Lighting and Electrical Equipment for use in Hazardous Atmospheres to IEC standards - A Useful Guide

We offer a selection of lighting and power distribution equipment suitable for use in areas where flammable atmospheres may occur. The proper use of protected apparatus is a specialist subject and these notes must be treated as being informative only. Users must themselves study the relevant codes of practice and construction standards in addition to the Installation and Maintenance manuals enclosed with each product (available upon request).

Methods of Explosion Protection For Electrical Equipment

The ignition of flammable atmospheres can be initiated by sparks or hot surfaces arising from the use of electrical power. Other possible sources of ignition are electrostatic effects and frictional sparking. The hot surfaces involved can be those of enclosures, components and light sources. Under fault conditions electrical connections may become over-heated and cause arcs or sparks. In addition, sparks may be the result of the discharge of stored energy or from switching contacts. A number of standard methods of protection against ignition have been established and these have been codified in construction standards. These design codes enable manufacturers to make apparatus of a uniform type and have it tested by certification authorities for compliance with the standards.

The methods of protection are summarized in Table 1:

Table 1 Methods of Explosion Protection

Method	Type of Protection
Designed to prevent any ignition from arising	Ex e Increased Safety Ex N or Ex nA Non Sparking
Designed to limit the ignition energy of the circuit	Ex i Intrinsic Safety
Designed to prevent the flammable mixture reaching a means of ignition	Ex m Encapsulation Ex p Pressurisation Ex o Oil immersion Ex N or Ex nR Restricted Breathing
Designed to prevent any ignition from spreading	Ex d Flameproof Enclosure Ex q Powder Filling

Ex o "Oil immersion" Protection EN 50015

This is an old technique primarily used for switchgear. The spark is formed under oil and venting is controlled. (The use of hydrocarbon oil has obvious disadvantages and the method of protection is confined to Zone 2).

Ex p "Pressurized Apparatus" Protection EN 50016

These are system methods. One maintains a positive static pressure inside the apparatus and the other a continuous flow of air or inert gas to neutralize or carry away any flammable mixture entering or being formed within the enclosure. Essential to these methods are monitoring systems and purging schedules to ensure their reliability.

Ex q "Powder Filling" Protection EN 50017

This involves the mounting of potentially incendive components in an enclosure filled with sand or similar inert powder and having a vent. It is primarily of use where the incendive action is the abnormal release of electrical energy by the rupture of fuses or failure of components such as capacitors. Usually it is used for components inside Ex e apparatus and for heavy duty traction batteries.

Ex d "Flameproof Enclosure" Protection EN 50018

The potentially incendive components are contained within an enclosure into which the flammable atmosphere can enter but which will contain any resultant explosion and prevent its transmission outside the enclosure.

Ex e "Increased Safety" Protection EN 50019

Normally sparking components are excluded. Other components are designed to substantially reduce the likelihood of the occurrence of fault conditions which could cause ignition. This is done by reducing and controlling working temperatures, ensuring the electrical connections are reliable, increasing insulation effectiveness, and reducing the probability of contamination by dirt and moisture ingress.

Ex i "Intrinsic Safety" Protection EN 50020

The circuit parameters are reliably controlled to reduce potential spark energy to below that which will ignite the specific gas mixture. This includes the occurrence of one (ib) or two (ia) component faults in the apparatus. It should be noted that this method does not protect entirely against the local over-heating of damaged connections or conductors and these should be kept sound and suitably enclosed against damage.

Ex m "Encapsulation" Protection EN 50028)

Potentially incendive components are encapsulated by a method which excludes the flammable atmosphere and controls the surface temperature under normal and fault conditions.

Ex s "Special" Protection BASEEFA SFA 3009

This method, being special, has no definite rules. In effect it is any method which can be shown to be safe in use. Much of the apparatus having 's' protection was designed with encapsulation and this has been superseded by EN 50028. In addition, the s coding is used when apparatus has been assessed to one of the individual parts of the CENELEC series but does not exactly comply with it. Ex s protection has been commonly used for Zone 0 and Zone 1 applications and its use was contained in BS 5345, the previous UK code of practice. The introduction of the **ATEX** directive removes the need for the continuing use of the 's' coding.

Ex N "Non Sparking" Protection BS 4533 Section 102.51 (Luminaires) Ex n "Non Sparking" protection EN 50021

Precautions are taken with connections and wiring to increase reliability, though not to as high a degree as for Ex e. Where internal surfaces are hotter than the desired T rating they can be tightly enclosed to prevent the ready access of a flammable atmosphere into the internal parts. This is the "restricted breathing enclosure" technique. Its employment also means that high ingress protection ratings of IP65 and above are built into the design. When tested to EN 50021, the coding Ex nR denotes that the protection method employs a restricted breathing enclosure. This enclosure may be restricted to the part of the enclosure containing the hot components such as lamps. Where the normal non-sparking construction is used the coding is Ex nA. The Ex N/Ex n methods have been developed specifically for the use of such equipment in the remotely hazardous area Zone 2.

Classification of Hazardous Areas and the Use of Protected Apparatus

Codes of practice have been established for the classification of the potential hazards, the selection of suitable equipment to protect against the hazards, and their installation and their maintenance. The codes of practice will list the methods of protection which, used individually or in combination, may be employed to attain an acceptable degree of safety.

The hazardous areas are classified in Table 2 according to EN 60079-10:

Table 2 Hazardous Area Classification

Zone	Description
Zone 0	Zone in which an explosive atmosphere is continuously present for long periods.
Zone 1	Zone in which an explosive atmosphere is likely to occur in normal operation, typically between 10 and 100 hours per year.
Zone 2	Zone in which an explosive atmosphere is not likely to occur in normal operation, and if it occurs it will exist only for a short time, typically less than 10 hours per year. (Zone 2 is often referred to as the remotely hazardous area.)

Deployment of protected apparatus in the areas according to EN 60079-14 is summarized in Table 3:

Table 3 Selection of Protected Apparatus in Hazardous Areas

Zone	Description
Zone 0	Ex ia
Zone 1	Any type of protection suitable for Zone 0 and Ex d, Ex ib, Ex p, Ex e, Ex s, Ex m
Zone 2	Any type of protection suitable for Zone 0 or Zone 1 and Ex N or Ex n Ex o Ex q Also see notes on Ex s protection

The relevant directives of the EU are:

• 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres.

• 99/92/EC Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

The directives are adopted into national law by the individual member states. Some candidate entrant states have also aligned their national regulations with ATEX.

ATEX covers hazards arising from the use of both electrical and mechanical equipment in potentially explosive atmospheres. The ATEX equipment directive and the accompanying health

and safety directive, specifying the protection of workers, apply to the European Union and are in operation from July 2003. The safety directive requires hazardous areas to be subjected to a risk analysis, classified into Zones and suitably equipped.

The manufacturer must make a declaration of compliance with the equipment directive and apply the CE mark before the product can be placed on the market in the EU. The individual governments of the member states appoint “notified bodies” to carry out testing and certification. Apparatus is divided into Equipment Groups (I for mining and II non-mining), the ignitable component of the explosive atmosphere, Gas (G) and Dust (D) and Categories 1, 2 and 3. The Categories provide respectively, very high, high and normal levels of protection against ignition. The Categories should be considered as achieving the level of protection obtained by applying the existing protection techniques (Ex d, Ex e etc). Alternatively, the existing techniques can be replaced or supplemented by new concepts and engineering judgements made by the manufacturers in the design and construction of the apparatus. Where required, this would be validated by notified bodies performing an EC type examination of the product.

In practice, the Categories are equated to suitability for Zones. The actual category of apparatus specified by the user for a Zone will depend on the overall risk assessment. The Zoning considers only the probability of the occurrence of an explosive atmosphere, its extent and duration. It does not consider the consequential effects of an ignition having taken place or of the environment. Apparatus will be marked with the Grouping and Category in addition to the marking required by the individual protection standards.

For example, the Chalmit Lighting range of products falls within Group II for industrial applications and covers designation as Category 2 or 3. This means that products will generally be suitable for use in Zone 1 and 2 areas as defined by the codes of practice for zoning such as EN 60079-10 (IEC 60079-10) and selection, EN 60079-14 (IEC 60079-14) etc.

Currently EN 60079-14 does not refer to categories so the protection code of the apparatus is used as listed in the standard or the category can be equated as being suitable for a specific Zone as detailed in the directive. These codes of practice provide the user with guidance in selecting apparatus needed to obtain the degree of safety that is required for the particular hazardous area application.

The Euro-norms (EN) have been updated for ATEX but as the updating mainly consisted of a cross reference to the ATEX categories this did not affect the standards technically except where co-incidental technical amendments were made. Compliance with the Euro-norme gives a presumption of compliance with those aspects of the directive covered by the standard. These are “The Essential Health and Safety Requirements” EHSR’s. Lists of standards giving a presumption of compliance with the directive are published in the official journal (OJ) of the EU. The European Commission web site contains a large quantity of material concerning the directives along with the actual directive itself and the guidelines for its application.

An EC type examination by a notified body is mandatory for Category 1 and 2 electrical equipment but not for Category 3. Chalmit have chosen to obtain a certificate of compliance from a third party for Category 3 equipment in order to promote customer confidence and continue the long standing practice that Chalmit has used for Ex N apparatus. The designation EC can not be used for certification of Category 3 apparatus. In the data. the term “type examination” rather than “EC type examination” is used for Category 3 apparatus.

The relationship between Categories and applications is shown in Table 4.

Table 4 ATEX Categories and Applications

Category	Degree of Safety	Design Requirement	Application	Expected Zone of Use
1	Very High level	Two independent means of protection or safe with two independent faults	Where explosive atmospheres are present continuously or for lengthy periods	Zone 0 (gas) and Zone 20 (dust)
2	High level	Safe with frequently occurring disturbances or with a normal fault	Where explosive atmospheres are likely to occur	Zone 1 (gas) and Zone 21 (dust)
3	Normal level	Safe in normal operation	Where explosive atmospheres are likely to occur infrequently of for short duration	Zone 2 (gas) and Zone 22 (dust)

Marking of ATEX product and CE mark

The product carries the ATEX marking which includes the CE mark, CE Ex, the Group, the Category and the Category sub-group G or D. The product also carries the normal coding, Ex d etc. and the surface temperature and ambient temperature (Tamb) ratings. The Group also forms part of the marking in the product standards and pre-dates ATEX. The Category is additional to the previous marking. This means that all of the familiar marking is still present.

All products carry the general product safety and electromagnetic compatibility CE mark on the product, installation manual or packaging, as appropriate. The marking attests that the product meets the requirements of the Low Voltage and Electro-Magnetic Compatibility (EMC) directives of the EU as transposed into UK law. If the product carries the CE mark for ATEX it is not repeated. The scope of compliance is given in the IOM.

Products exported directly outside of the European Community are not required to carry any CE marking but local marking regulations may apply.

Surface Temperature Rating And Gas Groupings

Any flammable mixture can be classified for explosion protection under two main characteristics; temperature of ignition by a hot surface and the spark energy to ignite the mixture. The spark energy of ignition is also related to the intensity of explosion. This property is crucial to the design of the joints in flameproof enclosures (Ex d) and the energy level of intrinsically safe (Ex i) apparatus. Other characteristics are the specific gravity and flash point, which are used in the determination of the area classification.

Surface Temperature For Ignition

The surface temperature rating is measured in the most onerous design attitude at the most severe supply voltage condition within the design tolerance. Usually this is +10% of rated voltage for lighting and with any fault or overload condition which could normally occur in service. A normal overload condition for motors is the starting or stalled condition and, for luminaires, the end of life of a lamp. In the case of Ex d, Ex m, Ex q and also restricted breathing Ex nR and dust proof enclosure methods, the maximum temperature is measured on

the external surface. In other methods of protection the maximum internal temperature of the apparatus is measured.

The explosive mixtures are allocated into broad bands giving the Temperature Classes shown in Table 5

Table 5 Classification of maximum surface temperatures for electrical apparatus EN 50014	
Temperature Class	**Maximum Surface Temperature ºC**
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

For dust protection using the enclosure methods the surface temperature is limited to a given value in **ºC**, the T grouping is not used.

Gas Grouping

The gas and vapor mixtures are classified as shown in below. The list shown is only representative as the possible number of chemical compounds is extensive. The classification shown is that associated with the IEC and CENELEC harmonized standards.

Table 6 Gas Grouping for Electrical Apparatus EN 50014 and IEC 60079-0	
Group	**Gas**
I	All underground Coal Mining applications Firedamp (methane)
IIA	Industrial methane, propane, gasoline and most industrial gases
IIB	Ethylene, coke oven gas and other industrial gases
IIC	Hydrogen, acetylene, carbon disulphide

The apparatus sub-groupings: A, B and C are only applicable to the design and marking of

flameproof and intrinsically safe, energy limited and non incendive apparatus.

Ingress Protection

The surface temperature classification and gas grouping are the primary safety considerations. A major secondary parameter is protection against the ingress of solid bodies and liquid, IP. In some cases the degree of IP protection forms part of the standard requirement of the explosion protection method. Where apparatus is used in dirty or wet conditions the resistance to ingress contributes to the reliability of explosion protection in that electrical faults within the apparatus are often the result of water ingress. Where our products are concerned, the latest edition of the appropriate standards are EN 60529 (IEC 60529).

The definitions of the IP code are summarized below. It will be noted that many luminaires have both IP66 and IP67 ratings which is because the IP66 test can be more severe than IP67 for some constructions. The minimum enclosure rating is IP54 for explosion-protected electrical products.

First Digit	Degree of Protection (Foreign Bodies)	Second Digit	Degree Of Protection (Liquids)
0	No protection	0	No protection
1	Protection against ingress of large solid foreign bodies	1	Protection against drops of water
2	Protection against ingress of medium sized solid foreign bodies	2	Protection against drops of liquid falling at any angle up to 15° from vertical
3	Protection against ingress of small solid foreign bodies greater in thickness than 2.5mm	3	Protection against rain falling at any angle up to 60° from the vertical
4	Protection against ingress of small solid foreign bodies greater in thickness than 1mm	4	Protection against splashing. Liquid splashed from any direction shall have no harmful effect
5	Protection against the ingress of dust in an amount sufficient to interfere with satisfactory operation of the enclosed equipment	5	Protection against water projected by nozzle from any direction
6	Complete protection against ingress of dust	6	Protection against powerful water jets

		7	Protection against temporary immersion in water
		8	Protection against indefinite immersion in water. Tests to be agreed between supplier and customer

NEMA Standards Publication No. 250-1997 Enclosures for Electrical Equipment (1000Volts maximum)
comparison to IEC 60529 Degrees of Protection provided by Enclosure IP Classification Designation
(cannot be used to convert IEC classification designations to NEMA type numbers)

NEMA Enclosure Type Number	IEC Enclosure Classification
1	IP 10
2	IP 11
3	IP 54
3R	IP 14
3S	IP 54
4 and 4X	IP 56
5	IP 52
6 and 6P	IP 67
12 and 12K	IP 52
13	IP 54

The IEC IP 56 rating is often specified for marine offshore applications of electrical enclosures, and corresponds to NEMA 4 and 4X enclosures which are intended for indoor and outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, hose-directed water, and damage from external ice formation. The ANSI/NEMA 250 standard also contains tests for corrosion resistance. For example, NEMA 4X designates that the enclosure also resists corrosion.

For more information on Comparision Between NEMA Enclosure Type Numbers and IEC Enclosure Classification Designations, please visit the Hubbell Wiring Device website and click on **Technical Data**: http://www.hubbell-wiring.com/library/pdf-catalog.htm

Resistance To Mechanical Damage

The indiv**i**dual protection standards also contain minimum levels of resistance to mechanical damage as measured by test methods producing an impact energy measured in Joules or Newton/meters. 10 Newton meters is, in effect, 1 Kilogram dropped from a height of 1 meter. Chalmit equipment generally exceeds the minimum level by a substantial margin.
The standards contain two levels of impact resistance appropriate to high and low risk of impact. If the apparatus is only suitable for low impact the certificate is suffixed X or the information is included in the installation information.

Compliance With General Product Standards

Luminaires comply with basic construction standards such as EN 60598, where these

requirements do not conflict with those in the protection standard. This also applies to internal components such as lamp holders, terminals and control gear. Apparatus complying with the individual product standard will have its internal components operating inside their rated performance when operated in the maximum rated ambient temperature. This contributes to the reliability and, ultimately, the safety of the installation. Compliance with product standards is the normal way of claiming compliance with the Low Voltage Directive for non Ex apparatus.

Operational Temperatures

The operational temperature limits are based on both product function and Ex protection standards. The normal lower limit for Ex d products is -20ºC unless otherwise noted on the certificate or literature. This is the standard lower level given in EN 50014.
The normal upper limit is 40ºC but some equipment is rated at other temperatures which may be linked to the surface temperature rating. The maximum ambient temperature is coded as T ambient. Lower limits of operation and starting for lamps and batteries can be obtained from the sales department. A usual guide is -40ºC for SON, -30ºC for MBF/MBI, -25ºC for fluorescents and -10ºC for battery operated equipment.

Generation Of Certificate

Many certificates contain a letter showing the "generation" of the certificate. The letters B, C and D show the amendment status of the standard to which the product is certified, E indicating the second editions of the standards.

‘X' Suffix On Certificate

Some products carry a suffix ‘X’ after the certificate number. This denotes "special certification conditions".
These are given on the certificate and on the installation leaflet. The conditions usually relate to cable entry, operation, lamps, installation position and location or maintenance, and must be observed by the user.

Opening Times

In those cases where internal temperatures are greater than the T rating or where energy is stored in electrical components, a time limit will be given to be observed following electrical isolation. This allows for cooling and discharge of energy. It applies to Ex d and e apparatus. For Zone 2 apparatus, opening times are not generally given as it is inferred that a flammable atmosphere is unlikely to arise during maintenance operations.

CE Marking CE

Chalmit hazardous area products carry the CE mark on the product, installation leaflet or packaging, where appropriate. Some products exported directly outside the European Community may not carry the marking. The marking attests that the product meets the requirements of the Low Voltage and Electro-Magnetic Compatibility directives of the EU as put into UK law. Except where stated otherwise the marking covers compliance with the hazardous atmospheres (ATEX) directive for which the transition period is from 1996 to 2003 unless specifically applied.

International Standards

Two distinct groups of apparatus standards used world-wide are the IEC/EN (Euronorme) series of standards and those used in the USA and areas influenced by US practice. Almost all work on hazardous area and equipment standards is now being carried out by IEC and those Euronormes which are not already technically identical to IEC will become so in their next

editions. The EN series EN 50014 etc will be renumbered in the IEC 60079-series. Many countries which have their own national standards have adopted the IEC standards in their entirety or incorporated material from them.

The practice in the US is different because it developed separately from the rest of the world. The US engineering practice, legal requirements, regulations and the use of approval organizations such as UL, FM and ISA mean that, whilst the safety principles are much the same as in the rest of the world, the detail is significantly different. The USA code of practice is the NFPA 70 ***National Electrical Code*** ® published by the National Fire Protection Association, and the 'standard' exclusively used, until recently, for luminaires is ANSI/UL844. This standard integrates the designation of the hazardous area in which apparatus is designed to be used and the protection method. For lighting purposes the types of protection are a flameproof type and a non-sparking type. These are used in Class 1 Division 1, and Class 1 Division 2 areas which are broadly equivalent to Zone 1 and Zone 2 respectively. Dust and fibre hazards are Classes II and III.

The only basic technical difference between these and the equivalent IEC/EN standards is that the ANSI/UL844 'non-sparking' technique, known as 'enclosed and gasketed', does not use the restricted breathing method. This is one factor which accounts for the generally higher surface temperature ratings of ANSI/UL844 listed apparatus and the practical need for a greater number of temperature sub-divisions. Another factor is that the standard specifies higher test pressures for flameproof equipment. In the case of HID luminaires this results in the lamp glass being smaller and the surface temperature inevitably hotter.

The construction and testing of dust protected enclosures is different to EN but is currently partially incorporated as an additional alternative in the IEC standards.

In both codes the gases and compounds are classified by surface temperature of ignition and grouped into ignition groups for the dimensioning of flameproof joints and for intrinsic safety. The classification and grouping are broadly similar to IEC/EN but differ in detail. The classification and protection cannot be mixed and must be used as complementary pairs. A general comparison between IEC/EN and NEC practice for gas hazard protection is shown in Tables 7 and 8. The US standards are also influenced by the use of conduit wiring systems which, in contrast to cable, form a flameproof distribution method for Class 1 Division 1 and a damage and ingress protected distribution method for Division 2.

The NEC has now introduced the Zone classification concept for gas hazards as an alternative to the Division method. The wiring methods currently remain unchanged. To support this, UL and ISA have now introduced their own IEC based protection standards for use in the alternative Zones. These standards are intended to become single ANSI documents. The objective is that the two systems will run in parallel until the older US system becomes obsolete. This will take many years. The new US standards, although based on IEC, may differ substantially from IEC. Certification to IEC based US standards can not be considered as being the same as to IEC.

Products may be marked for both divisions and zones. Where product complies with the US standard based on IEC the designation AEx is applied on the marking.

The Canadian practice has been a hybrid of USA and European concepts. The mining industry in Canada was much influenced by Europe which led to the use of European methods

elsewhere. Through the joint accreditation system with the USA (NRTL) there is a degree of overlap but the detail of this cannot be addressed properly in this introduction. Canada has now adopted the zone system for new construction.

Table 7 Comparison of Surface Temperature Classification IEC and NEC

Maximum	Surface Temperature Classification	
Temperature °C	**EN50014**	**ANSI / UL844**
450	T1	T1
300	T2	T2
280	(280C)T2	T2A
260	(260C)T2	T2B
230	(230C) T2	T2C
215	(215C)T2	T2D
200	T3	T3
180	(180C)T3	T3A
165	(165C)T3	T3B
160	(160C) T3	T3C
135	T4	T4
120	(120C)T4	T4A
100	T5	T5
85	T6	T6

Table 8 Comparison of Representative Gases in CENELEC and NEC Gas Groups

Gas / Compound	Explosion Group EN IEC 60079-10	Atmosphere (National Electrical Code)
Acetylene	IIC	A
Carbon Disulphide	IIC	B
Hydrogen	IIC	B

Ethylene Oxide	IIB	B
Hydrogen Sulphide	IIB	C
Ethylene	IIB	C
Acrylo-nitrile	IIA	D
Industrial Methane	IIA	D
Propane	IIA	D
Ethyl Acetate	IIA	D

Lamp standardisation

Most IEC type lamps are now standardised in form and cap dimensions even when, as newly developed lamps, they are not included in a standard.

The USA type lamps are generally somewhat different and are designed for use with USA control gear. Some USA fluorescent lamps are superficially identical to IEC lamps but may not run reliably on IEC control gear and vice versa. Some USA high pressure sodium lamps are identical in operating characteristicswith IEC lamps but others have different operating characteristics. USA and IEC lamp-cap sizes are often different.

It is recommended to consult with the lighting manufacturer if there are any uncertainties concerning matching lamps to luminiares.

Cabling And Cable Glands

For example, Chalmit Lighting Ex d floodlights and well-glass luminaires feature indirect entry via Ex e terminal enclosures. This means that the terminal chamber is separated from the main chamber by a flameproof barrier. Cable glands must satisfy the requirements for Ex e entry with reference to IP rating and impact. The cables must satisfy any requirement laid down in an installation code of practice. Where the entry is via an indirect Ex d terminal chamber or directly into an Ex d enclosure, Ex d cable glands must be used. The method for selecting cable gland types for Ex d is set out in the code of practice EN 60079-14.

Where glands are fitted as part of the apparatus, the diameter of the supply cables used must be suitable for accommodation within the cable glands supplied. If not correct they must be replaced by the user. The terminal size and looping facility available is shown in the product data sheets and IOM. Where there is an option, the requirement must be stated on the order. Apparatus is usually despatched with one or more permanent entry plug(s) and one travel plug which will keep out moisture during transport, storage and initial installation. Ex nR and Ex N apparatus with a restricted breathing enclosure is provided with a means of achieving the gas-tight seal needed to attain the protection method. It is the responsibility of the user to ensure that the cable entry system is satisfactory.

In relation to cable temperature, some products require to be supplied by cables with temperature ratings above 70ºC (ordinary PVC), particularly where the product is rated for higher ambient temperatures. The cable temperature is shown on the rating plate and in the installation manual. The rating is based on the maximum rated ambient. Where cable temperatures exceed 70ºC at the maximum rated ambient, Chalmit now gives the actual

temperature rise at the cable entry. The user can relate this to the actual operating condition and select appropriate cables. At their own discretion users may choose to adjust the cable temperature ratings of those products with specific cable temperatures on this basis.

For Ex nR luminaires complying with EN 50021 [IEC 60079-15] the cable glands which may be used are listed in the certificate pertaining to that piece of apparatus. This is to ensure that the restricted breathing properties are maintained. A list of suitable cable glands is given in the installation leaflet supplied with the product and available on request from the manufacturer.

Where cables do not enter directly into the restricted breathing enclosure the designation is Ex nA nR and special glands are not required, however the ingress protection and impact requirements must be met. Information on this can be found in the individual product installation leaflet.

Glossary (click on underlined terms for links to website)

ANSI	American National Standards Institute
ATEX	Abr. Directive 94/9/EC Equipment and protective systems intended for use in potentially explosive atmospheres.
BASEEFA	British Approvals Service for Electrical Equipment in Flammable Atmospheres. (UK)
BASEEFA 2001	A private organization which has taken on much of the work of BASEEFA
CAA	Civil Aviation Authority (UK)
CENELEC	Committee European de Normalisation Electrique European Committee for Electrotechnical Standardization
CIE	Commission Internationale de Leclairage
CSA	Canadian Standards Association
DNV	Det Norske Veritas
EC	European Communities
EU	The European Union
ERA	The Electrical Research Association (hazardous area testing section became part of ITS)
FM	Factory Mutual (USA)
IEC	International Electrotechnical Commission
IES	Illuminating Engineering Society of North America

IP	Ingress Protection
ISA	Instrument Society of America
ITS	Intertek Testing Services (formerly part of ERA)
KEMA	Netherlands Testing Laboratory
NEMA	National Electrical Manufacturers Association (USA)
NRTL	Nationally Recognised Testing Laboratories (USA)
NFPA	National Fire Protection Association
NORSOK	Norwegian petroleum industry is mostly based on ISO/EN standards. The NORSOK standards are complements to these and offer many useful installation, health and safety, and electrical engineering guidelines. www.standard.no
SCS	SIRA Certification Service (UK)
SOLAS	Safety of Life at Sea (convention)
T	Surface Temperature (Max).
Ta/Tamb	Ambient Temperature
UL	Underwriters Laboratories Inc.

Lamp Types	
CFL	Compact fluorescent
HID	High intensity discharge
GLS	General lighting service - Incandescent
MBFU	Mercury vapour high pressure
MBI/HQI	Metal halide high pressure
MBTF	Blended mercury vapour
SON/HPS	High pressure sodium
TH	Tungsten halogen

-E	Elliptical Shape
-T	Tubular Shape