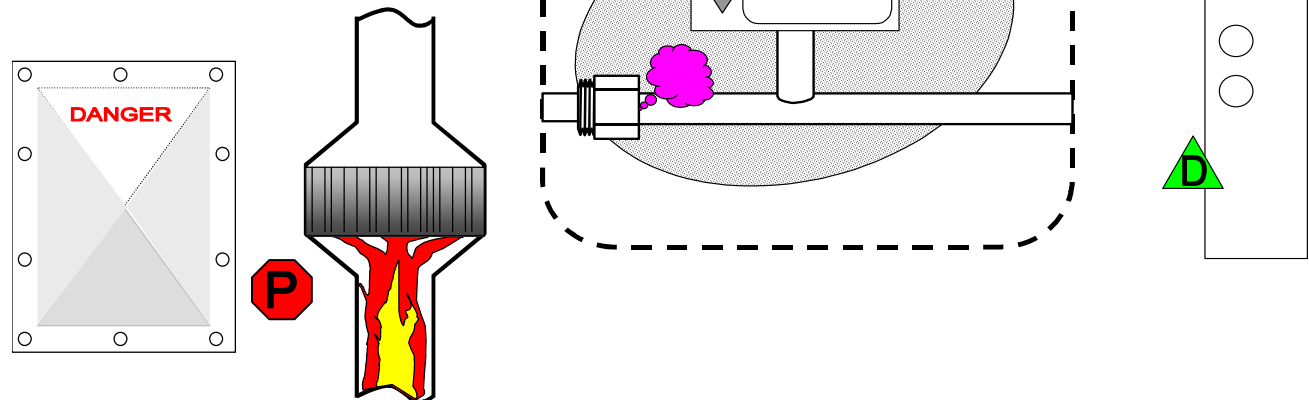
^{A1}
D Devices - Items outside a pxAtm that contribute to the safe functioning of Equipment within a pxAtm.

C Components - Items with no stand-alone function but needed for safety of Equipment and Protective Systems (intended for use within a pxAtm)

P Protective Systems – Items that limit the harm of explosions intended for use within a pxAtm



*pxAtm - A7
Mixture with
AIR at
Atmospheric
conditions*



Zoning Basics

The physical extent of a zone is related to

- ▶ The leak rate of the flammable material into the zone
- ▶ The physical qualities of the material {LEL, density, mass}
- ▶ The ventilation around/through the zone



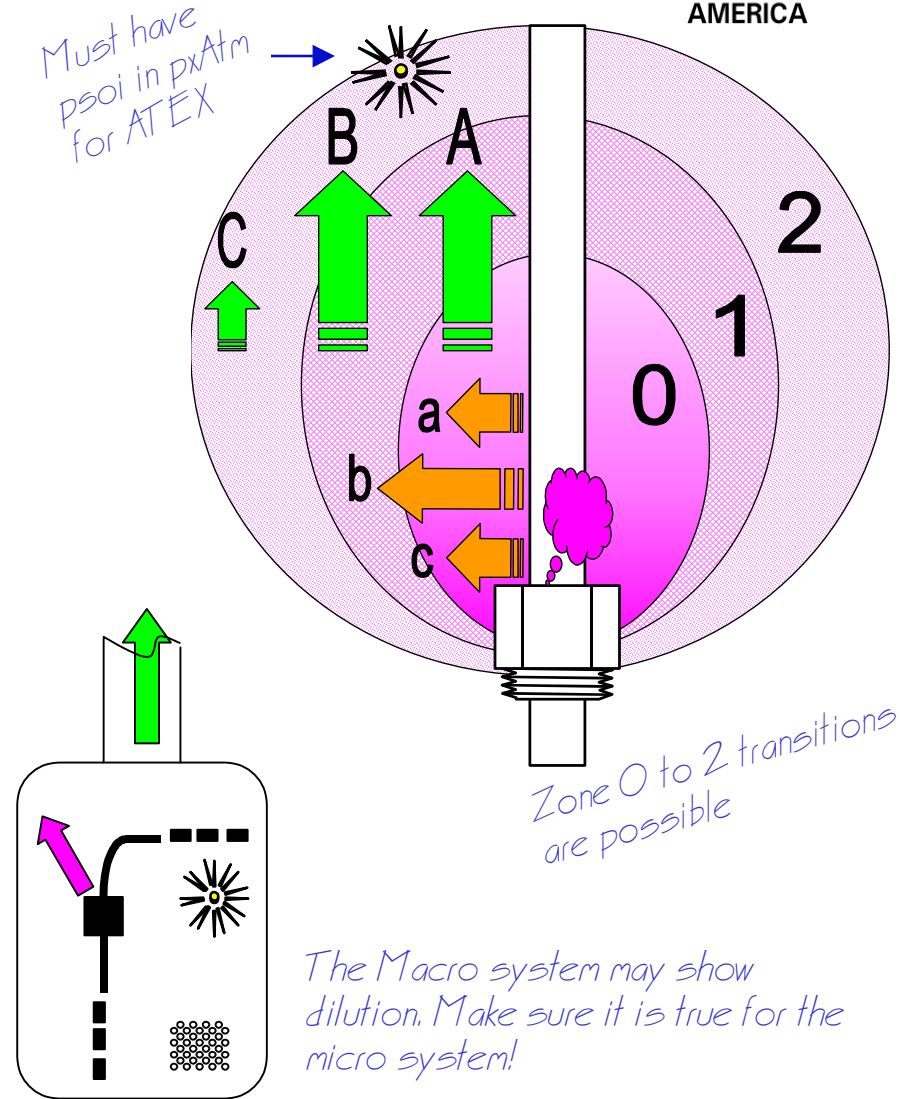
Example Scenarios:

- Nominal ventilation [A] and leak rate [a] are present continuously. **Zone 0**
- Occasionally pressure surges and so leak rate increases [b]. **Zone 1**
- Infrequently ventilation sags [C]. **Zone 2**

The zone border is the transition from

•LEL concentration	To	•Sub-LEL concentration
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With consideration of safety factors



Level of Effort

If you can demonstrate there is no pxAtm based on...	Then you only have to demonstrate control over...
Machinery Directive	
M' Q' V'	-
M Q' V'	M
M Q V'	M Q
M Q V	M Q V
ATEX Directive	
Zone the Product Use Equipment of proper Category Document all – M, Q, V, Z, Eq	

But if you can't

shortcut

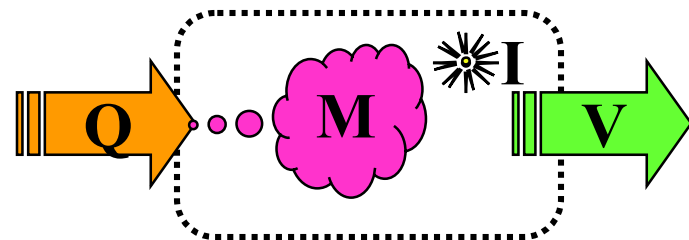
Demonstrate MD "satisfactory" interlock systems (or "control" in general) with EN 954-1

X' = worst possible conditions
 X = actual foreseeable conditions
 M = Material Q = Leak Rate V = Ventilation

For Example

V' : no ventilation provided, sealed containment (no diffusion)

V : Ventilation as specified in manuals or monitored via interlocks with consideration of possible or allowable fluctuations.



For Example...

Prove **X** is non-flammable

If you can't...then prove

Mixing interlock **j** keeps the material flowing from nozzle **k** below the LEL.

If you can't...then prove

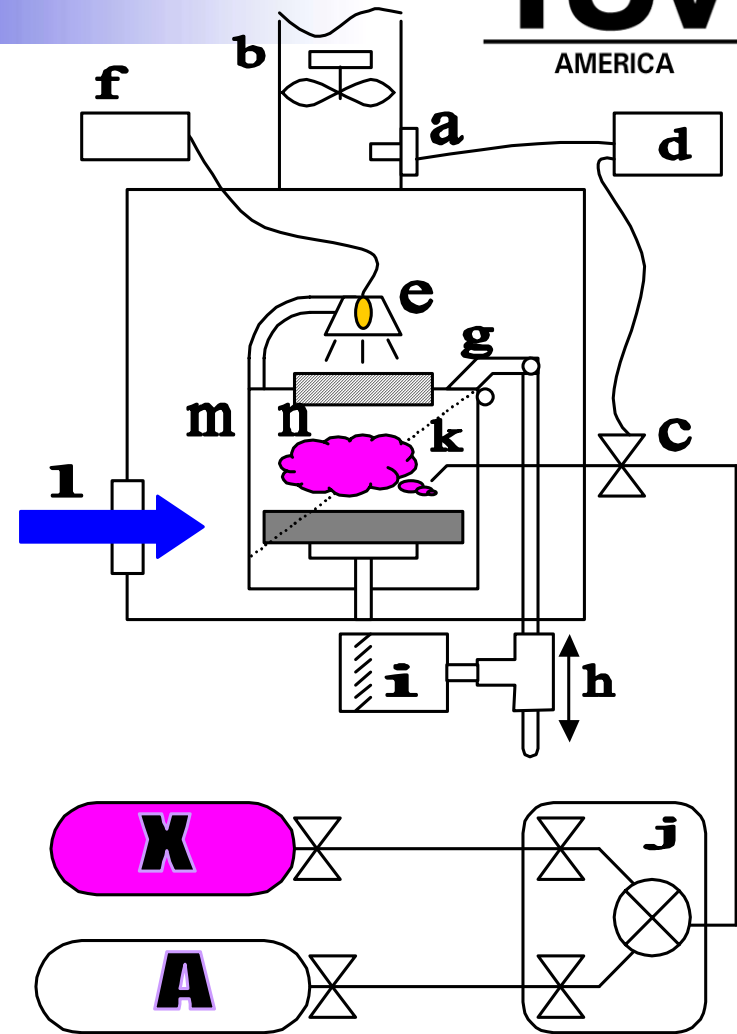
The highest flow rate from nozzle **k** does not form an px_{Atm} near **e**, **b** or **g** regardless of ventilation.

If you can't...then prove

The highest flow rate from nozzle **k** does not form an px_{Atm} near **e**, **b** or **g** with fan **b** working **and** that fan **b** with valve-fan-interlock **a-d-c** is a fault tolerant system.

If you can't...then demonstrate

e is cat 1 equipment; **f** is cat 1 art1(2) device; **g** is cat 2; **b** and **a** are cat 3. (assuming a particular zoning)



- a) Pressure sensor b) Ventilation fan c) Process gas control valves d) Interlock system controller e) Process lamp f) Lamp power supply g) Cover lift mechanical linkages h) Rack and pinion assy i) Cover lift motor j) Gas mixing assy k) Process chem dispense nozzle l) Wafer entry port (always open) m) Process enclosure (not sealed) n) quartz window

Appendix 1 – Examples of Article 1(2) devices from EU ATEX Guidelines pg 20

bold underline = Article 1(2) device

bold italic = equipment in PxAtm

- A **power supply** feeding an intrinsically safe (Ex i) ***measurement system*** used for monitoring process parameters;
- A **pump, pressure regulating device, backup storage device**, etc. ensuring sufficient pressure and flow for feeding a ***hydraulically actuated safety system*** (with respect to the explosion risk);
- **Overload protective devices** for ***electric motors*** of type of protection EEx e ‘Increased Safety’;
- **Controller units** in a safe area, for an environmental ***monitoring system*** consisting of gas detectors distributed in a potentially explosive area, to provide executive actions if dangerous levels of gas are detected;
- **Controller units** for sensors temperature, pressure, flow, etc, located in a safe area, for providing information used in the control of ***electrical apparatus***, used in production or servicing operations in a potentially explosive area.

Appendix 2 – Machinery Directive Annex 1 Excerpt

1.5.7. Explosion – Machinery must be designed and constructed to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery.

To that end the manufacturer must take steps to:

- avoid a dangerous concentration of products,
- prevent combustion of the potentially explosive atmosphere,
- minimise any explosion which may occur so that it does not endanger the surroundings.

The same precautions must be taken if the manufacturer foresees the use of the machinery in a potentially explosive atmosphere. Electrical equipment forming part of the machinery must conform, as far as the risk from explosion is concerned, to the provision of the specific Directives in force.

Appendix 3 – ATEX things within scope

Article 1(1) This Directive applies to **equipment** and **protective systems** intended for use in potentially explosive atmospheres.

Article 1(2) [**Devices**] - Safety devices, controlling devices and regulating devices intended for use outside potentially explosive atmospheres but required for or contributing to the safe functioning of equipment and protective systems with respect to the risks of explosion are also covered by the scope of this Directive.

Article 3(a) - '**Equipment**' means machines, apparatus, fixed or mobile devices, control components and instrumentation thereof and detection or prevention systems which, separately or jointly, are intended for the generation, transfer, storage, measurement, control and conversion of energy and / or the processing* of material and which are capable of causing an explosion through their own potential sources of ignition.

Article 3(b) - '**Protective systems**' means design units which are intended to halt incipient explosions immediately and/or to limit the effective range of explosion flames and explosion pressures. Protective systems may be integrated into equipment or separately placed on the market for use as autonomous systems.

Article 3(c) '**Components**' means any item essential to the safe functioning of equipment and protective systems but with no autonomous function.

* As corrected by corrigendum L 100 of 19 April 1994

Appendix 4 Question of scope – paint spray booths from <http://europa.eu.int/comm/enterprise/atex/paintspraybooths.htm>

This subject was discussed at the ATEX Standing Committee on the 6th & 7th February 2003. The following is a summary of that discussion.

These products are an enclosed area, where an operator may work inside or outside, and may be described as a "simple box". The "box", with no ignition source and not intended for use in a potentially explosive atmosphere, does not fall within the scope of the ATEX Directive 94/9/EC.

Under operating conditions a potentially explosive atmosphere is created and the enclosed area, openings and recovery systems are normally zoned. The equipment, protective systems and components intended for use in this zoned potentially explosive atmosphere including safety and controlling devices outside, but contributing to their safe functioning, are within the scope of the ATEX Directive 94/9/EC.

In summary, paint spray booths, as an integral whole, do not fall under scope of the ATEX Directive 94/9/EC and as such cannot be affixed with the special marking for explosion protection and other marking detailed at Annex II, EHSR 1.0.5. of the Directive.

Appendix 5 Question of scope

Situation	Equipment with own potential source of ignition	Equipment to be used in or in relation to pxAtm	Equipment where an intended <u>internal</u> explosive atmosphere is present	Equipment within scope of directive 94/9/EC?
A / D	YES	YES	YES / NO	YES
B / E	NO	YES / NO	YES	NO (a,b)
C / F	YES	NO	YES / NO	NO (a,b)
G/ H	NO	YES / NO	NO	NO (b)

a) but YES for products inside the internal potentially explosive atmosphere. Moreover it has to be considered that the equipment as a whole has to be capable of functioning in conformity with the operational parameters established by the manufacturer and ensuring the required level of protection according to Annex II, item 1.0.1 (Principles of integrated explosion safety). Also YES for non-electrical (mechanical) equipment where an intended explosive atmosphere is inside the equipment (e.g. fans, ventilators, blowers or compressors providing ignitable mixtures) and a potential source of ignition has to be assumed.

b) but YES for devices according to Article 1.2 of the directive.

Appendix 6 – Level of protection ... from ignition – excerpt from EN 1127-1 section 6.4.1

Equipment, protective systems, and components for use in explosive gas/air, vapour/air, and mist/air atmospheres:

Category 3: Sources of ignition which can occur continuously or frequently (e.g. during normal operation of equipment, protective systems, and components) shall be avoided.

Category 2: In addition to the avoidance of sources of ignition specified for category 3, sources of ignition that can occur in rare situations (e.g. due to malfunctions of equipment, protective systems, and components) shall also be avoided.

Category 1: In addition to the avoidance of sources of ignition specified for category 2, even sources of ignition that can occur in very rare situations only (e.g. resulting from rare malfunctions of equipment, protective systems, and components) shall be avoided.

Appendix 7 – pxAtm – from the EU Guide to the ATEX Equipment Directive

An **explosive atmosphere** for the purposes of directive 94/9/EC is defined as a mixture

- i) of **flammable substances** in the form of gases, vapours, mists or dusts;
- ii) with **air**;
- iii) under **atmospheric conditions***;
- iv) in which, after ignition, the combustion spreads to the entire unburned mixture

*The directive 94/9/EC does not define atmospheric conditions. However, a surrounding temperature range of –20°C to 60°C and a range of pressure between 0.8 bar and 1.1 bar may be appropriate as a basis for design and intended use of products. This does not preclude that products may be specifically designed and assessed for operation occasionally outside these conditions. It should be noted that electrical products are normally designed and tested for use in the ambient temperature range –20°C to 40°C in conformity with the standard EN 50014. Products designed for use outside of this range will require additional marking to be added and further testing as appropriate.