SHAPA TECHNICAL PAPER

SHAPA Practical Guidance for Suppliers and Operators of Solid Handling Equipment for Potentially Explosive Dusts

Document reviewed and updated by the SHAPA Technical committee November 2019

Foreword to SHAPA Practical Guidance for Suppliers and Operators of Solid Handling Equipment for Potentially Explosive Dusts.

It is the policy of the SHAPA technical committee to systematically review the technical papers & presentations listed in the "Technical Advise" section of its website.

The following Practical Guidance for Suppliers and Operators of Solid Handling Equipment for Potentially Explosive Dusts. Compliance with legislation implementing the ATEX Directives was reviewed in August 2019 and the following notes are based on that review.

The article was originally published in July 2005 & subsequently reviewed in July 2014.
Since the review a number of important changes have taken place in respect to the ATEX directive and the introduction of IECEx Certification of Non-Electrical Equipment.

The material for the original article was compiled and edited for SHAPA by Dantherm Filtration Ltd with contributions from SHAPA members ATEX Explosion Hazards, Clyde Material Handling, Donaldson Filtration Systems, Fike UK, Guttridge Services, Russell Finex, Spiroflow with assistance and support of the UK Health & Safety Executive and the UK Cabinet Office Better Regulation Unit.

It is the Technical Committees opinion that the Article is well written, informative and still a very good practical guide and still relevant in 2019.
Based on this it is also the opinion of the committee that the Article should not be re-written, but attention drawn to the changes in legislation since its original publication and subsequent review.

These are listed below with brief explanations.

ATEX

Directive 94/9/EC was replaced by ATEX Directive 2014/34/EU in 2016, for testing and certification of equipment intended for use in potentially explosive atmospheres in the EU.
From the manufactures perspective, the changes are not significant, as there are no changes to the Essential Health and Safety Requirements in Annex ll of the directive. Therefore the directive does not affect the standards that are used, and there are no significant changes in the remainder of the Annexes regarding the conformity assessment procedures for manufacturers.

Below are the most important changes for manufacturers.

The EC declaration of conformity must be replaced by an EU declaration of conformity.

The EC examination certificate must be replaced by an EU examination certificate.

Importers are required to put their names and addresses on the products.

Manufacturers, importers and distributers responsibilities for traceability and market surveillance are more precisely defined.

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IECEx

In 2016 standards ISO/IEC 80079-36 and ISO/IEC 80079-37 were published, meaning that for the first time non-electrical equipment for use explosive atmospheres can achieve IECEx certification.

IEC 80079-36 is the standard which covers the basic method and requirements for non-electrical equipment and IEC 80079-37 covers non-electrical equipment for types of protection 'constructional safety' ("c"), 'control of ignition sources' ("b") and 'liquid immersion' ("k").

Non-Electrical Equipment meeting the requirements of EN ISO 80079-36:2016 shall be marked with the Ex-marking code "h"; non-electrical equipment meeting the requirements of EN ISO 80079-37:2016 supplemental to those of EN ISO 80079-37 shall also be marked with the Ex –marking code "h".

There is no additional marking in regard to the specific Type(s) of protection applied. In accordance with EN ISO 80079-36 – clause 9, and EN ISO 80079-37-clause 10, the description of types(s0 of protection, e.g. "c".

IECEx Compliance route.

The compliance route follows the same process that governs IECEx approval for electrical equipment. As well as a product assessment (and issue of an IECEx certificate of Conformity), a Quality Audit Report (IECEx QAR) is also required to demonstrate that the manufacturing process of the equipment is in line with the product approval.

IECEx Quality Assessment Report (QAR).

The manufacture must ensure compliance with the full requirements of IECEx operational document OD 005 and have an ISO 9001 compliant Quality Management System.
The report will be subject to an annual audit (under the terms of the IECEx rules) to ensure that full compliance can be declared.
If the manufacturer hold an accredited ISO 9001 certificate from a certification body that hold national accreditation (e.g. UKAS, RAB,ANAD) and are a signatory of the IAF MLA, the audit frequency may be changed to 18 month periods.

ATEX & IECEx marking requirements.

Marking / labelling has changed as detailed below.
The non-electrical standards are the same for both ATEX & IECEx, they are the EN ISO 80079-36 & -37 standards.
These replace the obsolete EN 13463 series of standards (ATEX only).

The ATEX markings are the Hexagon Ex symbol followed by the equipment group, followed by the ATEX Category, followed by D and or G (D for Dust, G for Gas).

The standard marking applies to both ATEX & IECEx certified equipment. For equipment certified against the 80079 standards the equipment marking is Ex h, this replaces the symbols d, c, b and k that were part of the EN13463 marking requirements.

Examples of Ex h marking :-

Ex h IIB T4 Gb. Typical gas marking.
Ex h IIIC T120°c Db. Typical dust marking.

Note : The following sheets give examples & details of ATEX & IECEx marking & information. They are included in this guide by kind permission of CSA Group.

ATEX & IECEx

Examples of ATEX Directive Marking

CE 0518 Ex II 2 G	
CE	Denotes that a product complies with all the relevant European Directives
0518	Notified Body Number (Sira Certification Service)
Ex	Specific marking for explosion protection
II	Equipment group (Could be I for mining or II for surface industry)
2	Equipment category (Could be 1, 2, 3 depending upon Zone of intended use)
G	Type of flammable atmosphere (G = Gas, D = Dust)
CE 0518 Ex I M1	
M1	Mining applications (M1 = equipment remains energised, M2 = de-energised)

Example of Standards Marking – Gas
(Marking derived from the EN and/or IEC standards)

Ex db IIC T4 Gb	
Ex	Denotes explosion protection
db	Denotes type of protection (see protection concepts for alternatives)
IIC	Denotes gas group (see gas groups for alternatives)
T4	Denotes temperature classification (see temp classification for alternatives)
Gb	EPL – Equipment Protection Level (see EPL table for alternatives)

Example of Standards Marking – Dust
(Marking derived from the EN and/or IEC standards)

Ex tb IIIC T135ºC Db	
Ex	Denotes explosion protection
tb	Denotes type of protection (see protection concepts for alternatives)
IIIC	Denotes dust group (see dust groups for alternatives)
T135ºC	Denotes temperature classification (see temp classification for alternatives)
Db	EPL – Equipment Protection Level (see EPL table for alternatives)

STANDARDS ELECTRICAL

ATEX & IECEx

Zones System (Gas, Vapour & Mists)

Type of Protection	Symbol	IECEx EPL	ATEX Category	Permitted Zone	Standard EN-ATEX IEC-IECEx	Definition
General Requirements	N/A	Ga Gb Gc	1 2 3	0 1 2	60079-0	Applies to all protection concepts
Increased Safety	eb ec	Gb Gc	2 3	1 2	60079-7	No arcs, sparks or hot surfaces. Enclosure IP 54 or better
Type n (non-sparking)	nA	Gc	3	2	60079-15	
Flameproof	da* db dc	Ga* Gb Gc	1* 2 3	0* 1 2	60079-1	Contain the explosion and quench the flame. *applies to catalytic sensors only
Type n (enclosed break)	nC	Gc	3	2	60079-15	
Quartz/Sand Filled	q	Gb Gc	2 3	1 2	60079-5	Quench the flame
Intrinsic Safety	ia ib ic	Ga Gb Gc	1 2 3	0 1 2	60079-11	Energy limitation in sparks and hot surfaces.
Pressurised	pxb pyb pzc	Gb Gb Gc	2 2 3	1 1 2	60079-2	Keep the flammable gas out.
Encapsulation	ma mb mc	Ga Gb Gc	1 2 3	0 1 2	60079-18	
Oil Immersion	ob oc	Gb Gc	2 3	1 2	60079-6	
Type n (sealing & hermetic sealing)	nC	Gc	3	2	60079-15	
Type n (restricted breathing)	nR	Gc	3	2	60079-15	
Optical Radiation	Op is Op sh Op pr	Ga Ga Gb	1 1 2	0 0 1	60079-28	To prevent ignition by thermal, photochemical or plasma means

Equipment suitable for use in a Zone 0 is permitted in a Zone 1 or 2

Equipment suitable for use in a Zone 1 is permitted in a Zone 2, but **not** in a Zone 0

Equipment suitable for use in a Zone 2 is **not** permitted in either a Zone 0 or Zone 1

STANDARDS NON-ELECTRICAL

ATEX & IECEx

Zones System

Type of Protection	Symbol	IECEx EPL	ATEX Category	Permitted Zone	Standard EN-ATEX IEC-IECEx	Definition
General Requirements	N/A	N/A	1, 2, 3	0, 1, 2 20, 21, 22	EN 13463-1	Applies to all protection concepts
Flow Restricted Enclosure	fr	N/A	3	2 22	EN 13463-2	Relies on tight seals, closely matched joints and rugged enclosures.
Flameproof Enclosure	d	N/A	2, 3	1, 2 21, 22	EN 13463-3	
Constructional Safety	c	N/A	1, 2, 3	0, 1, 2 20, 21, 22	EN 13463-5	Ignition hazard eliminated by good engineering practices
Control of Ignition Source	b	N/A	1, 2, 3	0, 1, 2 20, 21, 22	EN 13463-6	Control equipment fitted to detect malfunctions
Liquid Immersion	k	N/A	1, 2, 3	0, 1, 2 20, 21, 22	EN 13463-8	Enclosure filled with liquid to prevent contact with explosive atmosphere
New Non-Electrical standards for ATEX and IECEx						
General Requirements	N/A	Ga, Da Gb, Db Gc, Db	1, 2, 3	0, 20 1, 21 2, 22	80079-36	Applies to all protection concepts
Constructional Safety	Ex h	Ga, Da Gb, Db Gc, Db	1, 2, 3	0, 20 1, 21 2, 22	80079-37	Ignition hazard eliminated by good engineering practices
Control of Ignition Source						Control equipment fitted to detect malfunctions
Liquid Immersion						Enclosure filled with liquid to prevent contact with explosive atmosphere

Equipment suitable for use in a Zone 20 is permitted in a Zone 21 or 22

Equipment suitable for use in a Zone 21 is permitted in a Zone 22, but **not** in a Zone 20

Equipment suitable for use in a Zone 22 is **not** permitted in either a Zone 20 or Zone 21

ATEX & IECEx

Zones System (Dusts)

Type of Protection	Symbol	IECEx EPL	ATEX Category	Permitted Zone	Standard EN-ATEX IEC-IECEx	Definition
General Requirements	N/A	Da Db Dc	1 2 3	20 21 22	60079-0	Applies to all protection concepts
Enclosure	ta tb tc	Da Db Dc	1 2 3	20 21 22	60079-31	Prevents dust coming into contact with electrical parts
Pressurised	pxb pyb pzc	Db Db Dc	2 2 3	21 21 22	60079-2	
Encapsulation	ma mb mc	Ga Gb Gc	1 2 3	20 21 22	60079-18	
Intrinsic Safety	ia ib ic	Da Db Dc	1 2 3	20 21 22	60079-11	Energy limitation in sparks and hot surfaces.
Optical Radiation	Op is Op sh Op pr	Da Da Db	1 1 2	20 20 21	60079-28	To prevent ignition by thermal, photochemical or plasma means

Equipment suitable for use in a Zone 20 is permitted in a Zone 21 or 22

Equipment suitable for use in a Zone 21 is permitted in a Zone 22, but **not** in a Zone 20

Equipment suitable for use in a Zone 22 is **not** permitted in either a Zone 20 or Zone 21

ATEX Compliance Routes for Non-Electrical Equipment	
Zone	**Procedure**
0, 20	EU Type Examination (Annex III) and Conformity to type (Annex VI) or Product QA (Annex VII – QAN)
1, 21	Lodge a Technical File(1) with a Notified Body and Internal Control of Production (Annex VIII)
2, 22	Internal Control of Production (Annex VIII)

Note 1 (see Zone 1, 21 from the above) – **Technical File Contents**
General description of the equipment
Ignition Hazard Assessment
Design and manufacturing drawings
Description of the purpose and functionality of the equipment
Procedure for the safe installation, operation and repair of the equipment
Assessments against the relevant ATEX standards or EHSR's (Essential Health & Safety Requirements)
Calculations and test results where applicable

IECEx Compliance Routes for Non-Electrical Equipment	
Zone	**Procedure**
0, 20	Certificate of Conformity and QAR (Quality Assurance Report)
1, 21	
2, 22	

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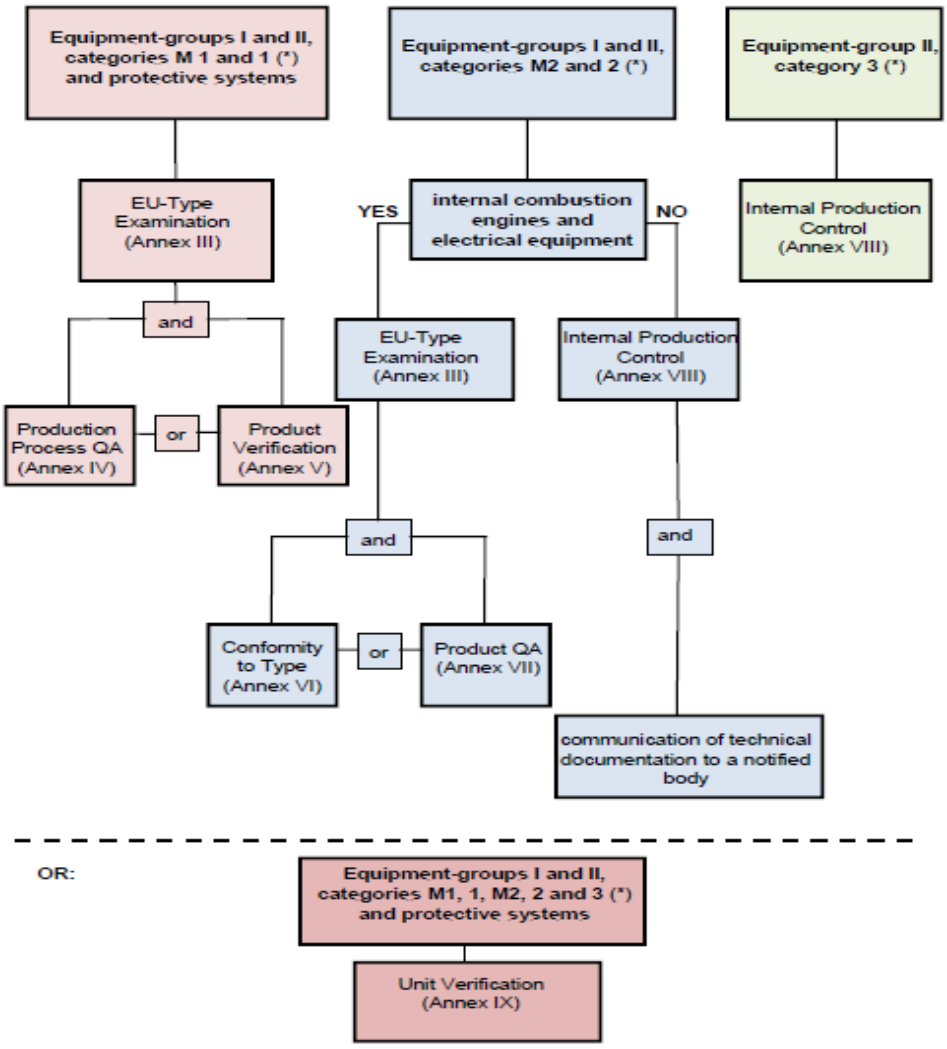
Conformity Assessment Procedures.

With reference to the flow chart on page 23. This has now been superseded by the chart below in accordance with ATEX 2014/34/EU.

ATEX 2014/34/EU Guidelines – 2nd Edition – December 2017



(*) and their components and devices according to Article 1(1), if separately assessed

Note: According to Article 13(4) for all equipment and protective systems of all groups and categories conformity to 1.2.7 of Annex II to the Directive 2014/34/EU (protection against other hazards) can be fulfilled by following the procedure of Internal Production Control (Annex VIII).

Practical Guidance for Suppliers and Operators of Solids Handling Equipment for Potentially Explosive Dusts

Compliance with legislation implementing the ATEX Directives.

Compiled and edited for SHAPA by Gus Bishop, Dantherm Filtration Ltd Contributions from SHAPA members: ATEX Explosion Hazards, Clyde Materials Handling, Dantherm Filtration, Donaldson Filtration Systems, Fike UK, Guttridge Services, Russell Finex, Spiroflow

with assistance and the support of the UK Health & Safety Executive and the UK Cabinet Office Better Regulation Unit.

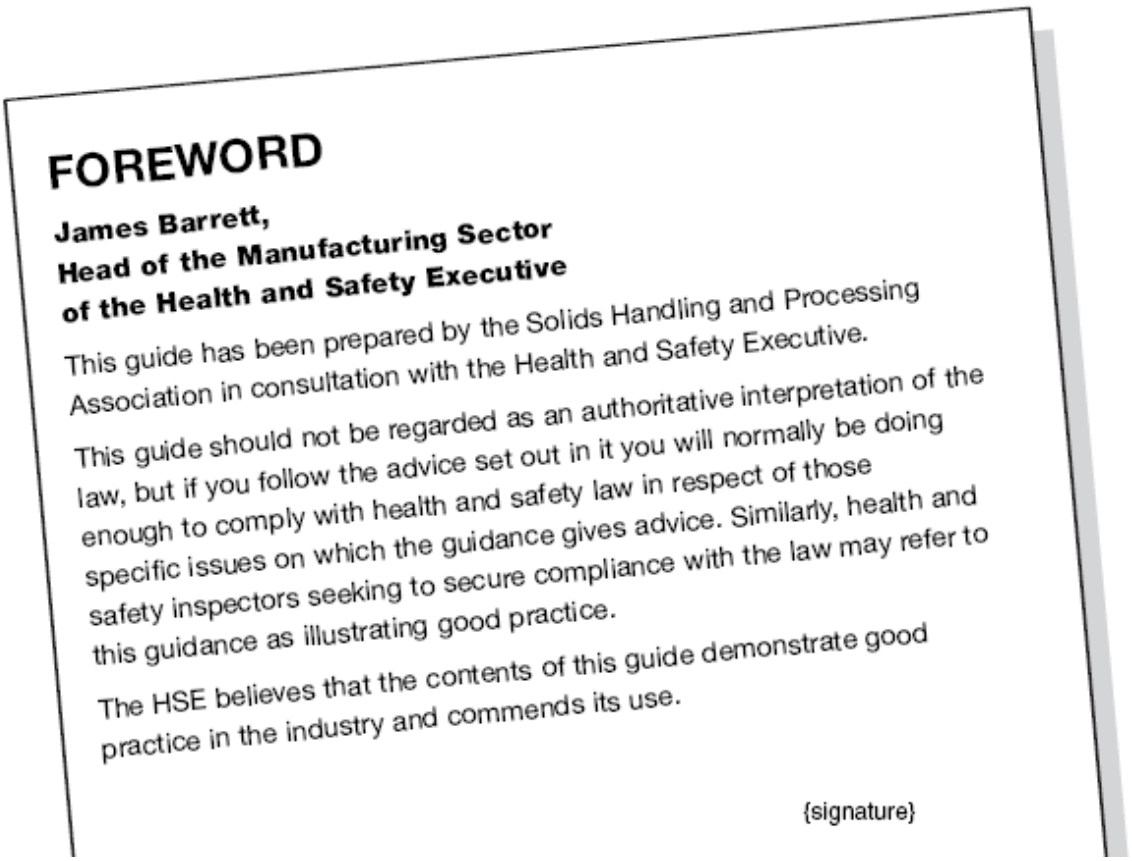
SCOPE AND OBJECTIVES

The purpose is to provide practical guidance to manufacturers, suppliers and operators, when manufacturing, installing and operating equipment or systems that may require compliance with standards under the ATEX Directives, particularly in dusty atmospheres.

A brief description of the two relevant ATEX Directives is included, together with their purpose and scope.

This Practical Guidance is intended to answer frequently asked questions and clarify issues surrounding new and used plant, resale and re-siting of existing plant, minimum documentation needs, certification and labelling.

Where possible, practical examples are included for illustrative purposes and a general bibliography is provided for more detailed reference.



FOREWORD

James Barrett,
Head of the Manufacturing Sector
of the Health and Safety Executive

This guide has been prepared by the Solids Handling and Processing Association in consultation with the Health and Safety Executive.

This guide should not be regarded as an authoritative interpretation of the law, but if you follow the advice set out in it you will normally be doing enough to comply with health and safety law in respect of those specific issues on which the guidance gives advice. Similarly, health and safety inspectors seeking to secure compliance with the law may refer to this guidance as illustrating good practice.

The HSE believes that the contents of this guide demonstrate good practice in the industry and commends its use.

{signature}

INTRODUCTION

Two European Union directives, 94/9/EC principally for manufacturers and 1999/92/EC for operators of plant, have given rise to the many harmonized (and yet to be harmonized) standards to enable this law to be applied. In the UK the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) implement the directive 1999/92/EC, often called the "*user's*" directive.

Directive 94/9/EC is implemented in the UK by the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 (EPS Regulations).

Whilst both these EU directives have been in existence for some years, 94/9/EC became legally enforceable on July 1st 2003 and the transitional provisions of 1999/92/EC extend to 1st July 2006.

Most previous legislation regulating explosive atmospheres has been principally aimed at electrical equipment. The ATEX Directives include hazards from mechanical sources and therefore the equipment scrutinised and regulated will be diverse. These Practical Guidance notes have been written particularly with the solids handling and processing industries in mind.

The first section deals with responsibilities placed upon manufacturers and suppliers of machinery and equipment for use in explosive atmospheres. The second section deals with responsibilities placed upon owners and operators of such equipment. Subsequent sections address responsibilities and actions arising from the use of such machines existing before July 2003 and to their purchase and re-use since that date.

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Multiple ATEX categories – equipment not requiring certification – safety hierarchy

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3. Guidance relating to pre-existing installations

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1.0 MANUFACTURER'S GUIDANCE.

This information regarding definitions of ATEX zones, equipment categories, protective systems and quality assurance requirements are clearly documented elsewhere and are provided here in summary form for general reference only.

There is an overriding responsibility on the part of the supplier to ensure that what he sells complies with the ATEX Directive 94/9/EC. This means that a system comprising more than one component, sub-assembly or machine must be safe. Therefore the total system, perhaps consisting of some parts that are ATEX equipment and other parts that are not, must be treated as a whole.

1.1 Zones.

- It is the **owner/operator's responsibility** to determine the possible explosion risk in his premises. Only when the operator has declared his Zones under ATEX Directive 1999/92/EC, to comply with DSEAR regulations, will it be possible for the **manufacturer or supplier** of machinery and equipment be able to assess the ATEX category required for such machinery and equipment
- Zones will therefore be outlined in Section 2.

1.2 Equipment categories to suit Zones.

This guidance does not cover equipment for use in mines, which are classified as Group 1, M1 or M2. This document addresses Group II Surface Industries only, where the hazard arises from explosive dusts.

- Group 1, categories M1 and M2 for mines.
- Group II, categories 1, 2 and 3 – gas/dust.

1.2.1 Criteria for the selection of equipment

1.2.1.1 Equipment and protective systems for all places in which explosive atmospheres may occur must be selected on the basis of the requirements set out in the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 unless the risk assessment finds otherwise. For an explanation of this last phrase see DSEAR ACOP L138 paras 239-243.

1.2.1.2 In particular, the following categories of equipment must be used in the zones indicated, provided they are suitable for gases, vapours, mists (0, 1 or 2) or dusts (20, 21 or 22), as appropriate:

- in zone 0 or zone 20, category 1 equipment,

- in zone 1 or zone 21, category 1 or 2 equipment,

-in zone 2 or zone 22, category 1, 2 or 3 equipment.

1.2.1.3 For the purposes of this Schedule and regulations 7(2) and 17(1) -

(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, as the case may be, and which are capable of causing an explosion through their own potential sources of ignition;

(b) "*protective systems*" means devices other than components of equipment which are intended to halt incipient explosions immediately or limit the effective range of an explosion or both, as the case may be, and which systems are separately placed on the market for use as autonomous systems;

(c) "*devices*" means 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;

(d) "*component*" means any item essential to the safe functioning of equipment and protective systems but with no autonomous function; and

(e) "*potentially explosive atmosphere*" means an atmosphere which could become explosive due to local and operational conditions.

1.3 Equipment and protective systems - definitions.

1.3.1 Equipment in the places where explosive atmospheres may be present must be chosen in accordance with the categories in Directive 94/9/EC, unless otherwise provided in the risk assessment. This is sometimes referred to as an "*explosion protection document*" but this term is not used in UK regulations

Further criteria such as **temperature class, type of protection** and **explosion group** must be considered to ensure safe operation of equipment in hazardous places. These criteria depend on the combustion and explosion properties of the substances used.

Work equipment for use in places where explosive atmospheres may occur which is already in use or is made available for the first time before July 2003 must comply from that date with the minimum requirements laid down in Annex II, Part A, of Directive 94/9/EC if no other Community Directive is applicable or is so only partially.

Work equipment for use in places where explosive atmospheres may occur which is made available for the first time after 30 June 2003 must comply with the minimum requirements laid down in Annex II, Parts A and B.

Work equipment that is not defined as "*equipment*" under the Directive 94/9/EC must meet the requirements of Directive 1999/92/EC. Therefore it must comply with DSEAR Regulations and the Provision and Use of Work Equipment Regulations 1998.

1.3.2 A **protective system** can mean any device that acts as a barrier between atmospheres in different Zones and any device designed to protect a vessel with an internal hazardous atmosphere. Examples would include material discharge devices on hoppers, such as rotary valves (air locks) and explosion relief devices built into a vessel to limit internal explosion pressures.

1.3.3 Definition of Categories.

1.3.3.1 Category 1 comprises products designed to be capable of remaining within their operational parameters, stated by the manufacturer, and ensuring a very high level of protection for their intended use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists or air/dusts mixtures are **highly likely** to occur and are present continuously, for long periods of time or frequently.

Equipment of this Category must ensure the requisite level of protection even in the event of rare incidents relating to equipment and is characterised by integrated explosion protection measures functioning in such a way that:

- in the event of a failure of one means of protection, at least a second independent means of protection provides for a sufficient level of safety; or,
- in the event of two faults occurring independently of each other a sufficient level of safety is ensured.

1.3.3.2 Category 2 comprises products designed to be capable of remaining within their operational parameters, stated by the manufacturer, and based on a high level of protection for their intended use, in areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists or air/dust mixtures are likely to occur occasionally.

The explosion protection relating to this Category must function in such a way as to provide a sufficient level of safety even in the event of equipment with operating faults or in dangerous operating conditions which normally have to be taken into account.

1.3.3.3 Category 3 comprises products designed to be capable of keeping within their operational parameters, stated by the manufacturer, and based upon a normal level of protection for their intended use, considering areas in which explosive atmospheres caused by mixtures of air and gases, vapours, mists or air/dust mixtures are **less likely** to occur and if they do occur, do so infrequently and for a short period of time only.

The design of the products of this category must provide a sufficient level of safety during normal operation.

1.4 Certification of protective systems.

Protective systems must be subject to the conformity assessment procedures laid down for Category 1 equipment. The design must be subject to EC type examination by a Notified Body and production items must either be covered by a production quality assurance system or approved and monitored by a Notified Body or be subject to product verification of each production item by a Notified Body.

1.5 Protective Systems and Category 3 equipment.

1.5.1 Manufacture of protective systems.
In order to be permitted to manufacture protective systems, the manufacturer must possess Quality Assurance Notification in accordance with Annexes IV and VII of directive 94/9/EC, issued and externally audited by a recognised Notified Body or follow the Product Verification procedure of Annex V. For the quality assurance route compliance with the provisions of EN 13980 is required.

EN 13980 is generally based upon the provisions of ISO 9001:2000, with specific additions.

1.5.2 Manufacture of Category 3 equipment.
For manufacture of Category 3 equipment, the manufacturer must be able to demonstrate internal control of production, typically by means of established written procedures, but no external certification or audit is required.

1.6 Ignition Hazard Assessment

1.6.1 Ignition sources.
It is important to identify possible ignition sources (Standard EN1127-1 and Directive 94/9/EC), in particular:

- during normal operation;
- solely as a result of malfunctions;
- solely as a result of rare malfunctions.

Installation, operation, maintenance, decommissioning etc. together with possible external conditions such as vibration and heat need to be taken into account.

1.6.2 Types of ignition sources may include the following:

1.6.2.1 Hot surfaces, such as bearings and machine casings, equipment housings, clutches and brakes, heating and hot fluid pipes. Faulty or worn parts may give rise to hot surfaces.

1.6.2.2 Hot particles resulting from local chemical reactions or friction from conveying methods.

1.6.2.3 Mechanically generated sparks from friction, impact and abrasion processes, such as grinding, can produce hot spots and also result in particles becoming separated from solid materials.

1.6.2.4 Ingress of foreign materials between moving contact surfaces.

1.6.2.5 Thermite reaction (highly exothermic oxidation) for example impact between rust and light metals, e.g. aluminium and magnesium, and their alloys. Light metals titanium and zirconium can also form incendive sparks under impact or friction against any sufficiently hard surface.

1.6.2.6 Electric sparks from opening and closing electric circuits or possibly loose connections. Low voltages (less than 50V) may produce sufficient energy to ignite an explosive atmosphere.

1.6.2.7 Unexpected stray electric currents may cause ignition, for example from cathodic protection systems, as return currents in power generating systems in the vicinity of electric railways, faults in electrical installations and large welding systems.

1.6.2.8 Static electric charge may accumulate in materials, notably plastics, due to friction. This could possibly discharge with sufficient energy to ignite a dust cloud.

1.6.2.9 Lightning and mechanisms such as radio frequency, ionising and electromagnetic radiation are also possible sources of localised ignition energy.

1.6.2.10 Chemical reactions which develop heat, exothermic reactions, can act as an ignition source. The high temperatures developed can lead to ignition of explosive atmospheres or smouldering or burning of dust layers. The reaction itself may produce flammable substances which then form explosive atmospheres with the surrounding air.

1.7 ATEX markings on Cat 1, 2 and 3 equipment.

1.7.1 Directive 94/9/EC states that:
"All equipment and protective systems must be marked legibly and indelibly with the following minimum particulars:

- name and address of the manufacturer;
- CE marking;
- designation of series or type;
- serial number, if any;
- year of construction;
- the specific marking of explosion protection followed by the symbol of the equipment group and category;
- for equipment-group II, the letter 'G' (concerning explosive atmospheres caused by gases, vapours or mists); and /or the letter 'D' (concerning explosive atmospheres caused by dust)

Furthermore, where necessary, they must also be marked with all information essential to their safe use."

1.7.2 There are also additional marking requirements to meet EN standard 13463-1 "Non-electrical equipment for potentially explosive atmospheres – Part 1: Basic method and requirements":

- symbol for each type of ignition protection;
- where appropriate the symbol of the explosion group of the equipment (commonly referred to as gas group);
- for Group II equipment, the symbol indicating the temperature class and/ or maximum surface temperature in ℃;
- the ambient temperature marking where appropriate i.e. when not within the normal range of -20℃ to +40℃;

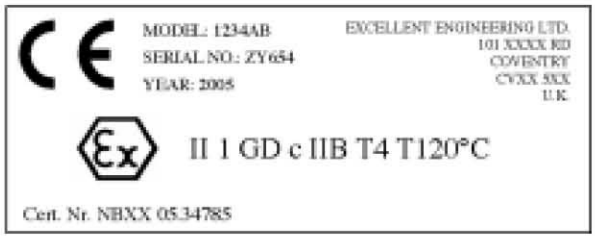
- where a certificate has been issued, the name or mark of the testing station and the certificate reference. Where a certificate has not been issued i.e. self certification, the reference number allocated by the manufacturer to the technical documentation;
- where special conditions apply, the symbol "*X*" placed after the reference or a warning marking giving appropriate instructions.

There may be other marking requirements to comply with the various ignition protection EN standards.

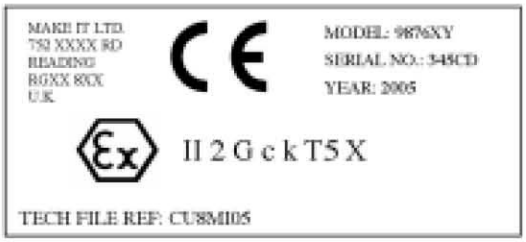
For very small equipment where there is limited space for marking, a reduction is permitted. At the very least:

- the name or registered trademark of the manufacturer
- the symbol of the type of protection
- the name or mark of the testing station
- the certificate reference
- the "*X*" symbol if appropriate

1.7.3 Examples



- Group II (non mining), category 1 Gas and Dust.
- Protection by constructional safety '*c*'.
- Gas group IIB.
- Temperature class T4 for gas and max. surface temperature 120°C for dust.



- Group II (non mining), category 2 Gas.
- Protection by constructional safety '*c*' and liquid immersion '*k*'.
- Temperature class T5
- X = special conditions apply

- Group II (non mining), category 1 Dust.
- Protection by constructional safety '*c*'.
- Max surface temperature 95°C
- Special ambient temperature in service.

1.8 Application of ATEX Directive in conjunction with other Directives

If a product is within the scope of more than one directive, then all directives apply equally. The presence of the CE mark indicates compliance with ALL the applicable directives, eg for machinery the CE mark indicates overall compliance with the Machinery Directive implemented by the Supply of Machinery (Safety) Regulations 1992.

1.8.1 ATEX and Machinery Directive

The Machinery Directive will normally be the "*headline*" directive. However, for full compliance, the machine must also comply with all other relevant directives. ATEX needs to be applied additionally to fulfil the requirements of Machinery Directive (98/37/EC) Annex I paragraph 1.5.7. ATEX 94/9/EC takes precedence for explosion risks and has to be applied with regard to explosion protection in a potentially explosive atmosphere.

1.8.2 ATEX and EMC

ATEX 94/9/EC applies to ensure the requirements concerning "*explosive atmospheres*" safety requirements are fulfilled. Electromagnetic Compatibility 89/336/EEC also applies if the product could cause electromagnetic disturbance or if its normal operation could be affected by it.

1.8.3 ATEX and LVD

ATEX directive 94/9/EC Annex ll, Clause 1.2.7 requires all other safety risks to be addressed such as the essential Low Voltage 73/23/EEC requirements.

1.8.4 ATEX and PED

Equipment classified no higher than Category I equipment, as defined in PED, that is subject to ATEX 94/9/EC is excluded from the Pressure Equipment Directive 97/23/EC.

To fulfil the ATEX requirements, the manufacturer can design to mitigate the effects of an explosion if the formation of explosive atmospheres cannot be prevented and/ or the ignition sources cannot be prevented. Possible methods of mitigation include explosion pressure resistant design and explosion pressure shock resistant design.

Explosion pressure resistant design requires the vessel to withstand the expected explosion over pressure without the vessel becoming permanently deformed. With explosion pressure shock resistant design, the vessel must withstand the shock of the expected explosion overpressure but may be permanently deformed. Typically with the explosion overpressures involved, for most gas/air and dust/air mixtures the maximum explosion overpressure is 8–10 bar, so the PED will apply.

For this reason, it can often be more economic to consider explosion pressure relief or suppression methods in most materials handling equipment.

ATEX Directive 94/9/EC does not define atmospheric conditions. Standards such as EN 13463-1, specify a pressure range between 0.8 bar and 1.1 bar and a temperature range of –20℃ to 60℃ as a basis for design and intended use of products. However, specific standards regarding atmospheric pressure may apply to the equipment in question and should be checked when investigating explosion safety measures to be employed.

1.9 Possibility of single piece of equipment with more than one ATEX category.

The ATEX category of equipment required is dependent upon the zone classification under 1999/92/EC. If the equipment is merely a "*container*" of a potentially explosive atmosphere, then ATEX 94/9/EC does not apply. However, any protective system or closure of a breach in the container, for example an explosion relief panel or discharge device (eg. rotary valve) is regarded as a protective system is subject to ATEX 94/9/EC. This assumes that the "*container*" is situated in a safe non-zone area.

For example the internal parts of a screw conveyor will be in contact with potentially explosive powders for a significant time under normal operating conditions equating to Zone 20 or Zone 21. These conditions would require potential ignition sources to be protected to comply with the requirements of Cat. 1 or Cat. 2 equipment under ATEX 94/9/EC. Exemption is possible if it can be demonstrated that the device cannot produce a source of ignition by friction or generation of sufficiently hot surfaces even under rare malfunction conditions (Category 1). Otherwise the internal dust / gas contact parts must be certified to ATEX Cat. 1 or 2 as appropriate.

If the same screw conveyor is then situated in an ATEX zoned environment, then its external parts must also comply with the provisions of ATEX, according to the declared zone. If the external zone is Zone 22, then this can be by self certification by the manufacturer and will relate particularly to surface temperature and heat / spark generation under a fault condition. Thus the screw conveyor for this application may be Cat. 2 Zone 21 inside and Cat. 3 Zone 22 outside. The category only must be marked to meet the Essential Health and Safety Requirements.

Furthermore, if the equipment with an internal Zone 21 classification is connected directly to an external zoned area, for example a powder mill, then the interface must be equipped with a protective system to protect the external zone. If this is not achieved, the Cat. 2 equipment will be downgraded to Cat. 3. This would render it unfit for purpose. A suitable protective system include such as flame arrestors or suppression.

This can become complicated, but there are logical solutions. For this example, the powder mill may actually be declared as Cat. 3, because by its very nature it is not possible to eliminate all possible sources of ignition. It is a grinding machine and however carefully designed and used an ignition source may be present occasionally. Therefore it must be surrounded by suitable protection to inhibit ignition and minimise risk should it occur.

An alternative approach would be to offer the machine as a part of a total "*milling*" assembly, with EC Declarations of conformity defining the appropriate categories of its interfaces

with the complete "*machine*". Under these circumstances the end user could be required to comply with 94/9/EC for the complete assembly.

1.10 Equipment for use in potentially explosive atmospheres not requiring ATEX certification.

Equipment as defined in directive 94/9/EC, means machines, apparatus, fixed or mobile devices, control components and instrumentation thereof and detection or prevention system 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.

Equipment can be said to have its own potential source of ignition if, when operated as intended (including malfunctions, etc. to an extent depending on its category -see Annex I of the directive) in an explosive atmosphere, it is capable of igniting the explosive atmosphere unless specific safety measures are taken. Therefore, equipment must ensure the required level of protection.

Equipment is only considered to be within the scope of the ATEX directive it if is intended (either in whole or in part) to be used in a potentially explosive atmosphere; the fact that an intended potentially explosive atmosphere might be present inside the equipment is not relevant e.g. a silo or hopper.

If a product/equipment containing an intended explosive atmosphere, for example a vessel, itself contains equipment with an autonomous function as defined in the directive e.g. a suppression system, then the latter equipment is in effect in a potentially explosive atmosphere, albeit one which is contained by the vessel, and is therefore subject to the directive. The suppression system would be regarded as a "*protective system*".

If equipment containing a potentially explosive atmosphere can, due to its construction or operation, create a potentially explosive atmosphere that wholly or partially **surrounds it,** then such equipment is in effect in a potentially explosive atmosphere, and is therefore subject to the directive.

In some cases a product may only contain a potentially explosive atmosphere, which is deliberately ignited e.g. gas boiler. It is clearly not the intention that these fall under the scope of directive 94/9/EC unless other relevant hazards are identified.

The manufacturer of an assembly consisting of a number of different items of equipment (vessels) that comply with the ATEX 94/9/EC directive may presume conformity of these pieces of equipment and thus restrict his risk assessment to that of "*additional ignition sources*" that are now relevant due to the assembly. These may be for instance ignition from flame propagation, burning particles etc. If the assembly is placed on the market in the name of the manufacturer it must be subject to the full ATEX 94/9/EC conformity assessment procedure. When dealing with assemblies provision must be made to enable the end user to assess the possibility of the equipment/assembly becoming electrostatically charged. It is the end user's responsibility under directive 1992/92/EC to control such hazards.

1.11 Hierarchy of explosion safety principles.

Whilst this is relevant chiefly to installers and operators of equipment products should be designed with their final situation in mind.

The first consideration must be to eliminate the risk. Elimination (Prevention) techniques can be achieved in two ways:

1.11.1 Elimination of the explosive atmosphere. Reduce the level of product processed to below the lower explosive limit (LEL) or process the product with inert material.

1.11.2 Elimination or avoidance of ignition sources. For example, reduce mechanical and electrical sources of ignition, assess the product sensitivity to static ignition, prevent explosion propagation.

If these prevention techniques cannot reduce the risk to a safe level then Protective Techniques will need to be applied. Protective Techniques should be considered in the following order.

1.11.3 Explosion Isolation may need to be considered first as other areas of the process may be dependent upon avoidance of ignition sources such as explosion propagation. Selection of devices and their correct use must be ascertained. For example ensure ATEX approved devices have been selected.

1.11.4 Removal of all personnel when explosion risk is present. This may involve locating specific items of process in a remote location, establishing an "*exclusion zone*".

1.11.5 Using Explosion relief venting to a safe place, that is, not a manned area and one that avoids the risk of secondary explosions in the working area.

1.11.6 Use of Flameless venting device into a non-manned (restricted) area generally 2m distant from the device but overcoming the risk of secondary explosions in the working area.

1.11.7 Using Explosion Containment such that the process equipment resists the maximum explosion pressure developed. Note that the maximum explosion pressures may be in excess of the Pmax of the product.

1.11.8 Using Explosion Suppression to detect and suppress the incipient explosion before it reaches excessive levels of pressure.

1.12 Safe selection and positioning of explosion relief devices.

Explosion Relief is probably the most widely used Protective Technique. There are a number of criteria that must be fulfilled to ensure the technique will function as intended to and does not endanger personnel.

1.12.1 Determine if the vessel can be vented to a safe place which avoids the risk of secondary explosions. If not then Flameless venting may be investigated but this will require the supplier to correctly size the device.

1.12.2 The vent area must be sized correctly. The method of calculating the correct vent area is given in EN 14491 and EN14797 or if the explosion vent is to be ducted out to a safe area and the duct is not straight the IChem^{E} sizing method should be used. Either method may require the following to be confirmed and considered as part of the calculation:

1.12.2.1 Type of fuel (hydrocarbon, Metal, Gas).

1.12.2.2 Product K_{st} , K_G and Pmax.

1.12.2.3 Physical process limitations e.g. design strength, Maximum Process pressures and temperatures.

1.12.2.4 Explosion duct length.

1.12.2.5 Type of explosion relief device e.g. door, lightweight panel etc.

1.12.2.6 The efficiency of the device. Note EN 14491& EN14797 requires the efficiency to be used as an integral part of the calculation even for lightweight panels when the vent area to volume ratio exceeds 0.07.

1.13 Assessing requirements for vessels with small enclosed volume.

The risk of a damaging explosive event from an igniting dust cloud decreases if the enclosed volume is small. In the case of a vessel such as a dust collector, with inlet and outlet openings, the risk of a sudden damaging pressure rise following ignition of an internal dust cloud may be further reduced. Therefore, for small vessels enclosing a volume typically about 0.5m^3 or less that handle material of explosibility up to kSt = 200 bar.m/s (St1), it may not be necessary to provide explosion relief or suppression measures. If protective systems are specified, they should carry suitable ATEX approval.

The risks should be assessed in relation to the process and proximity to personnel or sensitive equipment. For materials of higher explosibilty, St2 or St3, then suitable approved protective systems should be employed. Where a vessel is interconnected with other vessels then an explosion isolating device should normally be fitted to prevent propagation (see EN14491:2006).

1.14 Documentation required to be produced by manufacturers of Cat 1, 2 and 3 equipment and protective systems.

Documentation is an important requirement of the ATEX directive. It defines how the requirements of the directive have been achieved and also enables the user to install, operate and maintain the equipment safely within any necessary limits the supplier may need to impose to ensure conformity. Finally it provides visible evidence, in the form of the CE declaration of conformity that the unit is in compliance.

The documentation can be broken down into the following areas:

1.14.1 Manufacturer's product supporting documentation.

1.14.1.1 Technical file

There is a requirement to create a technical file. This file is essentially a collection of technical documents that describe how the product satisfies the Essential Health and Safety Requirements (EHSR's) of the ATEX directive. This file is not required to be available to the customer.

Due to the wide variation of products it is not possible to describe the content of this file to cover all eventualities but typically the content would contain at least:

- Description of the equipment covered and its intended use.
- Ignition hazard assessment.
- Details of how the ignition hazard has been reduced to an acceptable level.
- Design and manufacturing drawings.
- A list of the standards used in full or in part and descriptions of the solutions adopted where standards have not been applied.
- Any relevant test results and assessment data.
- How control over production is achieved.

Wherever possible provide non specific information for example:

In place of "*Motors used are designed and manufactured to EN50014 and EN50281-1-1*" use the words "*Motors are certified for use in the zone applicable*". This avoids an update to the file in the event of a standard change. Obviously there is a need to quote specific standards if these are directly applicable, for example the motor manufacturer will refer to the standards applicable as a means of satisfying the EHSRs.

Manufacturers will often assemble several pieces of equipment together and place these onto the market as a single functional unit. Any new risks associated with the assembly should be identified and the method used to reduce these risks to a safe level documented.

Where there is a need for the manufacturer to follow the route of Production Quality Assurance there will be an additional need to provide documentation relating to the quality system used.

1.14.1.2 Notified body certificates etc.

Whilst the content of the technical file will not vary a great deal for the various equipment categories, what happens to this file does. This also affects the documentation that may be given to the end user. The following is for Group II (above ground) equipment types only.

CAT 3D &G equipment requires that the technical file be retained by the manufacturer.

CAT 2D & G mechanical equipment requires a copy of the technical file to be lodged with a suitable notified body. Written acknowledgment of the file should be given by the Notified Body.

Protective systems, CAT 1D & G equipment as well as 2G electrical equipment only, require notified body involvement in the assessment process and whilst the manufacturer will normally create the technical file this will likely be completed only after the notified body assessment. Since the technical file is part of a EC type examination there will be documentation issued by the notified body to support its compliance.

1.14.1.3 EC Declaration of Conformity.

Once the technical file has been created, shown compliance and followed the storage/assessment route shown above the manufacturer (or representative) must create a written EC declaration of conformity and affix the CE mark to the equipment, protective system or device.

1.14.1.4 Written Attestation of Conformity.

For components, as defined within the directive, a written attestation of conformity is to be created, this document should not only declare conformity but also provide the characteristics of the component and how it incorporated into equipment or protective systems to ensure compliance with the directive. No CE mark is affixed to the component.

1.14.1.5 Period of retention of documents.

Documentation must be retained for a period of 10 years after the last product has been manufactured.

1.14.1.6 Manufacturer's documents issued to the customer.

In order that the user may use the product safely there is a need for the manufacturer to provide adequate instructions. These instructions should cover the complete life cycle of the product including all activities from installation to dismantling.

They should at least include a reproduction of any marking the equipment or protective device may have, excluding the serial number, along with any appropriate additional information to facilitate maintenance.

Whilst most manufacturers will have standard documentation available for the standard products there may be a need to create bespoke documentation when assemblies are supplied. This documentation should ensure adequate instructions are available to the user to enable them to assemble the equipment correctly and avoid further conformity assessment.

Where applicable this documentation should include an indication of danger areas such as areas in front of pressure relief devices. It should include any relevant training instructions and also provide details that allow a decision to be taken beyond doubt as to whether the equipment can safely be used in the area. The instructions should also give the expected operating conditions.

The instructions should also advise of any special conditions of use and foreseen misuse and include the operating limits of the equipment, for example the pressure limitations for the equipment.

These instructions must accompany the equipment or protective system when put into service and be provided in the original country language and the language(s) of the country in which the equipment or protective system is used.

In summary the documents released to the customer must include:

- Written instructions for safe use.
- EC Declaration of Conformity or Written Attestation of Conformity.

Whilst there is not a requirement for the documentation issued by the notified body to accompany the product often customers may request these to be supplied.

This is obviously at the discretion of the supplier but could include:

- EC-type examination certificate
- Quality assurance notification – see example.
- Conformity to type notification.
- Product verification certificate.
- Unit verification certificate.
- Declaration of conformity.
- Lodged documents notification. – see example.

1.15 Summary of manufacturer's responsibility to customer.

Users of equipment have a legal right to expect an acceptable level of safety from the equipment supplier. It is important therefore to ensure the user has adequate information to support this expectation. Providing the customer with a written "*scope of supply*" covering operating conditions and limitations of use is a good way of providing traceable evidence of this and will support the normal product instructions.

Since users are required to operate the equipment according to the manufacturer's instructions it is important these cover all aspects of the product's operation. A clear set of instructions is likely to ensure ongoing safety and reduce the manufacturer's liability.

Users quite often carry out their own maintenance of the product, this can produce situations where the product is modified either deliberately (for example the changing of conductive filter media) or non-deliberately resulting from disassembly and reassembly. These changes can obviously affect the product's ongoing compliance with the Directive and therefore it is important to advise the user of this situation within the written instructions. The instructions should provide information on what replacement parts are critical to ongoing compliance and provide adequate instructions to avoid the non-deliberate situation. As a manufacturer it is also important to be able to identify changes to the product after supply should the product's conformance be questioned.

2.0 CUSTOMER / OWNER / OPERATOR'S GUIDANCE.

2.1 Equipment owner / operator's responsibility.

A supplier of machinery or equipment for handling or for use within explosive dusty atmospheres will need data from the customer who will be the employer and operator of the machinery.

- The properties of the material to be handled, including its explosibility class St1, St2 or St3. For St3 materials, the actual explosibility kSt (bar.m/s) should be known in order to determine the nature and capacity of necessary protective devices for ATEX compliance.

- The ATEX zone classification of the areas into which the machinery will be installed will be required and this is the responsibility of the owner / employer / operator.

- The operator is responsible for the safety of the machinery and equipment under DSEAR Regulations, so it is his responsibility to produce risk assessments and keep operation and maintenance records. Information and declarations from his suppliers of machinery and equipment may be used to support this dossier, but the final responsibility nonetheless remains with the operator.

2.2 ATEX hazardous zones.

Purpose of zoning: One of the requirements of the ATEX directive is to classify places where explosive atmospheres may occur into zones and mark the zones where necessary.

Zone definitions - Directive 99/92/EC A

hazardous place is a place in which an **explosive atmosphere** may occur in such

quantities as to require special precautions to protect workers against explosion hazards. Such a quantity is termed a **hazardous explosive atmosphere**. As a basis for determining the extent of protective measures, any remaining **hazardous places** must be classified in terms of **zones** according to the likelihood of occurrence of such atmospheres.

Zone 20: A place in which an explosive atmosphere, in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.

E.g.: In general, these conditions arise only inside containers, pipes, vessels, etc., i.e. usually only inside plant (mills, dryers, mixers, pipelines, silos, etc.), when explosive dust mixtures in hazardous quantities can form continuously, over long periods or frequently. Historically >1000 hours/year (EN 67009:10)

Zone 21: A place in which an **explosive atmosphere** in the form of a cloud of combustible dust in air is likely to occur, in **normal operation** occasionally.

Example: This zone can, for example, include places in the immediate vicinity of e.g. powder filling and emptying points and places where dust deposits occur and in normal operation give rise occasionally to an explosive concentration of combustible dust when mixed with air. Historically 10 to 1000 hours/year

Zone 22: A place in which an **explosive atmosphere** in the form of a cloud of combustible dust in air is not likely to occur in **normal operation**, but, if it does occur, will persist for a short period only.

Example: This zone can include, e.g.: places in the vicinity of plant containing dust, if dust can escape at leaks and form deposits in hazardous quantities. Historically <10 hours per year

Layers, deposits and heaps of combustible dust must be considered, like any other source which can form a **hazardous explosive atmosphere**. Operators should put measures and systems in place to prevent such build-ups.

"*Normal operation*" means the situation when installations are used within their **design parameters**.

Extent of the Zones (typically):

Zone 20
- Bounded by equipment wall

Zone 21
- typically distance of 1 m around source of release vertically downwards to ground or solid floor

Zone 22
- evaluated in relation to the environment
- typically 1 m around source of release
- non-confined zone 21 always surrounded by zone 22

Typical Zones:

Zone 20
- inside dust containment – hoppers, silos, cyclones, filters, blenders, mills, dryers, bagging equipment – dust transport systems

Zone 21
- outside dust containment – filling / emptying points without extract – immediate vicinity access doors frequently used when dust cloud present – dust layers frequently disturbed forming explosive dust air mixture

– inside equipment – silos, filters where dust cloud occurs only occasionally

Zone 22
- outlets from bag filter vents
- vicinity access doors / openings infrequently used
- bag storage areas (bag breakage)
- filling / emptying points with extract / ventilation
- areas with dust layers that can form explosive dust clouds

Non-hazardous
- layers removed by cleaning before explosive dust / air mixture formed

2.3 Adjacent hazards.

When siting equipment that either contains an explosive atmosphere, or is to be situated in an ATEX zoned environment, special care should be taken relating to its effect on the surroundings and also effects arising from the surroundings.

2.3.1 Safe area as exclusion zone.

A"*safe area*" is an area from which personnel and the general public are excluded, to allow the safe relief of hot gases and burning material from a recognised explosion relief device. It must be positioned to eliminate as far as possible the risk of a secondary explosion. Whilst there is little published guidance for determining a "*safe area*", indicative calculations concerning maximum flame lengths and external pressure effects may be found in the book "*Dust Explosion Protection and Prevention*" at Chapter 12, edited by John Barton – please see bibliography and reference list.

Where it is not practical to accommodate a safe area of the size indicated by calculation, it is often possible to add a deflector in front of the relief device. It should be far enough away so as not to influence the reduced explosion pressure with the vessel being vented and its area should at least encompass the width of the fireball. The above book offers numerical assessment methods for this.

If the explosion relief "*safe area*" is bounded by a building wall or other structure, the effect of the explosion pressure on the obstruction must be considered. The deflection of the flame sideways and upwards must also be taken into account.

2.3.2 To summarise: If the equipment is fitted with an explosion relief device, then the following should be considered:

- A safe area (exclusion zone) should be available for the ventilation of an explosive event, allowing for the pressure wave and flame front of burning material.
- Care should be taken to minimise the risk of a secondary explosion or fire.
- There should be a suitable distance between the explosion relief device and any adjacent walls or equipment to prevent back pressure causing excessive pressure in the vessel to be ventilated.
- The effect of the force of an explosion on an adjacent building should be considered
- The vessel itself should be securely located to prevent unwanted reaction.
- Suitable signs should be clearly visible to indicate the presence of an explosion relief venting device.

The book "*Dust Explosion Prevention and Protection*" by John Barton (see bibliography) addresses the above points.

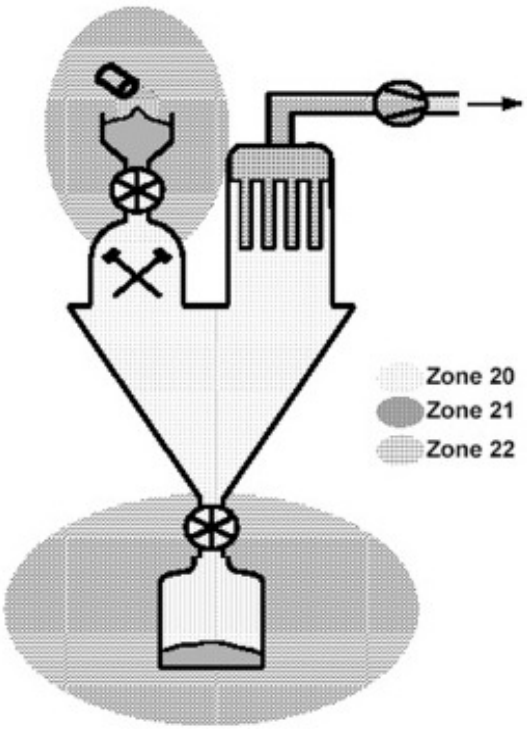
Where there is no possibility of maintaining a safe exclusion zone, or where there remains a risk of secondary explosion or fire, then "*flameless*" explosion vents may be installed, which allow pressure relief whilst quenching flame so that only non combusting material escapes.

2.3.3 If the equipment is situated within an ATEX zoned area, then the external features of the equipment must comply with the ATEX provisions according to the zone. If the equipment also contains an area assigned an ATEX zone, then some kind of containment or suppression should be considered. Containment will normally mean that the equipment housing will be a certified pressure vessel according to the Pressure Equipment Directive. If this is not practical, then a specialist manufacturer of explosion suppression equipment should be consulted.

2.4 Siting to comply with DSEAR and ATEX.

If the equipment is to be sited in a workplace, other manned area or in close proximity to people, then it is most likely that it will be in a no-zone (safe – non hazardous) area. For the general area to be classified even as Zone 22, there could be considerable deposits of dust lying on surfaces. In order to comply with general health and safety legislation such as COSHH Regulations, it would be more effective to identify and eliminate the causes of dust emissions.

There is a case for zoning areas very close to material filling and discharge points where spillage may occur. The following diagram illustrates this. However, the nature of the equipment and specific manufacturer's guidance should be sought to clarify the extent of the possible zoned area.



Compliance with ATEX Directive 1992/92/EC will be satisfied by complying with DSEAR Regulations, but all relevant health and safety requirements should be considered within the same exercise. Reducing hazard is always better than increasing the Zone.

2.5 Responsibilities for authorised repairs by a third party.

Under the provisions of DSEAR Regulations implementing the ATEX "*user*" directive 1999/92/EC, the responsibility for the safe use of all equipment is the responsibility of the owner / operator of the equipment. This responsibility cannot be transferred to a third party.

Repairs to protective devices in Category 1 or Category 2 are not permitted without the express permission of the manufacturer. Under the terms of the manufacturer's ATEX design and manufacture certified, externally audited QA notification (EN 13980), the manufacturer has sole permission to work on these items.

A third party who is a manufacturer's nominated subcontractor may carry out work for the owner / operator, under the manufacturer's quality control. Drawing and component control remains with the manufacturer, but the final responsibility for safe use rests with the owner/operator.

2.6 Responsibilities of signatories.

All declarations provided by a sub-supplier become part of the owner / operator's risk assessment for the whole installation of equipment. Signed declarations of incorporation and conformity for CE marking with reference to the Machinery Directive must include compliance with all other/subordinate directives, including ATEX 94/9//EC. Therefore each declaration is required to support overall compliance. It is the owner / operator's responsibility, however, to ensure that the risk assessment is complete.

3.0 SPECIAL REQUIREMENTS RELATING TO PRE-EXISTING INSTALLATIONS, MODIFICATIONS and EXTENSIONS

3.1 Equipment installed before July 2003.

It is not the intention of the Health & Safety Executive (HSE) to condemn well-maintained, safe equipment merely because it was installed before July 2003. However, a risk assessment must be made to comply with the provisions of DSEAR as it reflects 1999/92/EC to ensure that the equipment is still safe to operate.

For hazardous area classification in existing workplaces, the risk assessment should be completed well before the transition date of 1st July 2006 to enable any changes and upgrades to be in place and operational by that date. DSEAR reg. 17 deals with the transitional provisions.

The following checks should be made and action taken to support the risk assessment:

- Check that the equipment or installation complied with regulations and best practice at the time of its installation.

- Check that the surroundings of the equipment have not changed in a way that may prejudice safety. For example, other equipment, work stations or rights of way may have been established within range of an explosion relief panel.

- Check that the products handled and equipment duty cycle have not changed in a way to enhance possible risk.

- Check that the equipment is in good condition and not worn or weakened in a way that may enhance risk.

- Check that maintenance records are complete and correct and that inspection and maintenance schedules are followed correctly.

- Compile a risk assessment and keep records of the above checks plus safety and technical data. All Machinery Directive declarations that apply to the installation should be available as required.

- Check that the operation and maintenance manual is complete and up to date.

In the event of a claim arising from a subsequent explosive event, the operator's legal defence will rely heavily on the quality of the Risk Assessment.

3.2 Equipment installed before July 2003 but modified or extended after July 1st 2003.

It is quite likely that older serviceable equipment may have been or will be modified or extended. It will not always be necessary to replace the whole machine or installation, but it is essential that any mandatory ATEX compliant additions are compatible with the existing equipment and that the integrity and safety in the event of an explosion are not compromised.

A risk assessment should be made for the original equipment following the plan in the previous section "*Equipment installed before July 2003*". This should then be extended to cover the added features and components.

Additional points to consider include the following:

- The strength of the housing that may contain the explosive atmosphere must be assessed. Any extension to this housing must not weaken the structure.

- The reduced explosion pressure (Pred) for the extended vessel or housing should be assessed. This can be done by making a direct comparison with a vessel or housing of known strength.

- All explosion ventilation measures and other equipment that may act as a barrier between the zoned hazardous atmosphere

and a safer or safe area are regarded as protective systems under 94/9/EC. If these have been installed after 30th June 2003 they must be manufactured by a manufacturer with current ATEX EC-type examination certificate and a Production QA notification or verification certificate included in the application of standard EN 13980. These documents must be obtained from a Notified Body. These items include explosion relief devices and material discharge devices such as rotary valves.

- If the modified or extended vessel or housing incorporates explosion relief or suppression devices, these must be compatible. In the case of explosion relief panels, it would be wise to replace them all with panels of equal rating, to prevent possibly destructive effects in the event of an explosion. These can occur if, for instance, explosion panels open at different pressures.

- Any new protective system, including replacements for existing devices must be externally certified to the protective system requirements of 94/9/EC

3.3 Equipment installed after 30 June 2003.

All equipment installed after 30 June 2003 must fully comply with the provisions of ATEX Directive 94/9/EC. It is therefore essential to know the zone under the ATEX guidelines where the equipment is to be sited. There is sometimes a tendency to over-zone; this can lead to extra difficulty and cost without enhancing safety.

In outdoor locations equipment will normally be installed in a safe area for dust hazards, with Zone 22 applying at most to the immediate area around discharge or loading points.

The internal ATEX Zone within housings, enclosures and machines handling dust will apply to all electrical devices and all mechanical devices that could be a possible ignition source. The housing itself, for example a hopper, silo or dust collector is not directly affected by the provisions of ATEX.

However, it may be possible for this enclosure to import an ignition source from elsewhere and therefore an explosive event could occur. It would then be necessary to minimise the risk. This could be by methods such as spark detection and quenching or explosion pressure relief devices.

If such devices are to be employed the strength of the vessel must be established, to ensure that the suppression or venting takes place without the possibility of a dangerous rupture. The reduced explosion pressure (Pred) for the vessel or housing is a parameter used to determine the design and size of the protective device.

3.4 Re-locating equipment first used before July 1st 2003

If an existing machine or installation is moved to a new site, then checks should first be made as in the section "*Equipment installed before July 2003*".

When planning the installation of the equipment at the new site, the following points should also be addressed: -

- Check that the ATEX Zone for the new location is no more hazardous than the previous location.

- Check that safe areas required for explosion ventilation are available and can be reasonably declared as exclusion zones.

- Check that the equipment being moved to the new location will not obstruct existing safe area exclusion zones.

Σ

• Check that the materials handled and the duty cycle at the new location do not differ materially from those at the old location. In particular check that the explosibility (St rating or kSt value) of the dust from the material is no higher at the new location. Any such changes should be the subject of a risk assessment and protective devices and other safety measures reassessed accordingly.

3.5 Risk assessment for DSEAR and 1999/92/EC

A full risk assessment of the installation in its new location should be made incorporating all the points outlined above to comply with DSEAR and therefore ATEX directive 1999/92/EC.

A revised Declaration of Conformity (Machinery Directive) should also be made by the supplier or installer, with reference to ATEX compliance at the new location.

4.0 PURCHASE AND INSTALLATION OF USED OR SECOND HAND EQUIPMENT.

There are certain questions that need to be asked when contemplating using second hand or imported equipment that may be used in an ATEX zone. The fundamental question to be asked is: Is the equipment being placed onto the market or taken into service for the first time? Yes – 94/9/EC applies No – 94/9/EC doesn't apply.

If a product has been used within the EU prior to 1st July 2003 and was compliant with the applicable legislation in force at the time then ATEX directive 94/9/EC does not apply unless it is modified as a new product.

Imported products. ATEX 94/9/EC applies for all used products imported from a non-EU country and made available for the first time in the EU after 30th June 2003.

Reconditioned products. Products that were used within the EU and which have been modified to either: a) restore their external appearance b) restore their performance, Directive 94/9/EC does not apply if modifications are not substantial.

Substantial modifications are ones that affect one or more of the Essential Health and Safety Requirements, such as:

- Integrated explosion safety,
- Selection of materials,
- Design & construction,
- Potential ignition sources,
- External effects,
- Safety related devices,
- System related devices,
- Info passed to customer i.e. manual info.

If ATEX Directive 94/9/EC does apply for the used equipment according to the statements above then the directive needs to be applied exactly as it would for a new product as described earlier in this document.

5.0 EXTENDING AN EXISTING INSTALLATION.

5.1 Compatibility.

A product that would now come within the scope of ATEX may have been installed and used before July 1st 2003. If so, it could continue to be used in compliance with directive 1999/92/EC subject to a satisfactory risk assessment. However, if any products that would now be regarded as ATEX equipment, protective system or safety device need repair or replacement, the replacement must conform to ATEX 94/9/EC.

Therefore, if a piece of equipment is extended after July 1st 2003, any new protective system on the extension must be certified to ATEX 94/9/EC. For safety, compatibility and the integrity of the equipment (eg. a vessel), all other protective systems should be considered for replacement by similarly certified items.

If the existing general construction is suitable according to the risk assessment under DSEAR, then it is logical that an extension my follow the same construction methods.

5.2 What constitutes an extension under ATEX?

A separate piece of equipment connected by say, a conveyor to an existing installation; a new silo connected to an existing bank of silos; an additional dust collector unit serving a newly extended duct system – none of these would be an extension, merely an additional piece of equipment and therefore would need to comply as appropriate with DSEAR Regulations and ATEX 94/9/EC.

An extension would be a direct addition to existing equipment, for example increasing the size of a vessel and therefore its possible behaviour during an explosive event. The size of the addition relative to the original equipment is not relevant. The key points are that the newly extended plant will operate under identical parameters to the original before enlargement.

If the material physical or chemical nature such as density or explosibility, or the operating temperature or pressure or relative flow rate is altered, then the whole may be regarded as a new installation and therefore must comply as appropriate with ATEX directives. Any changes to products coming within the scope of 94/9/EC must be subject to conformity assessment if their conformity with the essential health and safety requirements (EHSR) could have been affected. In all cases the changes must be subject to risk assessment under DSEAR and the outcome must be recorded.

Para 351 of the DSEAR ACOP L138 states that if an extension is carried out, the area affected must comply in full with DSEAR before use

If the extension is entirely for the purpose of greater capacity, with no other change, then the conditions outlined in 5.1 will apply.

Minimising risk when planning an extension.

The existing equipment should be thoroughly inspected and its future life span assessed.

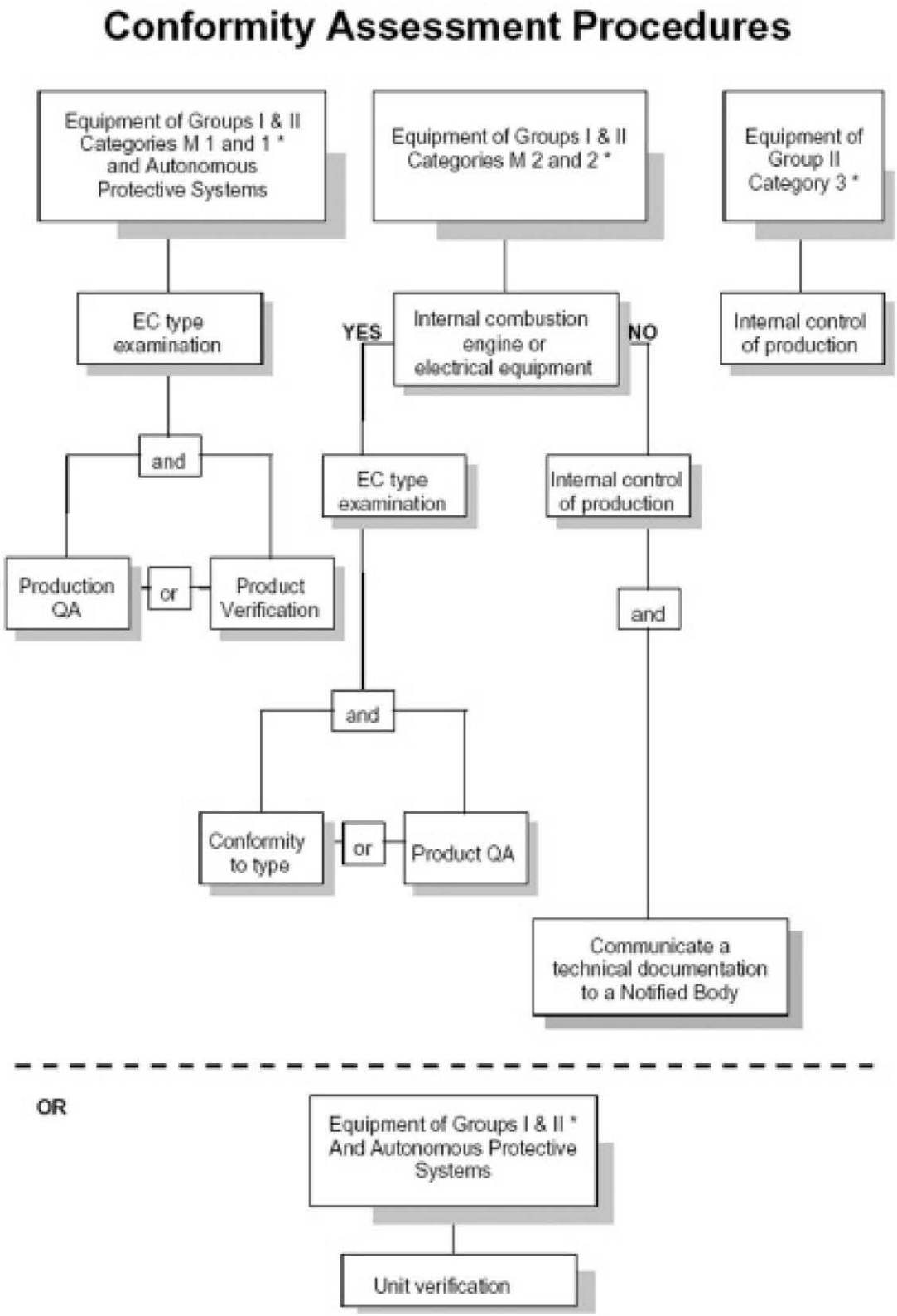
The structural integrity and compatibility of the interface between existing and new should be calculated to ensure no weakening of the combined structure.

All explosion relief devices should be mutually compatible and release at the same pressure. Therefore all such devices should be renewed with ATEX certified devices on the existing and new parts of the extended installation. Failure to do this could result in a catastrophic failure during an explosive event.

Risk assessment documentation must be updated, together with operational and maintenance instructions.

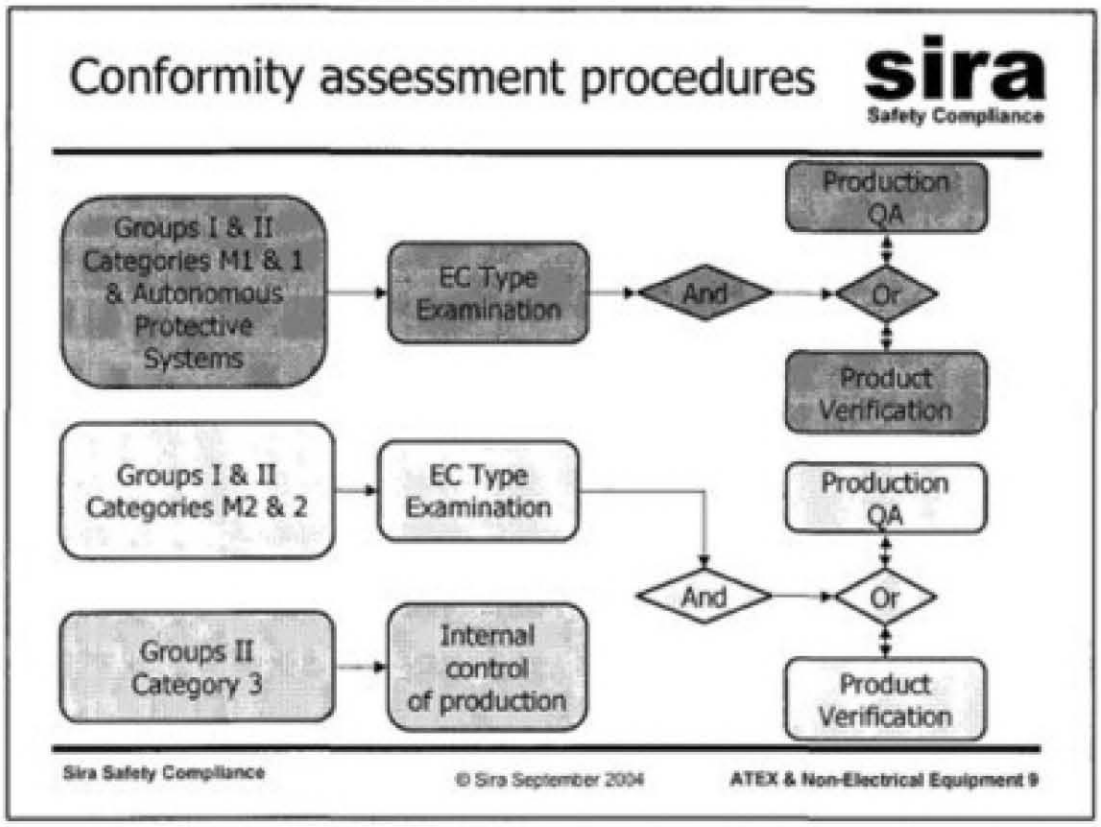
6.0 APPENDIX Illustrations and examples.

6.1



(*) and their components if separately certified

Note: According to Article 8.4 for all equipment and protective systems of all groups and categories conformity to 1.2.7 of Annex II of the directive (protection against other hazards) can be fulfilled by following the procedure of internal control of production (Annex VIII).


Conformity assessment procedures
sira
Safety Compliance
Groups I & II Categories M1 & 1 & Autonomous Protective Systems
EC Type Examination
And
Production QA
Or
Product Verification
Groups I & II Categories M2 & 2
EC Type Examination
Production QA
And
Or
Product Verification
Groups II Category 3
Internal control of production
Sira Safety Compliance
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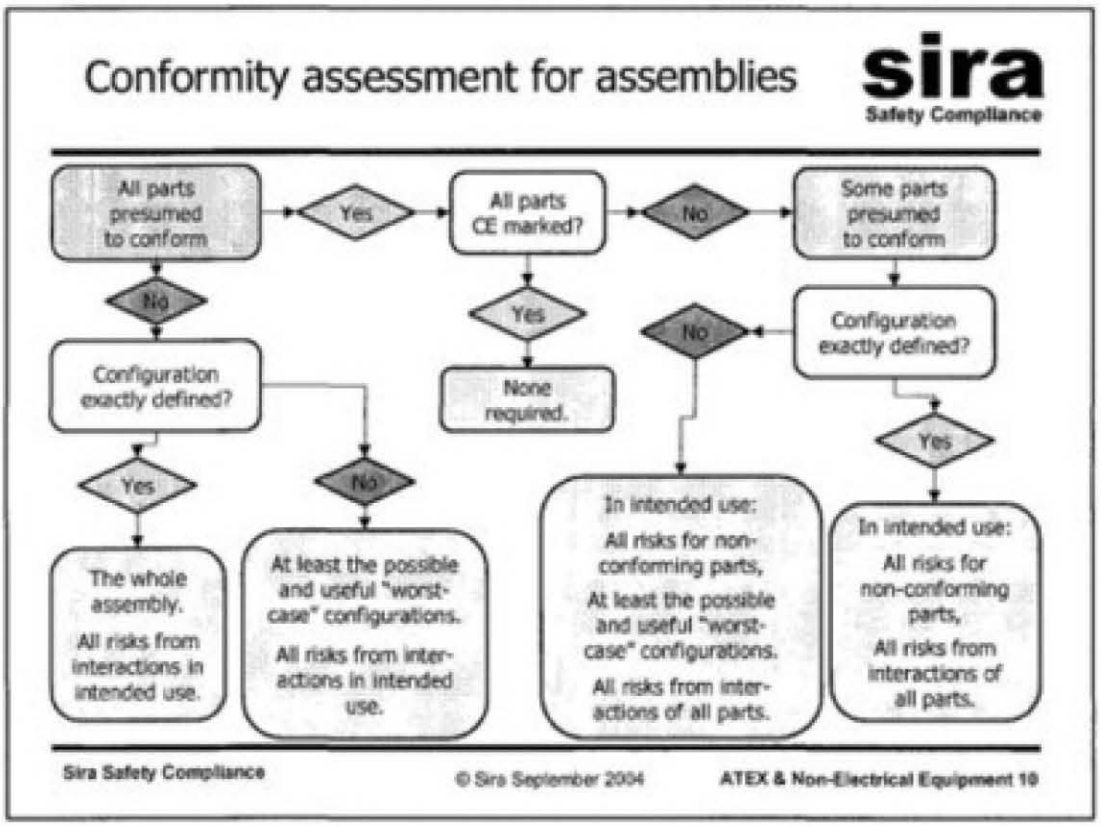
Conformity assessment for assemblies
sira
Safety Compliance
All parts presumed to conform
Yes
All parts CE marked?
No
Some parts presumed to conform
No
Configuration exactly defined?
Yes
None required.
No
Configuration exactly defined?
Yes
Yes
No
The whole assembly.
All risks from interactions in intended use.
At least the possible and useful "worst-case" configurations.
All risks from interactions in intended use.
In intended use:
All risks for non-conforming parts,
At least the possible and useful "worst-case" configurations.
All risks from interactions of all parts.
In intended use:
All risks for non-conforming parts,
All risks from interactions of all parts.
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Who can "Self-certify"?

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The manufacturer of the product or assembly

or

The manufacturer's authorised representative

Choices

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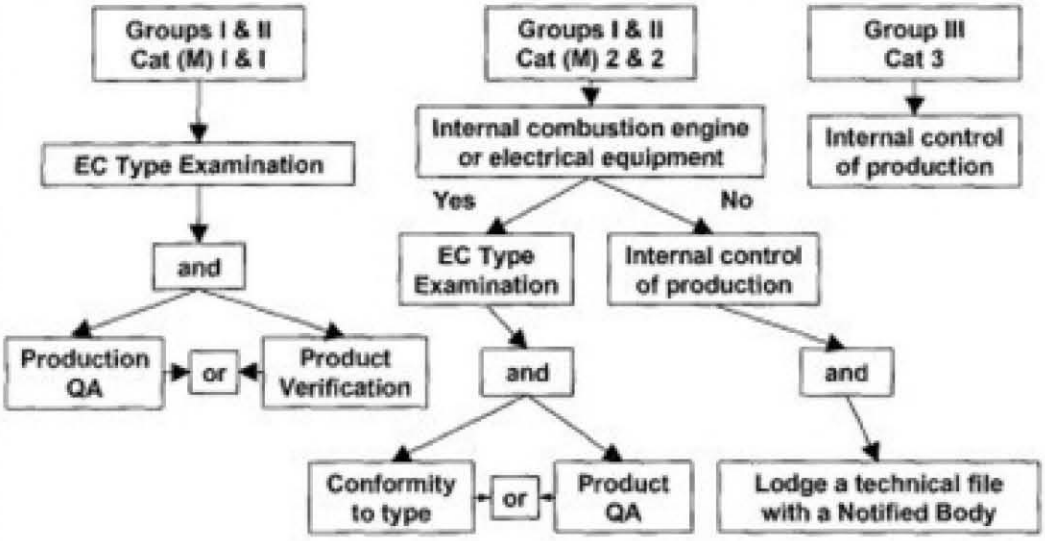

7.0 BIBLIOGRAPHY.

This section contains a selection of material that has been used in the compilation of this document and that may be referred to for further information.

Directive 94/9/EC Equipment and Protective Systems intended for use in potentially explosive atmospheres.

Directive 1999/92/EC Minimum requirements for improving the Safety and Health Protection of workers potentially at risk from explosive atmospheres.

Directive 73/23/EC (as amended 93/68/EEC) Low Voltage Directive.

Directive 97/23/EC Pressure Equipment Directive

Directive 89/655/EEC Safety and Health Requirements for the use of work equipment by workers at work.

Pressure Equipment Regulations 1999 (SI 1999/2001)

Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) and Approved Code of Practice L138.

EN1127-1:1997 Explosive Atmospheres – Explosion prevention and protection – part 1: basic concepts and methodology.

EN 12874:2001 Flame Arrestors – Performance requirements, test methods and limits for use.

EN 13237:2003 Potentially explosive atmospheres – terms and definitions of equipment and protective systems.

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EN13980: 2002 Potentially explosive atmospheres – Application of quality systems.

ATEX Guidelines – Second edition July 2005 (from:

http://europa.eu.int/comm/enterprise/atex/guide/index.htm