



Exploration & Production

GENERAL SPECIFICATION

ELECTRICAL

GS ELE 079

**Electrical apparatus for
potentially explosive gas atmospheres**

02	10/04	Revised as indicated – Appendix 3 added.
01	12/03	ATEX Directives requirements incorporated - Change of Group name and logo
00	03/01	First issue
Rev.	Date	Notes



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1. Scope

This specification defines the criteria to be followed for the selection of electrical equipment and protective systems in potentially explosive gas atmospheres of the COMPANY facilities located either onshore or offshore.

Two new European Directives commonly called ATEX (**AT**mosphères **EX**plosibles) Directives have been in force since the 01 July 2003. The ATEX Directive 94/9/EC sometimes called the "Product" Directive affects the MANUFACTURERS (known also as ATEX 95). The ATEX Directive 1999/92/EEC sometimes called the "User" Directive affects the workers (known also as ATEX 137).

Both ATEX Directives shall be applicable for all the COMPANY facilities located within the European Union (EU countries) and also outside the EU.

Explosives and dust/fibres are excluded from this scope.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Where national and/or local regulations exist, their provisions and those of the standards and codes to which they refer shall apply, when their requirements are more stringent than this specification.

If there are no national regulations covering all or part of this specification, the reference documents, as listed here after, shall be strictly applied.

In all cases the ENGINEER/CONTRACTOR shall inform the COMPANY of any deviation to this specification.

The design, selection and installation of electrical apparatus in explosive gas atmospheres shall satisfy all statutory requirements of national/local Authorities of the country in which the electrical apparatus will be located.

The construction and installation of electrical equipment shall comply with the requirements of the relevant parts of the CENELEC harmonised standards and IEC standards. Other recognised standards shall be subject to **COMPANY formal approval**.

In the event of contradiction between the requirements of this General Specification, the Particular Specification (if any) and IEC, CENELEC or national standards the following shall apply in order of precedence:

- Applicable laws, rules and regulations of the country in which the equipment will be installed. In cases where no "local" regulations exist, then the European Directives ATEX n° 94/9/EC and 1999/92/EC shall be applied
- COMPANY Particular Specification (which amends the General Specification for the Particular Project)
- COMPANY General Specification (the latter)
- Applicable CENELEC harmonised Standards
- Applicable International Electrotechnical Commission (IEC) standards

Standards

The latest issue of the following standards shall be applied.

Reference	Title
Electrical apparatus for gas explosive atmospheres	
IEC 60079-0, part 0	General requirements
IEC 60079-1, part 1	Flameproof enclosures "d"
IEC 60079-1-1, part 1-1	Flameproof enclosures "d": Method of test for ascertainment of maximum experimental safe gap
IEC 60079-2, part 2	Pressurized enclosures "p"
IEC 60079-4, part 4	Method of test for ignition temperature
IEC 60079-4A	First supplement
IEC 60079-5, part 5	Powder filling "q"
IEC 60079-6, part 6	Oil immersion "o"
IEC 60079-7, part 7 ¹	Increased safety "e"
IEC 60079-10, part 10 ²	Classification of hazardous areas
IEC 60079-11, part 11	Intrinsic safety "i"
IEC 60079-12, part 12	Classification of mixtures of gases or vapours with air according to their maximum experimental safe gaps and minimum igniting currents
IEC 60079-13, part 13	Construction and use of rooms or buildings protected by pressurization
IEC 60079-14, part 14 ²	Electrical installations in hazardous areas (other than mines)
IEC 60079-15, part 15	Type of protection "n"
IEC 60079-16, part 16	Artificial ventilation for the protection of analyser(s) houses
IEC 60079-17, part 17 ²	Inspection and maintenance of electrical installations in hazardous areas (other than mines)
IEC 60079-18, part 18	Encapsulation "m"
IEC 60079-19, part 19	Repair and overhaul for apparatus used in explosive atmospheres (other than mines or explosives)
IEC 60079-20, part 20	Data for flammable gases and vapours relating to the use of electrical apparatus
IEC 61892-7	Mobile and fixed offshore units - Electrical Installations Part 7 - Hazardous areas

¹ The revised edition (August 2003) of IEC 60079-7 includes the requirements of the ENV 50269 (Assessment Representative Testing of HV Machines), the latter one being repealed.

² These IEC standards exist also under the CENELEC references EN/IEC 60.079.

Reference	Title
IEC 62086, part 1 and 2	Electrical resistance trace heating Part 1: General and testing requirements Part 2: Application guide for design installation and maintenance.
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code).
Electrical apparatus for potentially explosive atmospheres	
EN 1127 - 1	Explosive Atmospheres: Explosion prevention and protection. Part 1: Basic concepts and methodology
EN 50014 ³	Electrical apparatus for potentially explosive atmospheres - General requirements
EN 50015 ³	Electrical apparatus for potentially explosive atmospheres - Oil immersion "o"
EN 50016 ³	Electrical apparatus for potentially explosive atmospheres - Pressurized apparatus "p"
EN 50017 ³	Electrical apparatus for potentially explosive atmospheres - Powder filling "q"
EN 50018 ³	Electrical apparatus for potentially explosive atmospheres - Flameproof enclosures "d"
EN 50019 ³	Electrical apparatus for potentially explosive atmospheres - Increased safety "e"
EN 50020 ³	Electrical apparatus for potentially explosive atmospheres - Intrinsic safety "i"
EN 50021 ⁴	Electrical apparatus for potentially explosive atmospheres - Type of protection "n"
EN 50028 ³	Electrical apparatus for potentially explosive atmospheres - Encapsulation "m"
EN 50039 ³	Electrical apparatus for potentially explosive atmospheres - Intrinsically safe electrical systems "i"
EN 50102	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
EN 50284	Special requirements for construction, test, marking of electrical apparatus of equipment group II, category 1G
EN 60079 – 10	Electrical apparatus for explosive gas atmospheres: classification of hazardous areas

³ should be repealed on the 01/07/2006 and replaced by the EN 60 079 series (60 079-7 published in August 2003)

⁴ should be repealed on the 01/07/2006 and replaced by EN 60 079-15 (already published : September 2003) which is identical to IEC 60 079-15 (2nd edition dated 2001 with minor amendments). A new revision of the IEC 60 079-15 is in progress which might include the tables as shown in the ENV 50 269.

Reference	Title
EN 60079 - 14	Electrical apparatus for explosive gas atmospheres: electrical installations in hazardous areas (other than mines)
EN 60079 – 17	Electrical apparatus for explosive gas atmospheres: Inspection and maintenance of electrical installations in hazardous areas (other than mines)
Non electrical equipment for potentially explosive atmospheres	
EN 13 463 - 1:	Part 1: Basic methodology and requirements
pr En 13463-2	Part 2: Protection by flow restricting enclosure (fr)
pr EN 13463-3	Part 3: Protection by flameproof enclosure (d)
pr EN 13463-4	Part 4: Protection by inherent safety (g)
EN 13463-5	Part 5: Protection by constructional safety (c)
pr EN 13463-6	Part 6: Protection by control of ignition sources (b)
pr EN 13463-7	Part 7: Protection by pressurisation (p)
EN 13463-8	Part 8: Protection by liquid immersion (k)

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
94/9/EC (ATEX 100a ⁵ /ATEX 95 ⁶)	European Directive 94/9/EC (23/03/94) on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres
1999/92/EEC (ATEX 118 ⁵ /ATEX 137 ⁶)	European Directive 1999/92/EEC (16/12/99) on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres

Application of Directive 94/9/EC alongside others that may apply:

- In the case of Directive 94/9/EC and the Directive relating to Electromagnetic Compatibility (EMC) no. 89/336/EEC (amended by 92/31/EEC and 93/68/EEC), the Directive 94/9/EC has to be applied to fulfil the requirements concerning explosive atmospheres safety requirements.
- Products for use in potentially explosive atmospheres are explicitly excluded from the scope of the Low Voltage Directive 73/23/EEC, except the relevant standards for the safety, controlling and regulating devices.
- Machinery directive: 98/37/EC, Art. 4.2. and Annex II sub B.

⁵ Reference to Articles 100/118 of the Treaty of Rome

⁶ Reference to Articles 95/137 of the Treaty of Amsterdam

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS SAF 216	Area classification
GS ELE 161	Electrical cables

3. Selection of electrical apparatus versus hazardous areas

If the explosion protection document based on a risk assessment does not state otherwise, equipment and protective systems for all places in which explosive atmospheres may occur must be selected on the basis of the categories set out in Directive 94/9/EC.

In particular, the following categories of equipment must be used in the zones indicated, provided they are suitable for gases, vapours or mists as appropriate as per the Directive 1999/92/EC:

- In zone 0, category 1 equipment
- In zone 1, category 1 or 2 equipment
- In zone 2, category 1, 2 or 3 equipment.

The Process and/or Safety Engineer will classify the hazardous areas into zones 0, 1, 2 as defined in the standards [IEC 60079-10](#), now transformed (reproduction without any modification) into the CENELEC standard [EN 60079-10](#). He will specify the maximum surface temperatures of the products (T_1 to T_6) and the apparatus group (II A - II B - II C) as per the CENELEC standard [EN 50014](#).

Unless otherwise specified in the Particular Specification or drawings, the apparatus group shall be IIA and the temperature class shall be T3 (200°C). Electrical equipment in batteries room shall be apparatus group II C.

Electrical apparatus with the following types of protection may be permitted to be installed in the zones indicated below as per [IEC 60079-14](#) / [EN 60079-14](#).

	Hazardous areas			Non-hazardous area
	Zone 0	Zone 1	Zone 2	
Type of protection of electrical apparatus	i _a	d e i _b m o p q Apparatus suitable for zone 0	n (only) including nA nC nR nL nZ Apparatus suitable for zone 1	Normal industrial apparatus

Yet, by COMPANY decision the following shall be met:

- HV alternators & motors with type of protection “e” or “nA” shall not be used. The standard ENV 50269 (Assessment Representative Testing of HV Machines) is no longer valid. It has been partly included into the [EN 60079-7](#) (Increased Safety “e”) – edition August 2003 ([EN 50 019](#) Ex-e being repealed). For existing plants, the strict application of the [EN 60079-7](#) is required where electric motors of “e” type of protection exist.
- The type of protection “N” as per BSI 5000 is no longer acceptable in zone 2 (since there is the European standard [EN 50021](#) and IEC 60 079/15).
- Electrical apparatus which does not comply with the requirements of the [IEC 60079](#) standards series, but is recognized as safe by a national or the appropriate Authority shall be marked with the symbol “s”.
- For machines of type “n”, a new revision of [IEC 60 079-15](#) is under preparation.

Electrical apparatus selection (references as per CENELEC 50014)

The selection of electrical apparatus shall be carried out according to the **type of protection**.

Equipment type	Hazardous areas			Non-hazardous area
	Zone 0	Zone 1	Zone 2	
HV alternators	Prohibited	Prohibited	EEx “d” EEx “p”	Enclosed: IP 23/IK 08 Non-enclosed: IP 55/IK 08 Standard industrial generator
HV electric motors	Prohibited	EEx “d” (< 1 MW) EEx “p” (> 1 MW)	EEx “d” or “de” (< 1 MW) EEx “p” (> 1 MW)	IP 55/IK 08 Standard industrial motor

Equipment type	Hazardous areas			Non-hazardous area
	Zone 0	Zone 1	Zone 2	
LV alternators	Prohibited	Prohibited	EEx "e" EEx "d" EEx "nA"	Enclosed: IP 23/IK 08 Non-enclosed: IP 55/IK 08 Standard industrial generator
LV electric motors	Prohibited	EEx "e" EEx "d" EEx "de"	EEx "e" EEx "d" or "de" EEx "nA"	IP 55/IK 08 Offshore: EEx "nA" ⁷ Onshore: normal industrial motor
Variable Speed Drive (VSD) • Motor • Frequency converter • Transformer	Prohibited	See HV or LV electric motors Prohibited	EEx "de" ⁸ or EEx "p" Prohibited See HV/LV power transformer	Standard industrial
HV and LV power transformers (oil type)	Prohibited	Prohibited	EEx "o". connections: LV: EEx "e" HV: Elastimold terminals MCR*: EEx "ib"	Indoors IP 21/IK 08 Outdoors IP 55
HV switchgear	Prohibited	Prohibited	Prohibited	Normal industrial apparatus
LV switchgear	Prohibited	EEx "d" or "de" (to be avoided)	EEx "d" or "de"	IP 55/IK 08
Lighting fixture ⁹ (Luminaires, floodlight, beaconing, emergency lighting)	Prohibited	EEx "de" EEx "d" EEx "e"	EEx "de" EEx "d" EEx "e"	Offshore: process areas: idem Zone 2 ⁷ Living quarters: industrial type Onshore: industrial type
Distribution panel (lighting, small power, etc.)	Prohibited	EEx "d" EEx "de"	EEx "d" EEx "de"	IP 55/IK 08

⁷ For standardization purposes

* Multicontrol Relay

⁸ Subject to COMPANY formal approval

⁹ Other combination of protection type (only suitable for category 2 product may be used)

Equipment type	Hazardous areas			Non-hazardous area
	Zone 0	Zone 1	Zone 2	
Control unit monitoring device security sensor	EEx "ia"	EEx "m" EEx "d" or "de" EEx "d" EEx "ia/ib" EEx "p"	EEx "m" EEx "d" or "de" EEx "d" EEx "ia/ib" EEx "p"	IP 55/IK 08
LV socket outlet	Prohibited	Prohibited	EEx "de" EEx "d"	Offshore: process areas: idem Zone 2 Living quarters: industrial type Onshore: industrial type
Solenoid valve	Prohibited	EEx "e" EEx "d"	EEx "e" EEx "d"	IP 55/IK 08
Heater	Prohibited	EEx "d"	EEx "d" EEx "de"	IP 55/IK 08
Electric starter for diesel/gas engine	Prohibited	Prohibited	Prohibited	Enclosed: IP 23/IK 08 Non-enclosed: IP 55/IK 08
Junction box Terminal box	Prohibited	EEx "e"	EEx "e"	Offshore: process areas: idem Zone 2 Living quarters: industrial type Onshore: industrial type
Control Station Push button	Prohibited	EEx "de"	EEx "de"	Offshore: process areas: idem Zone 2 Living quarters: industrial type Onshore: industrial type
Trace heating	Prohibited	EEx "e" EEx "d"	EEx "e" EEx "d"	Industrial type
Accumulator Batteries	Prohibited	EEx "e" Protection against short circuits Insulated enclosure Natural cooling Global certification (box + battery box)	EEx "e" or IP23/IK08 minimum	Protection against short circuits Insulated enclosure Natural cooling IP22/IK08 minimum
Package control panel	Prohibited	EEx "e" EEx "d"	EEx "e" EEx "d"	Industrial Type
Solar array	Prohibited	EEx "em"	EEx "n"	Industrial Type

Equipment type	Hazardous areas			Non-hazardous area
	Zone 0	Zone 1	Zone 2	
Cable glands	Prohibited	In accordance with the equipment type of protection		Industrial type or in accordance with the equipment type of protection
		Equipment type:	Cable glands type:	
		EEx "d"	EEx "d"	
		EEx "e"	EEx "e"	
		EEx "p"	IP 55	
		EEx "n" (zone 2 only)	IP 55	

4. Cables and wiring

As a general rule, all cables running in hazardous areas shall be of armoured type as defined in the COMPANY specification GS ELE 161 (Electrical cables).

Non armoured cables are authorised for zone 2 only provided they are efficiently mechanically protected (lids on cable trays, metallic conduits).

Conduits for wires are prohibited.

5. Installation rules

5.1 Cable runs

In zone 1 and zone 2 areas:

- All rigid or flexible cables are to be adequately protected along their run against mechanical damages
- Cable entries into the equipment shall comply with the standard covering the apparatus protection method
- Electrical connections shall be of untightenable type and provisions shall be taken to prevent sparking and overheating
- The cable ducts should be either sufficiently large or the current in the cables sufficiently low to prevent any dangerous overheating due to bundling
- The cable ducts shall be fire-resisting or at the minimum flame retardant
- Sealing fittings (MCT) shall be effectively installed at the entrance of electrical room (pressurized or not-pressurized), at floor and wall crossings.

6. Documents required by COMPANY

6.1 EC Declaration of conformity

All electrical apparatus installed in a potentially explosive gas atmosphere (zone 0, 1, 2) shall be certified by a Notified Body. The list of Notified Bodies is given in the Appendix 2.

For equipment of categories 1 and 2, the MANUFACTURER shall deliver an EC Declaration of Conformity signed by the MANUFACTURER against an EC examination type certificate delivered by the Notified Body.

For electrical equipment of category 3 (for use in zone 2). Only EC declaration of conformity accompanied by statements of Compliance (or type examination certificate) delivered by a Notified Body shall be accepted by COMPANY.

“Self certification” (by internal control of production) by the MANUFACTURER is not recognised by the COMPANY.

6.2 EC type Examination

The EC type Examination certificate as described in the Appendix 1 § 3.6 shall be delivered to COMPANY for category of equipment (1-2).

A type examination certificate (or “Statements of Compliance”) shall be delivered to COMPANY for equipment of category 3.

6.3 Quality assurance notification

A production quality assurance notification shall be delivered by the MANUFACTURER to COMPANY for products of category 1-2 (Annex IV of the Directive).

A product quality assurance notification shall be delivered by the MANUFACTURER to COMPANY for products of category 3 (Annex VII of the Directive)

These documents are delivered by the Notified Body to the MANUFACTURER upon successful quality audit.

Copies of all the EC Declarations of conformity and EC type examination certificates and type examination certificate (Statements of compliance) and valid quality assurance notifications shall be provided by ENGINEER/CONTRACTOR for COMPANY review and/or approval.

All these documents shall be in English language. Translations (if any) shall be carefully checked.

7. Marking

All electrical apparatus used in a potentially explosive gas atmospheres shall be identified by the marking system as described in Appendix 1 § 3.7.

This marking shall be legible, visible and durable taking into account possible chemical corrosion.

All products must bear the CE marking, which indicates conformity with the essential health and safety requirements of the EC directive, stated in the EC declaration of conformity followed by the Epsilon x in a hexagon (the specific marking of explosion protection).

Appendix 1 ATEX Directives n° 94/9/EC and n° 1999/92/EEC - Summary and general considerations

1. Foreword

Due to major changes brought by these two new ATEX (ATmosphères EXplosives) Directives, this paragraph aims at highlighting the main modifications and new requirements which become mandatory by national law in the European Union (EU) countries.

The new ATEX Directives are called “**new approach**”, a new method for a total harmonisation of regulations covering this field.

2. Situation before the 01 July 2003

- European regulations concerning electrical equipment for potentially explosive atmospheres were based on European directives which require regular modification in the form of application or adaptation to directives, in order to keep up with technical developments.
- The basic European text in this field was the directive 76/117/EEC, which provided the general framework for regulations which allows the free circulation of goods within the European Union. Also the safety national regulations had to be applied (eg France NFC 15000, etc...) for each country.
- This directive concerned only products
- Electrical equipment for use in potentially explosive atmospheres is certified by a State-Notified Body often referred as the "Laboratory" when it meets the relevant European standards ([EN 50014](#) and upwards) covering each type of protection (d, i, e, p, etc.). Such equipment may then be issued with a European “certificate of conformity”, entitling it to carry the distinctive Epsilon x mark. This mark opens the way to trading within the European Union and even on occasion outside it.
- This system has now been in operation for many years. Although largely beneficial, it has certain drawbacks, notably a lack of flexibility and the absence of a global concept for safety. It is going to be considerably modified by the new European directive 94/9/EC which was published in 1994. Application was on a voluntary basis as from 01/03/1996 and is mandatory since the 01/07/2003.
- Old Directives are repealed from July 2003:
 - Directive 76/117/EEC (electrical equipment)
 - Directive 79/196/EEC (electrical equipment employing certain types of protection)
 - The system of Certification related to these Directives (**certificate of conformity** at European level for equipment in strict compliance with CENELEC standards and inspection certificate at national level only for equipment not strictly in accordance with CENELEC standards but offering at least the same safety level) has been repealed.

3. ATEX Directive 94/9/EC (applicable as from the 01 July 2003)

It aims at ensuring free movement for the products to which it applies, by removing barriers to trade via the “New Approach” concept.

3.1 Framework

It defines **essential health and safety requirements (EHSRs)**, without mandatory references to standards.

It applies to electrical and **non-electrical equipment**.

It applies to environments which are potentially explosive due to **gas and dust hazards**.

It takes into consideration **all potential hazards** equipment may cause, in particular at design and production level.

The one directive applies to both mines susceptible to fire damp, and surface industries.

It recognizes the European Standards Committee **CEN** and the European Committee for Electrotechnical Standardization **CENELEC** as competent bodies to draw up the relevant standards, according to the scope of the Directive. These standards are then published or not to the EC's official journal.

It defines **procedures for assessment of conformity** to essential requirements, on the basis of modules which qualify such equipment to be allowed to bear the **CE marking**.

Note:

Equipment are no longer to be in compliance with a series of standards (as in the past) but to satisfy essential Health and Safety requirements (this is the spirit of the "new approach" directive), and this is a major change.

*The application of the harmonised CENELEC standards (as in the past) is only a **presumption** of conformity to the directive.*

The list of harmonised CENELEC standards is published in the EC's official journal.

When harmonised or non harmonized standards do not exist, then other standards may be applied.

3.2 Scope of the directive

Included:

The directive applies to the industrial field and concerns the following equipment:

- Equipment (machines including internal combustion engines, apparatus, fixed or mobile devices, control and instrumentation components, etc.).
- Protective systems (explosion relief systems, flame arresters, etc.).
- Components (item essential to the safe functioning of equipment and protective systems but with no autonomous function: terminals, push button, relays, empty flame proof enclosures, ballast for fluorescent lamps, etc.).
- Safety devices, controlling devices and regulating devices intended for use outside potentially explosive atmospheres but required for the safe functioning of equipment or protective systems with respect to the risk of explosions (controller units for sensors temperature, pressure, flow, overload protective devices for motors of protection EEX "e", gas detectors, power supply to an Exi measurement system used for monitoring process parameters, etc.).

Excluded:

- Medical devices intended for use in a medical environment.

- Equipment and protective systems where the explosion hazards result exclusively from the presence of explosive substances or unstable chemical substances.
- Equipment intended for use in domestic and non-commercial environments.
- Personal protective equipment covered by directive 89/686/EEC.
- Seagoing vessels and mobile offshore units (such as semi-submersible platforms, drilling jack up platforms)*, already covered by the IMO convention.
- Means of transport, except for vehicles intended for use in a potentially explosive atmosphere.

***Note:**

Fixed platforms are included in the scope, as well as FPSO's and FPP's units, and also units and vessels (below 500 t) not intended for high sea (navigation on river, lakes, etc.).

3.3 Groups and categories of equipment

The ATEX directive provides a classification covering the equipment arranged into category depending on the level of safety requirement, the nature of inflammable substances and the degrees of presence or duration of the explosive atmosphere.

This classification is summarized below, with the required level of protection and their correlation with the code of hazardous areas commonly used worldwide(except North American codes).

The link between the hazardous area (zone) and the category of equipment is defined in the ATEX directive 1999/92/EC.

The various categories (1, 2, 3) of equipment must be capable of functioning in conformity with the operational parameters established by the MANUFACTURER to a certain level of protection. In all cases the equipment remains energized and functioning in the designated zone.

Group	Category of equipment	Presence or duration of explosive atmosphere	Inflammable substances	Level of protection Faults to allow for	Correlation with hazardous areas
Equipment Group I (mines)	M1				
	M2				
Equipment Group II (surface)	1	Continuous presence Long periods Frequent	Gas, vapours, mist, dust	Very high level of protection ----- 2 types of protection or 2 independent faults Rare faults allowed for	Zone 0, 1, 2 gas Zone 20, 21, 22 dust
	2	Likely to occur	Gas, vapours, mist, dust	High level of protection ----- 1 type, level of protection Frequently occurring disturbances, or faults allowed for	Zone 1, 2 gas Zone 21, 22 dust
	3	Unlikely to occur Present for a short period	Gas, vapours, mist, dust	Normal protection ----- Required level of protection for normal operation	Zone 2 gas Zone 22 dust

Caution:

Zone 0 requires category 1 equipment

Zone 1 requires category 2 equipment

Zone 2 requires category 3 equipment

3.4 Potential ignition sources and other hazards to be controlled

The following represent potential hazards which may exist :

- Various sources of ignition, such as sparks, flames, electric arcs, high surface temperatures, acoustic energy, optical radiation or electromagnetic waves
- Static electricity
- Stray electric and leakage current
- Overheating (friction, etc.)
- Pressure compensation operations
- Disturbance from external sources, such as overloading, faults, changing environmental conditions, extraneous voltage, humidity, vibrations or contamination
- Software (fault in the programme)
- Power failure
- Connections (conduits and cable entries).

Provision is also made for specific requirements governing devices used to provide additional equipment safety.

These requirements necessitate detailed analysis to assess the operational reliability of such devices and their interaction with other components connected with the equipment.

3.5 Conformity assessment procedures

There are various conformity assessment procedures allowing the MANUFACTURER to declare that the equipment and protective systems complies with the Directive 94/9/EC, depending on equipment group and category.

Equipment - Group II/Category 1:

The MANUFACTURER must follow the **EC type-examination** procedure in order to affix the **CE marking**, in conjunction with the procedure relating to production quality assurance **or** the procedure relating to product verification. All these procedures are under the Notified Body control and responsibility.

The EC type examination is the procedure by which a Notified Body ascertains and attests that a sample representative of the production envisaged meets the relevant applicable provisions of the Directive.

The Notified Body shall deliver to the applicant (which may be different from the manufacturer) an EC type examination certificate including the name and address of the MANUFACTURER, conclusions of the examination and the necessary data for the identification of the approved type.

Equipment - Group II/Category 2:

In the case of internal combustion engines or electrical equipment, the MANUFACTURER must follow-up the EC type-examination procedure (under the Notified Body responsibility) in conjunction with the procedure relating to conformity to type referred to **or** the procedure relating to product quality assurance.

For other equipment (non electrical equipment) the MANUFACTURER must follow the procedure relating to internal control of production and communicate the dossier provided for, to



a Notified Body which shall acknowledge receipt of it and shall retain it.

For placing the product on the market, the MANUFACTURER shall demonstrate he is able to manufacture products with the same quality level as the representative sample through a valid quality assurance notification delivered by a Notified Body (applicable to category 1-2).

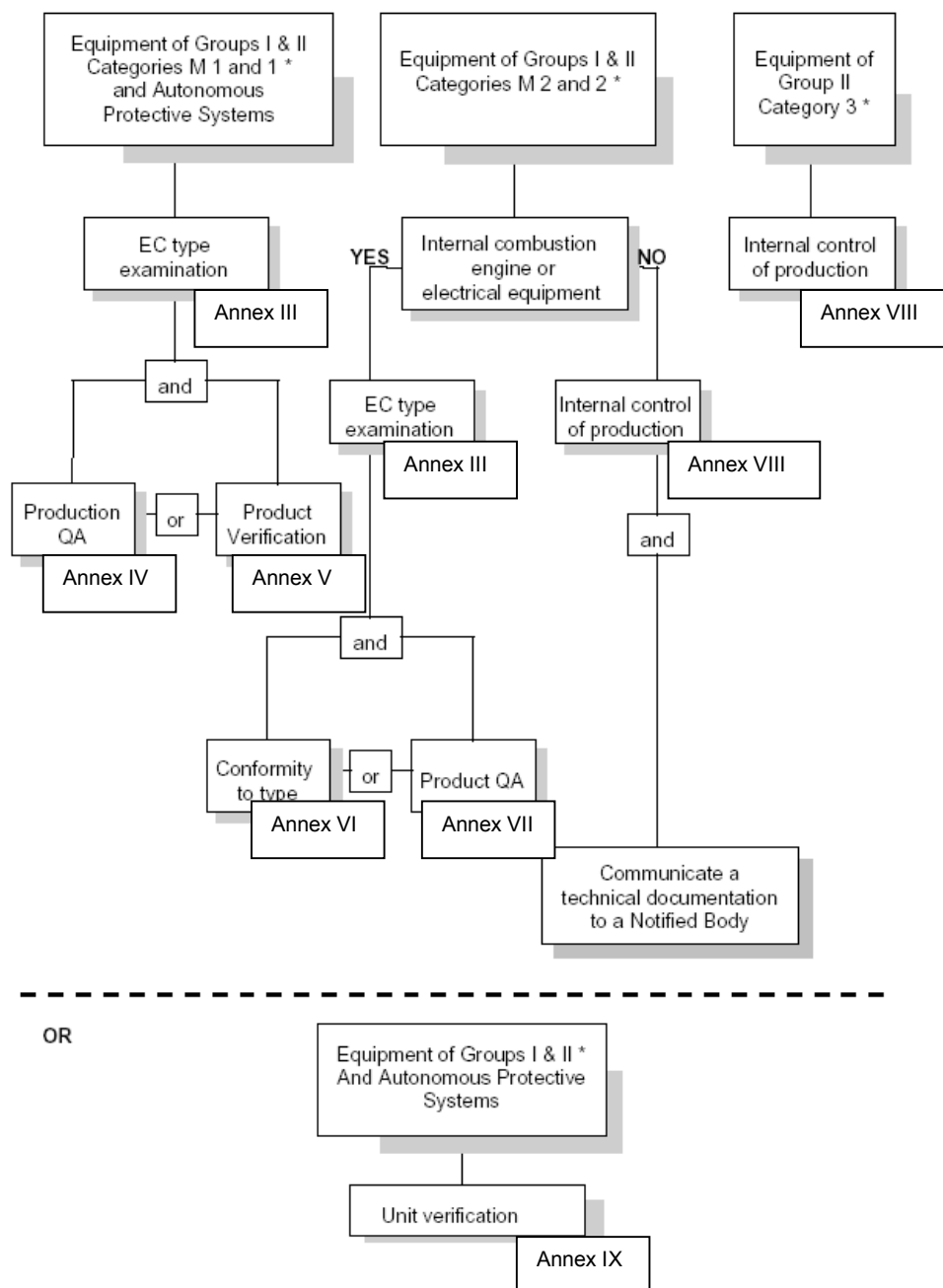
Equipment Group II/Category 3:

The MANUFACTURER must follow the procedure related to internal control of production.

Instead of the procedures here above mentioned (for category 1-2), the MANUFACTURER may follow the procedure relating to CE unit verification.

The above procedures are also applicable to components with the exception of the affixing of the CE marking.

Conformity Assessment Procedures



(*) and their components if separately certified

As a general rule, for electrical equipment, if each product cannot be individually inspected, the Notified Body (NB) performs an EC type examination then periodically ensures the conformity of equipment manufactured by means of a "production" or "product" quality assurance audit. These audits are carried out on the basis of the quality assurance standard EN 13980 (specific to EX equipment) similar to ISO quality standards, series 9000. Validity of these audits at manufacturer's works is 3 years. Annual visit is organised.

The ATEX conformity assessment for equipment group II, category 3 (surface, zone 2 application) permits self certification by the MANUFACTURER without third party intervention (N.B.), i.e. via the internal control of production.

All the assessment procedures (for category 1-2) rely on the expertise of the Notified Bodies to provide the guarantee that the essential health and safety requirements have been complied with. This is not the case for category 3 for which the assessment is completely under the MANUFACTURER responsibility.

The EC declaration of conformity is always the direct responsibility of the MANUFACTURER.

3.6 Documents of conformity

3.6.1 Documents issued by the MANUFACTURER

EC Declaration of conformity:

Once the **MANUFACTURER** has undertaken the appropriate procedures to assure conformity with essential requirements of the directive, it is the responsibility of the MANUFACTURER or his representative to draw-up a written EC declaration of conformity for each manufactured product.

In his declaration, the MANUFACTURER or his representative declares that the explosion protected equipment placed on the market complies with all essential health and safety requirements. The undersigning of the EC declaration by the MANUFACTURER or his representative authorises them to affix the CE marking to the equipment (it is not permitted to affix the CE marking to components).

The EC declaration of conformity has to include the following information:

- The name or identification mark and the address of the MANUFACTURER of his authorised representative established with the European Union
- Description of the explosion protected equipment (mark, type, etc.).
- All relevant provisions fulfilled by the equipment
- Where appropriate, reference to the harmonised CENELEC standards
- Where appropriate, the national or international standards and technical specifications which have been used
- Where appropriate, references to other European Directives with the relevant standards which have been applied
- Where appropriate, the name, identification number and address of the Notified Body and the number of the EC-type-examination certificate
- Identification of the signatory who has been empowered to enter into commitments on behalf of the MANUFACTURER or his authorised representative established within the European Union.

Written Attestation of Conformity for components:

In addition to declaring the conformity of components with the provisions of the Directive, the written Attestation of Conformity has to state the characteristics of the components and how the components are to be incorporated into equipment or protective systems to ensure that the

finished equipment or protective system meets the applicable essential health and safety requirements of the Directive.

Documents accompanying the product:

The EC declaration of conformity/the written attestation of conformity must accompany the information given with each single product or batch of products.

All equipment or protective systems must be accompanied by instructions which shall include:

- Repeat of the marking on the equipment
- Instructions for safe use and putting into service
- Assembling/dismantling and maintenance instructions
- Indication of danger areas
- Characteristics of special tools
- All relevant drawings.

All these instructions shall be translated in the language of the country where the equipment is installed. This is applicable for all the E.U. countries.

3.6.2 Documents issued by the Notified Body

The EC type examination certificate or type examination certificate is issued by the Notified Body.

Its number shall be as follows :

ZZZ	03	ATEX 1013	U
↓	↓	↓	↓
code of the Notified Body	Year of the certificate	Number of the certificate	Special conditions

X, if applicable, indicating that specific conditions apply as detailed in the certificate (for use, ...).

U, if applicable, indicating that the item is a component (e.g. : an empty EEx “d” box ; a Certification of the completed box (including all the electrical components) is required).

In addition the Notified Body may also issue the following documents according to the provisions of the relevant conformity assessment procedures:

- Production quality assurance notification (Annex IV of the Directive) :
 - include all the manufacturing process, and engineering and procurement aspects of the product (by NB).
- Product verification notification (Annex V of the Directive) : (applied when manufacturer has no quality assurance plan)
 - individual examination and testing of each piece (by NB).
- Conformity to type notification (Annex VI of the Directive) : (applied when manufacturer has no quality assurance plan)
 - each piece of equipment is type tested (by NB).
- Product quality assurance notification (Annex VII of the Directive) :
 - identical to Annex IV requirements with less engineering and procurement aspects.
- Unit verification notification (Annex IX of the Directive) :

- when no EC type examination is carried out and no quality assurance plan exists (applicable for a series of n products)
- include verification + test per unit
- Certificate of conformity
 - issued by a Notified Body, when ATEX directive is not applied; the certificate is only based on IEC standards (but not CENELEC)

These documents need not to accompany the product.

All the documents issued by a Notified Body must be kept by the N.B. 10 years after the last product sale.

3.7 Marking of equipment

Three types of marking are provided:

- **CE marking**

The new directive ATEX 94/9/EC as well as the New Approach directives, provide for the affixing of the CE marking, as part of the conformity assessment procedures. Where a product is subject to several directives which all provide for the affixing of the CE marking, the marking indicates that the product is presumed to conform to the provisions of all these directives stated in the EC Declaration of MANUFACTURER's equipment.

The CE marking is mandatory and must be affixed before any equipment or protective system is placed on the market or put into service.

The CE marking is followed by the Notified Body number who has approved the product for category 1 or category 2.

- **Supplementary marking**

Equipment, protective systems and components must bear the specific marking of explosion protection, the Epsilon x in a hexagon, which is already known from the "old explosive atmospheres directive".

This marking has to be followed by the symbol of the Group (II) and Category (1-2-3) of equipment, and the letter G (concerning explosive atmospheres caused by gases, vapours, mists) and D (concerning explosive atmospheres caused by dust).

- **Additional marking**

Equipment, protective systems and components must be marked with all the necessary information essential to the safe use. The European standard series [EN 50014](#) for electrical products foresees a supplementary marking:

- EEX symbol indicates that the product is in compliance with one or more standards of this series
- The symbol for each type of protection (o, p, d, q, e, i_a, i_b, m, n)
- Apparatus group II A, II B, II C in case of type of protection d, i, q, or nc, nL.
- Temperature class or maximum surface temperature.

Any equipment or protective system accompanied by the EC declaration of conformity and bearing the CE marking as specified by the directive is considered by the Member States to be in conformity with the EC Directive 94/9/EC.

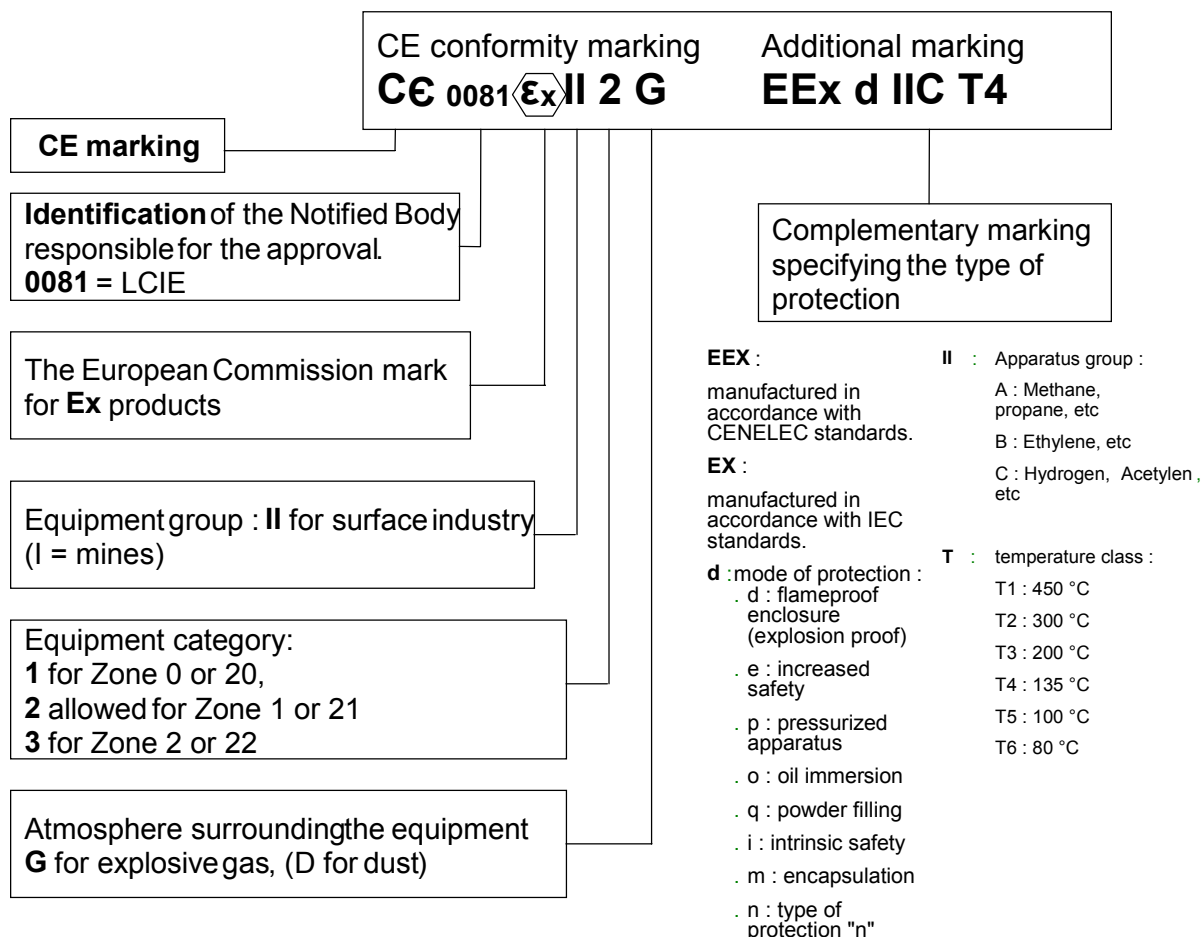


Components do not carry CE marking but must be covered by a written attestation of conformity.

Equipment bearing the CE conformity marking which presents a safety risk is withdrawn from the market and prohibited by the Member States under a specified procedure.

If equipment bearing the CE marking is found not to be in conformity, action is taken against those responsible for applying the marking.

Example for marking



Codes for all the Notified Bodies are indicated in Appendix 2.

4. ATEX Directive 1999/92/EC (applicable from the 01 July 2003)

Although this Directive is not directly under the responsibility of the Technology Division TDO/TEC/ELE, but rather under the Exploitation Division TDO/EXP and SAFETY Division SAF herebelow are summarized the main requirements of this Directive which cannot be separated from the ATEX Directive 94/9/EC.

- This Directive requires employers to protect workers from the risk of explosive atmospheres. Nothing equivalent did exist in the old directive.
- It does not apply to the use of appliances burning gaseous fuels in accordance with Directive 90/396/EEC, explosives and chemically unstable substances.
- To provide protection against explosion, the employer shall take technical and/or organisational measures appropriate to the nature of the operation, in order of priority and in accordance with the following basic principles:
 - The prevention of the formation of explosive atmospheres or where the nature of the activity does not allow that

- The avoidance of the ignition of explosive atmospheres, and
- The mitigation of the detrimental effects of an explosion so as to ensure the health and safety of workers.
- The employer shall carry out an assessment of explosion risks taking into account:
 - The likelihood that explosive atmospheres will occur and their persistence
 - The likelihood that ignition sources, including electrostatic discharges will be present and become active and effective
 - The installations, substances used, processes and their possible interactions
 - The scale of the anticipated effects.

The directive does not provide any means for an assessment of explosion risks.

Yet, a guide of good practice of a non binding nature, to address the topics of the directive has been prepared to the European Commission request (final edition dated April 2003).

Also the standard [EN 1127](#) might be used.

- The existing standards/codes such as API, IP15, IEC 60 079-10, French decree, are no longer considered as of strict application but only as reference documents.

The employer shall classify places where explosive atmospheres may occur into zones (zones 0, 1, 2). These zones have the same definition as the ones in the [IEC 60079-10](#) standard:.

- The employer shall ensure that the minimum requirements as given in the Directive are applied to workplaces and workstations covering organisational measures (training of workers, written instructions and permits to work) and explosion protection measures.
- Where necessary, places where explosive atmospheres may occur, shall be marked with signs at their point of entry in accordance with the type defined in the Directive (symbol Ex in black letters on a yellow background in a triangular shape).



- The employer shall ensure that a document hereinafter referred to as the “**explosion protection document**” is drawn up and kept up-to-date. This document shall demonstrate in particular:
 - That the explosion risks have been determined and assessed
 - That adequate measures will be taken to attain the aims of this Directive
 - Those places which have been classified into zones
 - Those places where the minimum requirements set out will apply

- That the workplace and work equipment, including warning devices, are designed, operated and maintained with due regard for safety
- That in accordance with Council Directive 89/655/EEC, arrangements have been made for the safe use of work equipment.

The explosion protection document shall be drawn up prior to the commencement of work and be revised when the workplace, work equipment or organisation of the work undergoes significant changes, extensions or conversions.

5. Non electrical equipment for potentially explosive atmospheres

The new Directive ATEX 1999/92/EC intends to protect the workers against all sources of risks: non electrical equipment must comply with the minimum requirements of safety when they operate in the work places in the same way as electrical equipment.

The new Directive ATEX 94/9/EC has introduced in its scope not only the electrical equipment, but also the **non electrical equipment** (mechanical, pneumatic, hydraulic, etc.) with specific Essential Health and Safety Requirements.

This annex has aimed to highlight some features and to bring to the “mechanical engineers” knowledge about the new requirements brought by this Directive, of which the application is mandatory in the EU countries.

It should be noted that mechanical machinery and equipment are generally not ignition sources during normal operation contrary to electrical equipment. The types of ignition sources which can arise when malfunctions occur in non-electrical equipment are usually hot surfaces or mechanical sparks from friction or impacts.

For many decades, mechanical equipment such as pumps, fans, compressors have been used in potentially explosive atmospheres and have worked safely. This happens in general without special regulatory control or standards, but is based on good design of machinery and equipment, backed up by well-founded engineering knowledge used to choose and install this equipment. Yet the ATEX Directive 1999/92/EC requires that a risk analysis be carried out on all non electrical equipment.

The CEN has the responsibility to prepare and to issue the relevant standards.

Non electrical equipment shall meet the requirements of the standards [EN 13463](#) series (or pre-standards pr EN) as listed in # 2.

New type of protection have been introduced (fr, g, c, b) which did not exist in the past in the electrical field. Also type of protection already used by the electrical engineers in the past (d, p) are covered by a different standard for non electrical equipment.

In addition to the above, other standards or pre-standards covering flame-arresters (pr EN 12874), safety requirements for ignition protected fans, etc., are under preparation.

Non electrical equipment include stand alone mechanical equipment or part, like a pump or valve and complete engineered equipment made of several components including electrical equipment or parts like a belt conveyor.

Potential and effective ignition sources and measures to prevent them to become effective must be assessed.

Normal operation, expected malfunctions and rare malfunctions have to be taken into account in liaison with equipment category.

In short, it can be said that a derating factor must be applied on the rollers of mechanical rotating equipment, or temperature monitoring be provided.

This short annex is a draft only and is to be developed in the future by the mechanical engineers (TEC/MTH).

Diesel generator in Zone 2 area :

Standards [EN 1834](#) 1-2-3 shall be taken into consideration.

MARKING :

Marking for a package, skid, including for example an electric motor + a pump + various other elements shall be marked for example as follows.

Motor : C E 081  II 2 G – EEx d II B T3

Pump : C E  II 2 G – C T 3

Other item :

Skid : C E II 2 G

It shall be the responsibility of the packager to make an explosion risk analysis to make sure of the right assembling of the various items onto the skid/package.

The packager shall issue the EC declaration of conformity.

Quality assessment of the package shall be mandatorily evaluated in accordance with Annex IX of the Directive (Unit Verification).

6. Existing Facilities (before the 01/07/03)

They also fall under the ATEX directives since the 01/07/03.

Certificates of conformity to harmonized standards obtained in compliance with previous directives will remain valid only if products meet the Essential and Health Safety Requirements of the new Directive.

For existing “work equipment”, they must comply with the minimum requirements of the USERS directive (1999/92/EC) and be safe. This is achieved by a formal risk assessment which looks at the individual pieces of equipment. This risk analysis should have been completed by 01/07/03.

The End users must review their equipment and provide an analysis as to whether their equipment can be a source of risk. Guidelines are given in the directive for how to conduct the risk assessment (hot points, leakage, friction due to contact, etc.). End users are responsible for this analysis. In some cases, a consultant or the equipment MANUFACTURER can do this risk assessment.

The inspection of the equipment may however reveal some damages, for instance the casing which will need to be taken into account in the risk assessment (e.g.: joints in flameproof motors).

Also the “Explosion Protection Measures” (deadline: 30/06/06) shall show how all the “works equipment” operate together in the “work place” (emergency situation during power failure, etc.).

Existing “Workplaces” shall comply with the minimum requirements of the USERS directive (1999/92/EC) no later than the 01/07/2006.

Particular attention shall be paid to Ex”n” and Ex”e” HV motors for which the standards have changed (risk of sparking during starting). For LV motors, only motors of type “e” which have



been rewound shall be checked. Also LV motors used in variable speed drive operation should be checked carefully.

Attention is drawn also on the new requirements for the repair of Ex equipment, with a greater responsibility placed on the end-user.

Appendix 2 List of notified bodies under directive 94/9/EC

LIST OF NOTIFIED BODIES UNDER DIRECTIVE 94/9/EC

Equipment and protective systems intended for use in potentially explosive atmospheres

(List updated - 04/10/2004 - as per <http://europa.eu.int/comm/enterprise/newapproach/standardization/harmstds/reflist/atex.html>)

COUNTRY	NAME OF NOTIFIED BODY	IDENTIFICATION N°
Austria	TÜV Österreich (TÜV-A)	0408
Belgium	Institut Scientifique des Services Publics (ISSeP)	0492
Czech Republic	Fyzikálne Technický Zkusební Ústav S.P.	1026
Denmark	DEMKO A/S	0539
	Teknologisk Institut	0396
Finland	VTT Industrial Systems	0537
France	Institut National de l'Environnement Industriel et des Risques (INERIS)	0080
	Laboratoire Central des Industries Electriques (LCIE)	0081
Germany	TÜV Nord Cert GmbH & Co. KG	0032
	TÜV Saarland e.V.	0034
	TÜV Industrie Service GmbH	0035
	RWTÜV Systems GmbH	0044
	Physikalisch-Technische Bundesanstalt (PTB)	0102
	TÜV Product Service GmbH	0123
	Deutsche Montan Technologie GmbH (DMT)	0158
	Deutsche Gesellschaft zur Zertifizierung von Managementsystemen mbH	0297
	Forschungsgesellschaft für Angewandte Systemsicherheit und Arbeitsmedizin mbH	0588
	Bundesanstalt für Materialforschung und Prüfung (BAM)	0589
	Institut für Sicherheitstechnik GmbH (IBExU)	0637
	Zelmex Prüf- und Zertifizierungsstelle	0820
Italy	Centro Elettrotecnico Sperimentale Italiano Giacinto Motta SpA (CESI)	0722
Luxembourg	Société Nationale de Certification et d'Homologation s.a.r.l.	0499
The Netherlands	KEMA Quality B.V.	0344
Norway	NEMKO AS	0470
	Det Norske Veritas classification AS	0575
Poland	Ośrodek Badań i Certyfikacji (OBAC)	1461
Slovakia	EVPU, a.s., SKTC 101 EVPU, JSC	1293
	Technická inšpekcia (TI)	1354
Spain	Laboratorio Oficial José Maria de Madariaga (LOM)	0163
Sweden	Swedish National Testing and Research Institute (SP)	0402
Switzerland	Swiss Electrotechnical Association (SEV)	1258
United Kingdom	Lloyd's Register of Shipping (LRQA Centre)	0038
	BSI Product Services	0086
	INTERTEK Testing & Certification Ltd	0359
	SIRA Certification Service	0518
	TRL Compliance Services Ltd	0891
	Baseefa (2001) Ltd	1180

Each Notified Body is responsible for a list of selected products, and for certification procedures/modules according to a certain number of Annex in the Directive. Details are given in the Official Journal of the EC.

Appendix 3 List of harmonised standards

List updated 04/10/04 as per :

<http://europa.eu.int/comm/enterprise/newapproach/standardization/harmstds/reflist/atex.html>

- **EN 1127-1:1997**
Explosive atmospheres - Explosion prevention and protection.
Part 1: Basic concepts and methodology.
- **EN 1127-2:2002**
Explosive atmospheres - Explosion prevention and protection.
Part 2: Basic concepts and methodology for mining.
- **EN 1755:2000**
Safety of industrial trucks - Operation in potentially explosive atmospheres - Use in flammable gas, vapour, mist and dust.
- **EN 1834-1:2000**
Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres.
Part 1: Group II engines for use in flammable gas and vapour atmospheres.
- **EN 1834-2:2000**
Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres.
Part 2: Group I engines for use in underground workings susceptible to firedamp and/or combustible dust.
- **EN 1834-3:2000**
Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres.
Part 3: Group II engines for use in flammable dust atmospheres.
- **EN 1839:2003**
Determination of explosion limits of gases and vapours.
- **EN 12874:2001**
Flame arresters - Performance requirements, test methods and limits for use.
- **EN 13012:2001**
Petrol filling stations - Construction and performance of automatic nozzles for use on fuel dispensers.
- **EN 13160-1:2003**
Leak detection systems.
Part 1: General principles.

- **EN 13237:2003**
Potentially explosive atmospheres - Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres.
- **EN 13463-1:2001**
Non-electrical equipment for potentially explosive atmospheres.
Part 1: Basic method and requirements.
- **EN 13463-5:2003**
Non-electrical equipment intended for use in potentially explosive atmospheres.
Part 5: Protection by constructional safety "c"
- **EN 13463-8:2003**
Non-electrical equipment for potentially explosive atmospheres.
Part 8: Protection by liquid immersion 'k'.
- **EN 13673-1:2003**
Determination of the maximum explosion pressure and the maximum rate of pressure rise of gases and vapours.
Part 1: Determination of the maximum explosion pressure.
- **EN 13760:2003**
Automotive LPG filling system for light and heavy duty vehicles - Nozzle, test requirements and dimensions.
- **EN 13821:2002**
Potentially explosive atmospheres - Explosion prevention and protection - Determination of minimum ignition energy of dust/air mixtures.
- **EN 13980:2002**
Potentially explosive atmospheres - Application of quality systems.
- **EN 50014:1997**
Electrical apparatus for potentially explosive atmospheres - General requirements.
Amendment A1: 1999.
Amendment A2: 1999.
- **EN 50015:1998**
Electrical apparatus for potentially explosive atmospheres - Oil immersion "o".
- **EN 50017:1998**
Electrical apparatus for potentially explosive atmospheres - Powder filling "q".
- **EN 50018:2000**
Electrical apparatus for potentially explosive atmospheres - Flameproof enclosure 'd'.
Amendment A1: 2002.
- **EN 50019:2000**
Electrical apparatus for potentially explosive atmospheres – Increased safety 'e'.
Corrigendum 04.2003.

- **EN 50020:2002**
Electrical apparatus for potentially explosive atmospheres - Intrinsic safety 'i'.
- **EN 50021:1999**
Electrical apparatus for potentially explosive atmospheres - Type of protection "n".
- **EN 50104:1998**
Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods.
- **EN 50104:2002**
Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods.
Amendment A1: 2004.
- **EN 50241-1:1999**
Specification for open path apparatus for the detection of combustible or toxic gases and vapours.
Part 1: General requirements and test methods.
Amendment A1: 2004.
- **EN 50241-2:1999**
Specification for open path apparatus for the detection of combustible or toxic gases and vapours.
Part 2: Performance requirements for apparatus for the detection of combustible gases.
- **EN 50281-1-1:1998**
Electrical apparatus for use in the presence of combustible dust.
Part 1-1: Electrical apparatus protected by enclosures - Construction and testing.
Corrigendum 08.1999.
Amendment A1: 2002.
- **EN 50281-1-2:1998**
Electrical apparatus for use in the presence of combustible dust.
Part 1-2: Electrical apparatus protected by enclosures - Selection, installation and maintenance.
Corrigendum 12.1999.
Amendment A1: 2002.
- **EN 50281-2-1:1998**
Electrical apparatus for use in the presence of combustible dust.
Part 2-1: Test methods - Methods for determining the minimum ignition temperatures of dust.
- **EN 50284:1999**
Special requirements for construction, test and marking of electrical apparatus of equipment group II, Category 1 G.
- **EN 50303:2000**
Group I, Category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust.

- **EN 60079-7:2003**
Electrical apparatus for explosive gas atmospheres.
Part 7: Increased safety "e".
- **EN 60079-15:2003**
Electrical apparatus for explosive gas atmospheres.
Part 15: Type of protection "n".
- **EN 61779-1:2000**
Electrical apparatus for the detection and measurement of flammable gases.
Part 1: General requirements and test methods.
Amendment A11: 2004.
- **EN 61779-2:2000**
Electrical apparatus for the detection and measurement of flammable gases.
Part 2: Performance requirements for group I apparatus indicating a volume fraction up to 5 % methane in air.
- **EN 61779-3:2000**
Electrical apparatus for the detection and measurement of flammable gases.
Part 3: Performance requirements for group I apparatus indicating a volume fraction up to 100 % methane in air.
- **EN 61779-4:2000**
Electrical apparatus for the detection and measurement of flammable gases.
Part 4: Performance requirements for group II apparatus indicating a volume fraction up to 100 % lower explosive limit.
- **EN 61779-5:2000**
Electrical apparatus for the detection and measurement of flammable gases.
Part 5: Performance requirements for group II apparatus indicating a volume fraction up to 100 % gas.
- **EN 62013-1:2002**
Caplights for use in mines susceptible to firedamp.
Part 1: General requirements - Construction and testing in relation to the risk of explosion.