Reference Guide

Low Voltage Motors
ATEX Jargon Buster

Power and productivity
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ATEX Jargon Buster

ABB's ATEX jargon buster explains the terminology users are likely to encounter when purchasing motors for hazardous areas.

ABB's *ATEX* Jargon Buster uses hyperlinks for quick navigation. A click on any underlined word takes you straight to the relevant article.

Quick navigation tool

A B C D E F G H I J K L M N O P Q R S T U V W Z

A

Approval

Motors are approved for use in hazardous areas by accredited testing laboratories known as Notified Bodies. To qualify for ATEX approval, manufacturers must show that their products incorporate measures to prevent the ignition of unavoidable explosive atmospheres.

See EC Type Examination

ATEX Directives

ATEX is not a standard but an acronym of the French *ATmosphères EXplosives*, which stands for Directive 94/9/EC from the Treaty of Rome. This European Directive amends and adds safety requirements for hazardous areas. The purpose is to enable the sale of equipment across the European Union, without manufacturers having to satisfy different requirements for each national market.

If a motor or another piece of equipment is to be used in potentially explosive atmospheres containing gas or combustible dust, it must comply with the ATEX directive.

ATEX consists of two parts: ATEX 95(*) / ATEX 100a(**), which concentrates on the duties of the manufacturers; and ATEX 137(*) / ATEX 118(**), which focuses on the end users' obligations

Compliance with the ATEX directives means reinforced safety aspects – safer design, more demanding testing procedures, and specific quality assurance measures for the design as well as the manufacturing process. It requires employers to protect both staff and local communities from the risk of an explosive atmosphere.

(*) Reference to Article 95 of the Treaty of Amsterdam (2nd October 1997)

(**) Reference to Article 100a of the Treaty of Rome (25th March 1957)

Compliance with the ATEX directives is mandatory from July 1st 2003.

The ATEX system depends on three key elements: Harmonised technical standards; production quality assessment of the manufacturing facilities; and notification by the European Commission to recognize bodies and test laboratories known as Notified Bodies.

ATEX 95

The product directive 94/9/EC, known as the ATEX 95 Directive, concentrates on the manufacturer's duties, giving the safety requirements to be fulfilled by all equipment, both electrical and non-electrical, installed in hazardous areas within the European Union.

It describes the Essential Health and Safety Requirements (EHSRs) of the products regarding their design, manufacturing process, testing, documentation and maintainability.

The requirements are divided into three categories: Technical requirements from harmonised European standards; health and safety aspects; and production quality requirements.

Voluntary since 1994, the requirements of the Directive are mandatory since 1 July 2003. The Directive covers any electrical or mechanical product that contains or constitutes a potential ignition source and which requires a special design or installation procedure to prevent an explosion. Regulated equipment includes control and communication devices, monitoring and detection equipment. It also includes safety or control devices installed outside hazardous areas that have an explosion protection function, such as pressure-relief panels and fast-acting shutoff valves.

ATEX 100

Article 100 in the treaty of Rome; the same as ATEX 95.

ATEX 118

Article 118 in the treaty of Rome; the same as ATEX 137.

ATEX 137

The "worker protection directive" 1999/92/EC, ATEX 137, describes the "minimum requirements" for improving the health and safety of workers potentially at risk. It classifies the environment into zones and outlines which category of equipment that can be used in each zone.

The Directive focuses on the analysis and description of the risks, the zone definitions, and the maintenance practices in relation to site safety.

The safety of an installation in a hazardous area is the result of co-operation between the equipment manufacturer and the end user.

ATEX 137 concentrates on the duties of the end user. Workers should be trained on hazardous area issues by the employer. Authorization should be given to each employee working in a hazardous area. Explosion protection measures should be taken and an explosion protection document (EPD) has to be established. When equipment is repaired, the end user has the responsibility to select an appropriate repair shop.

The Employers' obligations in relation to ATEX include assessing the site's *Sources of Hazard* and likely sources of ignition, classification of the area into zones and marking all points of entry, as well as producing and maintaining documentation. The main obligations relating to employers are: Preparing an explosion protection document (EPD); classifying the workplace into Zones where applicable; selecting ATEX 95 products according to Zone; and identifying, using warning signs, locations where explosive atmospheres may occur.

Essentially, the employer is required to take all reasonable measures to prevent the formation of an explosive atmosphere in the workplace. Where this is not possible,

measures must be taken to avoid the ignition of any potentially explosive atmosphere. In addition, the effects of any explosion must be minimised in such a way that workers are not put at risk.

Since the ATEX Directives are enforced, the sub-contractors, consultants, and/or service providers will operate under the responsibility of the end user.

See Third parties

Atmosphere

For ATEX purposes, atmosphere comes in two classifications: “G” for explosive gas and “D” for combustible dust. A product certified for both gas and dust is marked G-D.

Authorized body

North American terminology. Electrical equipment used in hazardous locations, classified according to North American rules, must be approved by an authorized body or the manufacturer.

Bearing currents

Variable Speed Drives can generate high frequency shaft and bearing voltages (see IEC 60034-17), which then can cause bearing currents and damages. Thus in hazardous environments specially designed Ex-motors and frequency converters must be used. The protective measures depend for example on voltage, physical size and output power of the motor. In practice the possible solutions usually are insulated N-end bearing and/or output filters in the frequency converter and convenient cabling.

Motor intended for variable speed operation will be equipped with a second rating plate, where the allowed operation conditions are mentioned. The use of Ex-motors in variable speed drives without the second rating plate is thus prohibited.

For more details see Variable speed drive

C

Canadian Electric Code (CEC)

The general description of hazardous areas and protection types in Canada are presented in Canadian Electric Code (CEC) published by CSA. More specific requirements can be found e.g. from several IEEE and UL publications. Electrical equipment used in hazardous locations, classified according to North American rules, must be approved by an authorized body or the manufacturer. The equipment for Division 1, Zone 0 or 1 areas must always be approved by an authorized body e.g. UL, CSA or FM.

Category

Hazardous area equipment is arranged into categories depending on the level of risk.

The Category defines the level of safety required for the design, testing, installation, operation, maintenance and repair of the equipment.

The safety requirements are related to the category of the equipment, not to the zone where it is installed. Consequently, to use equipment from a higher category than required by the zone will add unnecessary constraints in use and additional costs in inspection, maintenance and repair, especially in areas affected by combustible dust.

All hazardous area equipment is arranged into one of the following categories:

Category	Zone	Protection in Gas	Protection in Dust
1	0 / 20	Not Applicable	Not Applicable
2	1 / 21	“d”, “e”, “p”	DIP – IP 65
3	2 / 22	“n”, “d”, “e”, “p”	DIP – IP 55 or IP 65

Category 1

Equipment designed for very high level of safety. Requires two independent means of protection or safe operation with two separate faults. Used where explosive atmospheres are present continuously or for lengthy periods, typically Zone 0 and Zone 20.

No motors are allowed in theses Zones

Category 2

Equipment designed for a high level of safety. Requires the design to be safe with frequently occurring disturbances or with one operating fault. Used where explosive atmospheres are likely to occur, typically Zone 1 and Zone 21.

Category 3

Equipment designed for a normal level of safety. Used where explosive atmospheres are likely to occur infrequently and to be of short duration, typically Zone 2 and Zone 22.

CEC

See Canadian Electric Code.

CE marking

The CE-Marking affixed to the product is the manufacturer’s statement that the product complies with the Directives stated in the EC Declaration of conformity as signed by the manufacturer of the product. The CE mark shows that the product has been manufactured according to a certain design and procedure. It works like a passport, allowing a product to be installed anywhere in the EU. It provides reassurance for buyers both inside and outside the EU that the motor or machine conforms to the latest standards. For ATEX compliance, the CE Marking must appear prominently on each item of equipment or each protective system. In Category 1 or Category 2, it must be followed by the identification number of the

Notified Body that has approved the product. In Category 3, a statement of compliance from the manufacturer is acceptable.

CEMEP

A forum for co-operation between European motor manufacturers. Provides a system for classification of motors based on their energy efficiency. All standard low voltage motors sold or manufactured in the EU must be classified EFF1, EFF2 or EFF3, where EFF1 is the highest level of efficiency. Ex-motors are not considered standard motors and are therefore not subject to the scheme. See http://energyefficiency.jrc.cec.eu.int/eurodeem/index.htm.

CEN - European Committee for Standardization

One of the European Standards Committees. Produces harmonised standards in all fields except the electrotechnical field and telecommunications, giving the technical means to achieve the objectives of the Essential Health and Safety Requirements stated in the ATEX Directive.

CENELEC - European Committee for Electro-technical Standardization

One of the European Standards Bodies. Produces harmonised standards to cover the electrotechnical field and gives the technical means to achieve the objectives of the Essential Health and Safety Requirements stated in ATEX Directives.

Certificates

See Declaration of Conformity.

Circulating current

See Bearing current.

Classification societies

Organisations that verify the technical standard of ships. Requirements on equipment, for instance motors, may vary from one classification society to the next.

Clearance

Motors designed for hazardous area gas and dust should respect minimum distance in air, called clearances between two conductive parts (e.g. terminals board) or between rotating part (e.g. fan and fan cover at least 1mm) to avoid any risks of sparks.

Combustible dust

Combustible dust can be specified either as a dust/air mixture with a specified ignition temperature, or as a layer of dust of a specified thickness. The ignition temperature for various types of dust is available from commercially available tables.

Conductive dust

A dust with electrical resistivity equal to or less than 10^3 ohm.m

When conductive, the dust is not allowed to enter the motor enclosure, even in zone 22. IP 65 protection shall be requested and motor approved by a Notified Body

Converter Supply

See variable speed drive.

Co-operation

Co-operation is a cornerstone of ATEX 137. The safety of an installation in a hazardous area is the result of a co-operation of the equipment manufacturer, the installer and the end user.

Creepage distance

Components used for motors designed for hazardous area gas and dust should respect a minimum distance along of an insulating material between two conductive parts. This is known as creepage distance.

CSA

The Canadian Standards Association.

D

D

D on the nameplate indicates that the marking relates to dust. A product certified for both gas and dust is marked G-D.

Dangerous Substances and Explosive Atmospheres Regulations

The Dangerous Substances and Explosive Atmospheres Regulations is the UK implementation of the European ATEX directive. See Local regulations

Declaration of conformity

The EC Declaration of Conformity is the only document that has to be supplied with each delivery. With this document, the manufacturer takes responsibility for the product's compliance with the ATEX directive. It provides information about the EC type examination certificate, with reference numbers. To ensure that a motor is approved to the appropriate Directive, users need to check the directive number, which appears in the EC Declaration of Conformity delivered with the motor. Depending on the zone where the product is used, the number of the Notified Body can be stamped after the CE mark (mandatory for use in Zone 1 or Zone 21). This document replaces the previous old certificates.

DIP

See Dust ignition proof

Directive

A Directive is an EC document issued by the European Community. The aim of a Directive is to harmonize national provisions to ensure within each country:

- Safety Aspects
- Environment

A Directive is published in the Official Journal of European Community (OJEC)

Products are stamped “CE” as a proof of conformity to the Directives, which the EC Declaration of conformity refers to.

Directive 94/9/EC

See ATEX 95

Directive 1999/92/EC

See ATEX 137

Division system

An old U.S. system, which defines areas according to the so-called Division system (NEC 500). It will soon be replaced by the new NEC 505 standard, similar to the IEC standard.

Dresden agreement

In 1996, IEC and CENELEC reached a co-ordination agreement to develop new standards, called the 'Dresden agreement'. It means that since September 1996 the same document is submitted to IEC and CENELEC simultaneously and the standards are published at same time and are identical. This work stopped between 1998-2000 due to the introduction of ATEX Directive, pending the publication of harmonised standards. The procedure was re-introduced in 2001, which means that the IEC standards will be updated over the coming years in accordance with the EHSRs of ATEX Directive.

DSEAR

See Dangerous Substances and Explosive Atmospheres Regulations and Local regulations.

Dust

With ATEX, combustible dust is for the first time included in the regulations governing hazardous atmospheres. Typical applications include handling of grain, coal, sugar, wood and some chemical substances such as sulphur. Dust ignition proof motors have been designed to provide safe motive power in these areas.

Dust cloud

The risk of explosion in a hazardous area with combustible dust is either caused by a *cloud* of dust or a *layer* of dust.

The ignition temperature for a cloud of dust must be at least 50% above the motor’s marking temperature; or, put differently, the marking temperature must not exceed two-

thirds of the ignition temperature of the dust. For instance, if the ignition temperature of the dust is 210°C, the motor's marking temperature must be lower than 140°C.

The ignition temperature of a 5mm layer of dust must be 75°C above the marking temperature of the motor. For instance, if the ignition temperature is 200°C, the marking temperature must be 125°C or lower. It is the responsibility of the user to stage maintenance periods so that the dust layer does not build up above 5mm. The ignition temperatures for various types of dust are available from commercially available reference tables.

Dust ignition proof

Dust Ignition Proof (DIP) motors are used in atmospheres where combustible dust surrounds the motor, or where dust settles under its own weight on the motor. Typical applications include handling of cereal, animal feed, paper, wood, chemicals, plastics and coal.

On a DIP motor, the cooling fan is made of metal or other anti-static material, to avoid static electricity. The terminal board has increased clearances to guarantee higher security. The temperature marked on the motor will correspond to the running performance during the worst conditions allowed for the model. Motors for Zone 21 are protected to IP 65 as minimum.

For Zone 22, protection to IP 55 will be used if the dust is not conductive, but IP 65 will be necessary when the dust is conductive.

This degree of protection will prevent any explosion of combustible dust from being transmitted, because the motor itself is dust ignition proof. This means no potentially explosive atmosphere can penetrate inside the motor. The ingress of dust into the motor is prevented by the IP protection and the temperature marked on the motor corresponds to the temperature class for which the motor is certified in respect to standards.

The use of IP 65 protection requires regular inspection and maintenance.

Dust ignition temperature

The ignition temperature for various types of dust can be obtained from commercially available tables. The maximum temperature of the motor is relative to the ignition temperature of the prevailing dust. See Temperature class.

E

EC Declaration of Conformity:

See Declaration of Conformity

EC Type Examination

An EC Type Examination certificate is a document issued by an Ex NB accredited by the EU according to ATEX Directive 94/9/EC (ATEX 95) which allow them to issue this Certificate for Category 1 and Category 2 .

The Ex NB's are not allowed to issue an "EC Type Examination Certificate" according to 94/9/EC for category 3, only Statements of Compliance (or type examination certificate) is allowed.

EEx d

See Flameproof

EEx de

See Flameproof

EEx e

See Increased safety

EEx nA

See Non Sparking

EEx p

See Pressurized Enclosure

EEx pe

See Pressurized Enclosure

EFF1

The highest level of motor efficiency in the European classification system, established through cooperation between CEMEP and the European Commission.

Efficiency classification

See CEMEP and EPCA.

EHSR's

See Essential Health and Safety Requirements.

Electrical Insulation Resistance

The electrical insulation resistance of fans, fan cover and ventilation screen should not exceed 1 GigaOhm if peripheral speed of fan is equal or more than 50m/s for gas environment. For Dust Ignition Proof motors, it should not exceed 1 Gohm whatever the peripheral speed of the fan.

For all hazardous area the fan, fan cover or ventilation screen should not contain more than 6% of magnesium by mass. All surfaces which can charge electrically, should be earthed or connected with equipment bond.

Employers' obligations

See ATEX 137.

EN - European Norm

See European standards

End user

The duties of the end user company are outlined by the ATEX 137 directive.

EPAct

See EPCA

EPCA

The American Energy Policy and Conservation Act, often referred to as EPAct or EPCA, requires electric motors in the range 0.75 to 132 kW (1-200 hp), manufactured in or imported to the United States, to meet specific energy efficiency standards. The regulations also apply in Canada, where the legislation is referred to as the "Energy Efficiency Regulations" and "Canada's Energy Efficiency Act". For further information about the efficiency levels required, contact ABB.

EPD

See explosion protection document.

Equipment category

See Category.

Essential Health and Safety Requirements (EHSR)

The ATEX 95 Directive defines the "essential health and safety requirements" (EHSRs) of equipment for each Category. Different types of protection can be used to respect the EHSRs of ATEX Directive according to the Zones where the equipment is installed. The goal is to prevent the creation of a source that can create an explosion. The ATEX 137 Directive directly concerns the minimum requirements that are to be respected in different

working places(Zone area). The safety of an installation in a hazardous area is the result of a co-operation of the equipment manufacturer, the installer and the end user.

See also New approach directives.

European standards

A unified set of standards has been developed in the European Union. The goal is to have standards, which are accepted, and adopted, by all European countries. These European standards are commonly referred to as the European Norm (EN). The European standards Committee provide the leadership for the development of these standards.

The European standards for ATEX are issued by the European Standards Committee: CEN - European Committee for Standardization; and CENELEC - European Committee for Electrotechnical Standardization. These bodies produce harmonised standards to cover the electrical and mechanical fields and give the technical means to achieve the objectives of EHSRs stated in the ATEX Directives. In 1996, IEC and CENELEC made a co-ordination agreement to develop new standards called the 'Dresden agreement'. It means that since September 1996 the same document is submitted to IEC and CENELEC simultaneously and the standards are published at same time and are identical.

European Standards Committees

National standards are generally drawn up by private national standards organisations. These are in charge of standardization in their respective country. These bodies meet within three European organizations, which are also private:

CEN, the European Committee for Standardization, working in all fields except the electrotechnical field and telecommunications; CENELEC, the European Committee for Electrotechnical Standardization, and ETSI, the European Telecommunications Standards Institute.

The prime task of these organizations is the establishment and promotion of European standards, recognized by all member countries. This leads to the production of genuine European standards, which help to abolish technical barriers ensuring that, when a standard is used, the same standards are applied in all the member countries.

Ex d

See Flameproof

Ex de

See Flameproof

Ex e

See Increased safety

Ex mark

The Ex mark is the European Commission mark for products approved for hazardous areas.

Ex-motors

See hazardous area motors.

Ex nA

See Non-sparking

Ex Notified Body Group (ExNBG)

Hazardous area products are approved by the Notified Bodies, known collectively as the Ex Notified Body Group (ExNBG). These are test laboratories approved, or ’notified’, by the European Commission. Under the old directives, these were referred to as 'Heads of Test Laboratories' (HOTL: Head Of Testing Laboratories).

Ex p

See Pressurized Enclosure

Ex pe

See Pressurized Enclosure

Examination certificate

The Notified Body examines and tests the product to confirm it meets the standard and issues an EC-type examination certificate to the manufacturer, entitling him to display the CE mark on the product as proof of compliance.

See EC Type examination certificate.

Ex NB

See Notified Bodies.

Explosion protection document

The employer must carry out an assessment of risks arising specifically from explosive atmospheres and produce an Explosion Protection Document that demonstrates that explosion risks have been assessed. This should be at most 3 – 4 pages in length and contain the references to the whereabouts and mapping interpretation of the minimum requirements to the existing current safety management system documentation.

Explosive atmosphere

An explosive atmosphere is a mixture of air, under atmospheric conditions, of flammable substances in the form of gas, vapour, mist, dust, or fibres in which, after ignition, combustion spreads throughout the unconsumed mixture

Potentially explosive atmospheres are found in many areas of industry, from mines and the chemical, oil and gas, and pharmaceuticals industries, to plants handling cereal, animal feed, paper, wood and coal. All these have the potential to produce gas, dust or fumes which can be ignited by a spark or flame.

The classification of the potentially explosive atmosphere depends on the frequency with which potentially explosive atmosphere may exist and the capability of the gas or dust to create an explosion.

Explosive gas and combustible dust is classified according to its likelihood to be ignited, according to its characteristics: Minimum ignition energy; Minimum ignition temperature; Auto-ignition temperature; and Layer ignition temperature

F

Flamepath

A route for exploding gas to escape from the machine by, whilst cooling off. This is achieved by making the gas take a long route along extra long spigots etc. “Length of flamepath” refers to the shortest through a flameproof joint from the inside to the outside of a flameproof enclosure.

Flameproof enclosure, type “d”

Flameproof is the common name for enclosure type “d”, explosion proof enclosure. The designation under ATEX for this type of motor is EEx d. The corresponding designation according to IEC is Ex d.

The enclosure of this motor type will prevent an internal explosion, or flame, from being transmitted to the explosive atmosphere surrounding the machine, hence the name flameproof. The enclosure will withstand any pressure levels caused by such an internal explosion. The design includes a flamepath. There may be no dangerous hot surface or sparks on the outside of the enclosure at rated operation.

There is also another variant designated EEx de or Ex de. This is a a flameproof motor with the terminal box of an increased safety motor, combining the superior safety of a “d” protection with the less stringent electrical connection requirements of an EEx e or Ex e motor.

Flameproof motors are designed as Category 2 equipment for use in zone 1, but they can also be used in zone 2.

Flameproof bushing

An insulating device carrying one or more conductors, through internal or external walls of a flameproof enclosure without affecting the flameproof properties of the enclosure or its compartments.

Flameproof joint

The place where corresponding surfaces of the different parts of a flameproof enclosure come together and prevent the transmission of an internal explosion to the explosive gas atmosphere surrounding the enclosure. See also flamepath.

FM

Stands for Factory Mutual Research, a US based, non-profit scientific research and testing organisation.

Frequency converter

See variable speed drive.

G

G-D

A product certified for both gas and dust is marked G-D. If a motor is to be installed in an environment that contains gas and dust, the motor needs to fulfil the requirements for both. For instance, an EEx d motor in temperature class T4 and modified for use as a DIP motor, could be installed in both atmospheres.

Gap of flameproof joint

The distance between the corresponding surfaces of a flameproof joint when the motor has been assembled.

Global ATEX system

The term 'Global ATEX system' refers to the three key elements necessary for ATEX compliance: *Harmonised standards*, covering the EHSRs of ATEX Directive; *audits* at the manufacturing facility responsible for delivering the Ex-equipment, conducted by an expert for quality Ex-system approved by European Commission; and a *notification* by the European Commission to recognize bodies and test laboratories known as the 'Ex Notified Body Group' (ExNBG).

Group

Under the ATEX Directive, equipment is designated by the type of potentially explosive atmosphere in which the equipment may be used – Group 1 for underground mines and Group 2 for surface industries.

H

Harmonised Standard

Harmonised Standards are listed in the Official Journal of the European Communities to offer guidance to conformity with a particular Directive. See European Standards Committee and New approach directives.

Hazardous area

Explosive atmosphere is referred to as "Hazardous area" in IEC countries and "HAZLOC" in North America.

Hazardous Area Motors

Motors designed to meet high safety requirements to prevent any risk of ignition of explosive atmospheres, even under fault or in recognised overload conditions. Testing and certification by Notified Bodies ensures that the requirements are met.

The use of hazardous area motors is mandatory in explosive atmospheres, however they are also frequently used in severe environments, corrosive atmospheres or anywhere else where reinforced protection is required.

HAZLOC

Explosive atmosphere is referred to as "Hazardous area" in IEC countries and "HAZLOC" in North America.

Heads of testing laboratories (HOTL)

See Ex Notified Body Group.

Health and Safety at Work Act

Any incident in relation to hazardous areas, which involves injury or damage, would fall within the scope of legislation such as The Health and Safety at Work Act. This provides for much higher penalties than incidents under the more familiar Machinery Safety Regulations.

Health and safety requirements

See Essential Health and Safety Requirements (EHSRs).

Highly Flammable Liquids & Petroleum Gases Regulations 1972

Part of older UK legislation, replaced by the new 17 part regulations under DSEAR. This will deal with explosions and fires that are caused by dangerous substances that generate explosive atmospheres whether they are gases, vapours or dusts.

I

IEC

Stands for International Electrotechnical Commission. International standards for all electrical, electronic and related technology areas are issued by IEC. It is made up of more than 60 participating countries, with the major goals being to make the global market work more efficiently; to improve efficiency in industrial processes; to improve health and safety; and to protect the environment. An IEC Ex-scheme is in progress to harmonise the international requirements for hazardous applications.

IEC standards have no legal standing in any country, however they do tend to influence local regulations.

IEEE

The IEEE (pronounced *Eye-triple-E*) is a non-profit, technical professional association of more than 377,000 individual members in 150 countries. The full name is the Institute of Electrical and Electronics Engineers, Inc. Based in the United States; it is involved in technical publishing, conferences and consensus-based standards activities.

Ignition

The relevant parameters to characterise the potentially explosive atmosphere are: Frequency with which potentially explosive atmosphere may exist; Minimum ignition energy; minimum ignition temperature; auto-ignition temperature; and layer ignition temperature

Ignition temperature of an explosive substance

The lowest temperature of a hot surface at which ignition occurs of a flammable substance.

Increased safety

Under ATEX, the type designation for this type of motor is EEx e. The corresponding designation according to IEC is Ex e.

Increased safety motors prevent sparks, arcs or hot spots during service, including starting, by a number of constructional or dimensional provisions, and by the use of special protection devices, designed to trip within a specified time in case of stall position.

The maximum stall time "t_E" allowed for the motor is stamped on name plate, this t_E time respect a minimum value depending of ratio I_S/IN (given by the Standards)

To reduce the temperature rise, this type of motor typically has a special winding that effectively de-rates the motor in its increased safety design. In practise it means the customer will have to select a bigger motor compared to a flameproof motor for the same application.

Increased safety motors are designed as Category 2 equipment for Zone 1, but can also be used in Zone 2.

Insulated Bearings

See bearing currents.

International standards

Equipment for explosive atmosphere is designed, installed, operated and maintained according to international standards and local regulations dedicated to this area. See IEC: International Electrotechnical Commission; EN: European Norm; and NEC: National Electrical Code for North America

J

July 2003

1st of July 2003 is the implementation date for ATEX, marking the end of the transition period. This means that from this date, any Ex-equipment put on the market in a hazardous area in Europe must be ATEX certified. This deadline includes any spare parts for equipment, protective systems, components or devices that falls under the ATEX Directive.

L

Layer ignition temperature

The risk of explosion in a hazardous area with combustible dust is either caused by a *layer* of dust or a *cloud* of dust.

The ignition temperature of a 5mm layer of dust must be 75°C above the marking temperature of the motor. For instance, if the ignition temperature is 200°C, the marking temperature must be 125°C or lower. It is the responsibility of the user to stage maintenance periods so that the dust layer does not build up above 5mm. The ignition temperatures for various types of dust are available from commercially available reference tables.

The ignition temperature for a cloud of dust must be at least 50% above the motor's marking temperature; or, put differently, the marking temperature must not exceed two-thirds of the ignition temperature of the dust. For instance, if the ignition temperature of the dust is 210°C, the motor's marking temperature must be lower than 140°C.

Limiting temperature

Relevant to increased safety electrical apparatus. The maximum permissible temperature of apparatus of parts of apparatus equal to the lower of the two temperatures determined by:

a) the danger of ignition of the explosive gas atmosphere

b) the thermal stability of the materials used.

Loadability curve

The loadability curve gives the maximum torque at various speeds in variable speed drive operation.

Local regulations

See national regulations.

M

Maintenance

Inspection and maintenance operations under ATEX are described in EN 60079-17 for gas and in EN 50281-1-2 for dust. It is the responsability of the end user to ensure the safety of these operations, especially when sub-contracted.

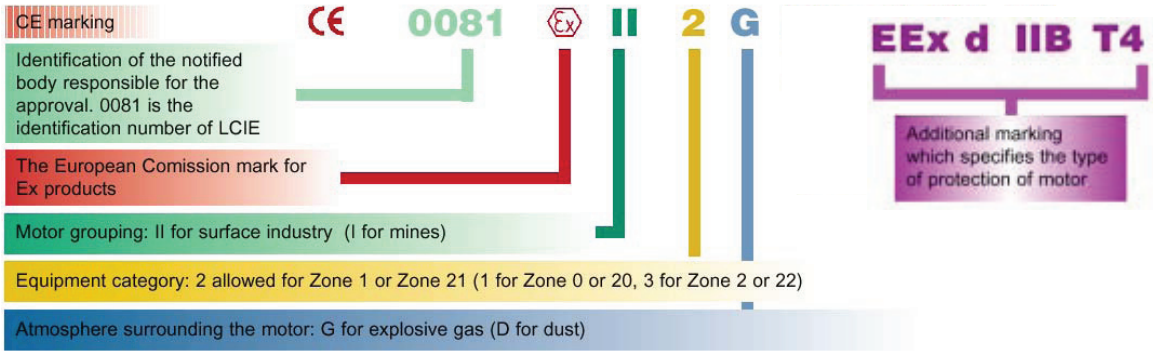
MEPS

Australian Standards MEPS (Minimum Energy Performance Standards) for High Efficiency (AS/NZ 1359.5:2000).

Marking

Products that meet the requirements of the ATEX Directive are marked by the manufacturer with the CE mark and the Ex mark. The following information is also required: name and address of manufacturer; designation of series or type; serial number, if any; and the year of manufacture. The Ex symbol should be followed by the equipment group and category. For equipment Group II the letters G and/or D for type of atmosphere (gases, vapours, mists and dusts); the symbol for the temperature class or the maximum surface temperature, or both; the Ex symbol, followed by the symbol for the type(s) of protection used and the identity of gas or gas group covered; the identity of the Notified Body involved at the certification stage and the certificate number; and any additional marking required for the type of protection concerned.

A typical hazardous motor description could look like this:



Maximum permitted gap

The highest value of gap, defined according to the electrical apparatus group, the volume of the flameproof enclosure and the length of the flameproof joint.

Maximum surface temperature

The highest temperature attained in service under the most adverse operating conditions within the rating of the electrical apparatus by any part or any surface of the apparatus that could produce an ignition of the surrounding explosive atmosphere

Minimum Requirements

The ”Minimum requirements” are listed in part A of annex II of the Worker Protection Directive 1999/92/EC (ATEX 137). These outline what the end user needs to do to fulfill health and safety obligations.

The minimum requirements cover the training and competences of the workers, the writing of all instructions for the operations maintenance, inspection, the description of the Explosion Protection Measures, the verification procedures before start up, the role of the safety manager, the traceability of all operations in relation with the the safety including the audit, qualification and control of the suppliers, service providers and sub-contractors.

All these points must be documented and updated in the Explosion Protection Document

These ”Minimum Requirements” apply to all ”Work equipment” from July 1st 2003 even if it was installed before that date and is not ATEX certified.

Motor design

Hazardous area motor designs must use the minimum values for clearances and creepage distances outlined in the latest edition of standards.

Insulating material with the highest class of resistance for tracking is used. In the case of IP 54 or IP55 protection, the clearance between fan and fan cover must be at least 1% of the maximum diameter of fan, with a minimum value of 1 mm and a maximum of 5 mm. The insulation resistance of fans, fan cover and ventilation screen should not exceed 1 gigaohm if peripheral speed of fan is equal or more than 50 m/s for gas environment. This always applies for Dust environment, even if peripheral speed is below 50m/s. The fan, fan cover or ventilation screen should not contain mass of more than 6% of magnesium.

All surfaces, which can charge electrically, should be earthed or connected with equipotential bond. Temperature of the relevant surface for determining the temperature class (external or internal surface) is determined by measuring the maximum temperature rise in worst condition whatever the network supply voltage, between 95% and 105% of UN during rated operation, with an additional margin of 5° below the temperature class.

Motor grouping

See Group.

N

National Electrical Code (NEC)

The general description of hazardous areas and protection types in the United States are presented in the National Electric Code (NEC) published by the National Fire Protection Association (NFPA). More specific requirements can be found in publications from e.g. IEEE and UL. Electrical equipment used in hazardous locations, classified according to North American rules, must be approved by an authorised body or the manufacturer. The equipment for Division 1, must always be approved by an authorized body e.g. UL, CSA or FM.

National Fire Protection Association (NFPA)

US based, non-profit organisation aiming to reduce the burden of fire and other hazards and advocating scientifically-based consensus codes and standards, research, training and education. Its membership totals more than 75,000 individuals from around the world and more than 80 national trade and professional organizations

National regulations

Equipment for explosive atmospheres is designed, installed, operated and maintained according to international standards and local regulations dedicated to this area.

Each country has its own regulations, which may differ. National requirements might be needed for final approval of installations e.g. in Russia, Brazil, Australia or Japan but generally relate to one of the main international standards.

NEC

See National Electrical Code

NEC 500

Used in the U.S., this is the actual standard defining the hazardous area according to the Division system.

NEC 505

This American standard defines the relationship between the Divisions as described in NEC 500 and the Zones used in the IEC system. The law enforcing this standard has never been published in the United States so it can be used only for items exported from the United States.

NEMA

National Electrical Manufacturers Association, the leading US trade association representing the interests of electrical industry manufacturers. Sets standards relating to electric motors.

New approach directives

In the past, EU Directives and Standards contained strict lists of requirements that needed to be fulfilled.

The New Approach Directives have introduced a new logic, where the goal of safety is defined through Essential Health and Safety Requirements (EHSR) or Minimum Requirements. Manufacturers and end users then have the freedom to find the best means to meet the stated goal.

This explains why the in the relevant standards many requirements are requested as “should” instead of “shall”, or appear as a note.

The purpose is to help engineers find cost-effective and convenient solutions without compromising safety.

Non-explosive atmosphere

An atmosphere with no explosive elements. All types of standard products can be used. Hazardous area motors are however also frequently used in non-explosive atmospheres, for instance in severe environments, corrosive atmospheres or anywhere else where reinforced protection is required.

Non-sparking

The designation for this type of motor under ATEX is EEx nA. The corresponding designation according to IEC is Ex n A. The letter “A” stands for non-sparking equipment according to EN50021.

With this type of protection, measures are applied to give security against the possibility of excessive temperatures and of the occurrence of arcs and sparks inside and on external parts of electrical apparatus which does not produce arcs or sparks in normal service.

The EHRS (Essential Health and Safety Requirements) introduced by ATEX now make this design safer against the risk of sparks during starting.

Non-sparking motors are for use in zone 2 only, i.e. for areas where explosive atmospheres occurs occasionally, but not during normal duty. EEx nA motors are not flameproof, and have no flamepath. The equipment is classified as Category 3.

Norsok

Recommendations used by the Norwegian offshore industry

North American regulations

The general standards for the electric motors according to North American regulations are: NEMA Motors and Generator (MG-1) in the U.S.; and C22.2 No. 100-95 in Canada. The general description of hazardous areas and protection types are presented in the National Electric Code (NEC) published by National Fire Protection Association (NFPA) and in Canadian Electric Code (CEC) published by CSA. More specific requirements can be found e.g. from several IEEE and UL publications. An authorized body or the manufacturer must approve electrical equipment used in hazardous locations, classified according to North American regulations. An authorized body e.g. UL, CSA or FM must always approve the equipment for Division 1, Zone 0 or 1 areas.

Notified Bodies

Approval of design and manufacture is issued by Notified Bodies, independent testing laboratories recognised to perform tests, audit quality systems and issue reports and EC Type Examination or certificates of conformity.

In hazardous areas, the manufacturer must use an European Notified Body for testing and certification of the products according to the category requirements, usually a company that specialises in testing industrial equipment.

The notified body examines and tests the product to confirm it meets the standard and issues an EC-type examination certificate to the manufacturer, entitling him to display the CE mark on the product as proof of compliance. A new feature of the ATEX Directive is that the manufacturer now also needs a quality system in place that must be checked by the Notified Body.

To ensure that a motor is approved to the appropriate Directive, users need only to check the directive number, which appears in the EC Declaration of Conformity delivered with the motor. Depending on the zone where the product is used, the number of the notified body can be stamped after the CE mark (mandatory for equipment category 2).

See also http://europa.eu.int/comm/enterprise/atex/nb/nblist.htm.

P

Pressurised enclosure

The designation under ATEX for this type of protection is *EEx p*. The corresponding designation according to IEC is *Ex px* or *Ex py* or *Ex pz*.

High voltage motors are available with a pressurised enclosure that can be purged and filled with an inert gas to prevent an explosion.

They meet the most stringent safety requirements for hazardous areas in the chemical and mineral oil industries. These motors are typically used instead of *EEx nA* in high voltage applications, 11kv or more, where a higher level of protection is desired.

The decision weather to use either *EEx d* or *EEx p* in a high voltage application is looked at on a case-by-case basis. It is often possible to offer a smaller frame size for the *EEx p* motor, but this is then offset by the need to provide the purging gas and the associated pipe-work.

There is also another variant designated *EEx pe* (alternatively *Ex pxe* or *Ex pye* or *Ex pze*).

No dangerous hot surface or sparks is permitted on the outside of the enclosure. The temperature of all parts inside the enclosure must be under the T-class limit under normal operating conditions.

Pressurised motors are designed as Category 2 equipment for Zone 1, but they can be used in Zone 2.

Product Directive 94/9/EC

See ATEX 95 .

Protection types

Motors are available in the following protection types: Flameproof; Increased safety; Non-sparking; Pressurised; and Dust ignition proof.

Production quality assessment

A new feature of the ATEX Directive (ATEX 95) is that the manufacturer now also needs a quality system in place that must be checked by the Notified Body. The production quality assessment of the manufacturing facility responsible for delivering Ex equipment is one of the three key elements in the ATEX system. The other two are the harmonised standards for equipment and the notification by the European Commission to recognize bodies and test laboratories as Notified Bodies.

This production quality assessment applies to the manufacturer, to the suppliers and service providers of the manufacturer. It has a 3 years validity and requests a yearly audit .

Q

Quality assurance

Specific quality assurance is required for the design and the manufacturing process relating to hazardous area motors. See production quality assessment.

R

Recognised test organisations

See notified bodies.

Repair

Repair operations must respect strict requirements as described in IEC 60079-19 for gas and EN 50281-1-1 for dust, the end user has the responsibility to select an appropriate repair shop. See ATEX 137.

S

Standards EN / IEC

EN Standards are issued by the European Comittee of Standardization, see CEN.

IEC Standards are issued by the International Electrotechnical Comission, see IEC.

There is a clear trend for the requirements harmonisation between the CEN and the IEC.

See Appendix 1 for the list of the ATEX relevant EN and IEC Standards.

Second rating plate

Hazardous area motors for variable speed drive applications can be fitted with a second rating plate, outlining its limitations in this configuration. See Variable Speed Drive.

Self-certification

For electrical equipment classified as category 3 according to Product Directive(ATEX 95) where the requirements are less stringent, the ATEX Directive allows manufacturers to self-certify products, although third-party certification is often preferred.

Shell Dep

Shell specifications also used by other companies of oil and gas sector.

Sources of Hazard

The Employers' obligations in relation to ATEX include assessing the site's Sources of Hazard and likelihood of sources of ignition, classification of the area into zones and marking all points of entry, as well as producing and maintaining documentation. See ATEX 137.

Statements of Compliance

A Statement of Compliance (sometimes called "type examination certificate") may be issued by testing laboratories, recognized by official organizations in Europe, as third party and independent testing laboratories for category 3.

The content is different from an "EC Type Examination Certificate" issued for category 1 or 2.

T

Temperature class

Temperature class, gas	Temperature °C
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

An Ex product should be marked with the corresponding temperature class. The temperature class corresponds to the maximum surface temperature of the product. According to the type of protection used, the temperature corresponds either to maximum temperature of external surface or to the maximum temperature inside. In every case, the temperature should be below the minimum ignition temperature of the explosive atmosphere where the motor is installed. It is the responsibility of the user to observe an appropriate margin between the minimum ignition temperature and the temperature marked on the motor.

For dust ignition proof motors, the marking temperature corresponds to the temperature class of the motor. This temperature will correspond to the maximum temperature of the external surface of the motor with a safety margin of 5º K.

Temperature class, dust

Substance	Wheat	Barley	Charcoal	Corn	Sugar	Sulphur	PVC
Ignition temperature for cloud of dust	420	450	500…600	400	350	240	530
Ignition temperature for layer of dust = 5mm	200	205	180	250	220	250	340
Max allow. Surf. Temp. (layer <= 5mm)	125	130	105	175	145	160	265
Temp class, dust	T125	T130	T105	T175	T145	T160	T265
Corresponding temp class, gas	T5	T5	T5	T4	T4	T4	T3

Temperature rise

Variable speed drives creates extra losses inside the motor, because of the non-sinusoidal wave they produce compared to the 50 or 60 Hz industrial network. This increases the temperature rise compared to the temperature rise at same torque with network supply. For this reason, hazardous area motors intended for variable speed drive applications must be fitted with a second rating plate.

Test organisation

See Notified bodies.

Testing laboratories

See Notified bodies.

t_E-time

This refers to the maximum stall time of the motor. The maximum stall time "t_E " allowed for the motor should be stamped on rating plate. The t_E time should respect a minimum value depending of ratio Is/IN (given by the Standards). Only applicable for EEx e.

Third Parties

As there are only two ATEX Directives, the Product Directive (ATEX 95) and the Workers Directive (ATEX 137), the areas of responsibility are split between the manufacturers and the end-users without the involvement of anyone else.

Any third parties involved operate under the responsibility or either the manufacturer or the end user.

Type of protection

The special design applied to motor to prevent ignition of a surrounding explosive atmosphere.

Transition period

The ATEX Directive was adopted in 1994. Since 1st of July 2003 the ATEX Directives are mandatory and the transition period is over.

U

UL

Underwriters Laboratories Inc. (UL) is an independent, not-for-profit product safety testing and certification organization, based in the United States.

V

Variable speed drive

Because of the non-sinusoidal wave produced by the variable speed drive compared to the industrial network, extra losses are created inside the motor. These losses increase the temperature rise compared to the temperature rise at same torque with network supply. Machines in variable speed operation are also susceptible to bearing currents, which may cause sparking.

Motors for use with a variable speed drive must therefore meet specific “Minimum Requirements”. In the rating plate(s) the following values must be shown:

- speed range
- power range
- voltage & current range
- type of torque
- converter type and required minimum switching frequency

For these applications, the dimensioning and installation are critical. The user should follow the manufacturer’s instructions carefully.

The new standards allowing the use of Ex-motors with variable speed drive supply consider the motor and the converter as a 'unit' and require them to be tested together for certification. In case of flameproof motors, the tests do not need to be carried out when there is a direct temperature control using embedded temperature sensors.

VIK

Recommendations used mostly only in the German chemical, gas and oil industry.

VSD

See variable speed drive.

W

Worker Protection Directive

See ATEX 137.

Z

Zone

Hazardous places/environment are classified in terms of zones on the basis of the frequency and duration of the occurrence of an explosive atmosphere

ATEX 137 Directive divides hazardous environment into zones and states which category of equipment that can be used in each zone.

Atmospheres are classified into zones. Zones 0, 1 and 2 refer to gas, while Zones 20, 21 and 22 refer to dust.

Zone 0

Explosive atmosphere with gas or vapour present continuously, for long periods or frequently due to malfunctions, typically more than 1000 hours per year. No motors are allowed in Zone 0.

Zone 1

Explosive atmosphere containing gas or vapour is likely to occur due to expected malfunctions, typically between 10 and 1000 hours per year. Flameproof or increased safety or Pressurized motors can be used in Zone 1.

Zone 2

Explosive atmosphere containing gas or vapour is unlikely to occur, or, if it does, is likely to only be of short duration and not during normal duty, typically less than 10 hours per year. Increased safety motors or non-sparking motors are used in Zone 2.

Zone 20

Permanent presence of combustible dust. No motors are allowed in Zone 20.

Zone 21

Incidental presence of combustible dust during normal duty. Only dust ignition proof motors approved and certified by a Notified Body can be installed.

Zone 22

Presence of combustible dust only by accident, but not during normal duty. Dust ignition proof motors approved by a Notified Body or by the manufacturer can be used here if non-conductive dust.

Zoning

The division of a hazardous area into zones depending on the frequency with which explosive atmosphere occurs. The overall aim is to ensure that the employees and the public are protected from fires and explosion.

It involves identifying and assessing the fire and explosion risks of dangerous substances within the operating plant. Properties of materials are to be agreed and documented. Safety measures to eliminate or reduce the risks of these substances are put in place.

Once no further improvements can be made to the operation, the plant can be put forward for risk assessment and area classification.

Appendix 1

List of the EN / IEC Standards

Standards for classification in Hazardous Areas

EN Standards	
EN 1127-1 (1997)	Explosive atmospheres - Explosion and protection, Part 1: Basic concepts and methodology
EN 50281-3 (Sept. 2002)	Equipment for use in the presence of combustible dusts, Part 3: Classification of areas where combustible dusts are or may be present
IEC Standards	
IEC 60079-10 (June 2002)	Electrical apparatus for explosive gas atmosphere, Part 10: Classification of hazardous areas
IEC 61241-3 (June 2002)	Electrical apparatus for use in the presence of combustible dust, Part 3: Classification of areas where combustible dusts are or may be present

Standards for Installation, Inspection and Repair

EN Standards	
EN 60079-14 (Aug. 1997)	Electrical appartus for explosive gas Atmospheres Part 14 Electrical **Installations** in hazardous areas
EN 60079-17 (Aug. 1997)	Electrical appartus for explosive gas Atmospheres Part 17 Inspection and **Maintenance** of Electrical Installations in hazardous areas
EN 50281-1-2 (Sept. 1998) + EN 50281-1-2/A1 (2002)	Electrical appartus for use in the presence of combustible dust Part 1-2: Electrical appartus protected by enclosures- **Selection, installation and maintenance**
IEC Standards	
IEC 60079-14 (Oct. 2002	Electrical appartus for explosive gas Atmospheres Part 14 Electrical **Installations** in hazardous areas
IEC 60079-17 (July 2002)	Electrical apparatus for explosive gas Atmospheres Part 17 **Inspection** and **Maintenance** of Electrical Installations in hazardous areas
IEC 60079-19 (Sept. 1993)	Electrical apparatus for explosive gas Atmospheres Part 19 **Repair and overhaul** for apparatus used in Explosive Atmospheres
IEC 61241-1-2 (June 1999)	Electrical apparatus for use in the presence of combustible dust Part 1-2 Electrical apparatus protected by enclosure and surface temperature temperature limitation- **Selection, installation and maintenance**

Standards for equipments

EN Standards	
EN 50014 (June 1997) + EN 50014/A1(Feb. 1999) + EN 50014/A2(Feb. 1999)	Electrical apparatus for potentially atmospheres: General requirements
EN 50016 (July 2002)	Electrical apparatus for potentially atmospheres: Pressurized apparatus ‘p’
EN 50018 (Nov. 2000) + EN 50018/A1 (2002)	Electrical apparatus for potentially atmospheres: Flameproof enclosure ‘d’
EN 50019 (July 2000) + Corrigendum 4.2003	Electrical apparatus for potentially atmospheres: Increased safety ‘e ‘
EN 50021 (April 1999)	Electrical apparatus for potentially atmospheres: Type of protection ‘n’
EN 50281-1-1 (Sept. 1998) + 50281-1-1/A1(2002)	Electrical apparatus for use in the presence of combustible dust Part 1-1: Electrical apparatus protected by enclosures - Construction and testing
IEC Standards	
IEC 60079 – 0 (June 2000)	Electrical apparatus for explosive gas atmospheres Part 0: General requirements
IEC 60079 – 1 (Feb. 2001)	Electrical apparatus for explosive gas atmospheres Part 1: Flameproof enclosures “d”
IEC 60079 – 2 (Feb. 2001)	Electrical apparatus for explosive gas atmospheres Part 2: Pressurized enclosures “p”
IEC 60079 – 7 (Nov. 2001)	Electrical apparatus for explosive gas atmospheres Part 7: Increased safety “e”
IEC 60079-15 (Feb. 2001)	Electrical apparatus for explosive gas atmospheres
IEC 61241-1-1 (June 1999)	Electrical apparatus for use in the presence of combustible **dust** Part 1-1: Electrical apparatus protected by enclosure and surface temperature limitation- specification for apparatus
Others	
AS 2380.9 (1991)	Electrical equipment for explosive atmospheres – Explosion-protection techniques Part 9: Type of protection n- Non-sparking

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