

# FLAMMABLE FACTS

## AREA CLASSIFICATION

Guideline figures	Flammable atmosphere present continuously >1000hrs/annum*	Flammable atmosphere present intermittently >10<100hrs/annum*	Flammable atmosphere present abnormally <10hrs/annum*	Standard
<b>IEC/CENELEC/EUROPE</b>				
Gas, vapour, mist	Zone 0	Zone 1	Zone 2	IEC 60079-10
Dust	Zone 20	Zone 21	Zone 22	IEC 60079-10-2
<b>NORTH AMERICA</b>				
NEC 505 Gas	Zone 0	Zone 1	Zone 2	Listed in NEC® Article 505
NEC 500 Gas & Dust	Division 1 > 100hrs/annum*			Listed in NEC® Article 500-3(c)
NEC 506	Zone 20	Zone 21	Zone 22	Listed in NEC® Article 506

\*Note: Guideline numbers only. These numbers do not appear in standards but can be found in various resources from IChemE, RoSPA, ISA

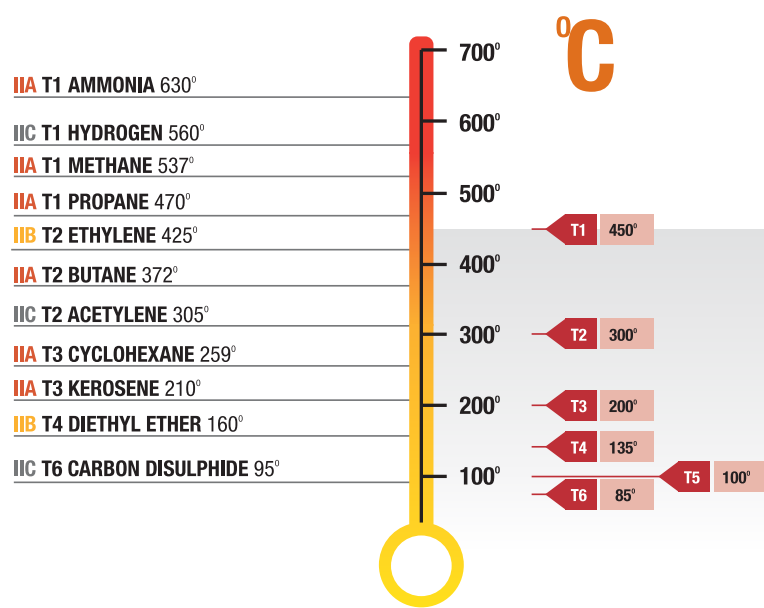
## APPARATUS/GAS GROUPS

Typical gas hazard	IEC 60079-0 IEC CENELEC	North America NEC Article 500 (Class I)*	Minimum ignition energy (microjoules) (Intrinsic Safety)
ACETYLENE	IIC	A	20
HYDROGEN	IIC	B	20
ETHYLENE	IIB	C	60
PROPANE	IIA	D	180

## DUST GROUPS

Typical material	IEC 60079-0	North America NEC Article 500
METAL DUST	IIIC	CLASS II, GROUP E
CARBON DUST	IIIC	CLASS II, GROUP F
FLOUR, GRAIN	IIIB	CLASS II, GROUP G
FIBRES AND FLYING	IIIA	CLASS III

## CLASSIFICATION OF MAXIMUM SURFACE TEMPERATURES FOR GROUP II ELECTRICAL EQUIPMENT (T CLASS)



## INGRESS PROTECTION (IP) CODES (IEC/EN 60529)

### FIRST NUMERICAL

Protection against solid bodies

NO PROTECTION	0
OBJECTS GREATER THAN 50mm	1
OBJECTS GREATER THAN 12mm	2
OBJECTS GREATER THAN 2.5mm	3
OBJECTS GREATER THAN 1.0mm	4
DUST PROTECTED	5
DUST TIGHT	6

### SECOND NUMERICAL

Protection against liquid

NO PROTECTION	0
VERTICALLY DRIPPING WATER	1
ANGLED DRIPPING WATER -75° TO 90°	2
SPRAYED WATER	3
SPLASHED WATER	4
WATER JETS	5
HEAVY SEAS	6
EFFECTS OF IMMERSION	7
INDEFINITE IMMERSION	8

### EXAMPLE IP65

Equipment is dust-tight and protected against water jets.

## Mechanical Impacts (IK) Code EN50102

IK code	IK00	IK01	IK02	IK03	IK04	IK05	IK06	IK07	IK08	IK09	IK10
Impact energy (Joules)	*	0.14	0.2	0.35	0.5	0.7	1	2	5	10	20

Degrees of protection provided by enclosures for electrical equipment against mechanical impacts

## US ENCLOSURE RATINGS

NEMA, UL & CSA type rating	Approximate IEC/IP classification	Abbreviated protection description
1	IP20	Indoor, from contact with contents
2	IP22	Indoor, limited, falling dirt & water
3	IP55	Outdoor, from rain, sleet windblown dust & ice damage
3R	IP24	Outdoor, from rain, sleet & ice damage
4	IP66	Indoor & outdoor, from windblown dust, rain, splashing & hose directed water & ice damage
4X	IP66	Indoor & outdoor, from corrosion, windblown dust, rain, splashing & hose directed water & ice damage
6	IP67	Indoor & outdoor, from hose directed water, water entry during sub-mersion & ice damage
12	IP54	Indoor, from dust, falling dirt & dripping non-corrosive liquids
13	IP54	Indoor, from dust, spraying water, oil & non-corrosive liquids

NEMA 7 TO 10 ENCLOSURES ARE DESIGNED FOR HAZARDOUS AREA USE

REFERENCE NEMA PUBLICATION NOV 2005

## Group II Electrical Apparatus for gas atmospheres 'G' and combustible dusts 'D'

Protection Method	IEC/EN	Permitted Zone				Permitted Zone				REMARKS
		ATEX category				ATEX category				
		0	1	2	3	20	21	22	3	
IEC Equipment Protection Level (EPL)		Ga	Gb	Gc		Da	Db	Dc		
General requirements	60079-0								Equipment - General requirements	
Two independent methods	60079-26								Permits combined methods of protection (marking shows symbols for the 2 types of protection joined by '+')	
Oil immersion	60079-6		0	0					Protection by gas exclusion e.g. Transformers	
Pressurised	60079-2		pX, pY	pZ			P	P	Protection by gas exclusion e.g. Analysers	
Powder filling	60079-5		q	q					Protection by exclusion e.g. Weighing machines	
Encapsulation	60079-18	ma	mb	mc		ma	mb	mc	Protection by exclusion e.g. High power electronics	
Increased safety	60079-7		e	e					Prevention by design e.g. Junction boxes & terminals	
Type of protection 'n'	60079-15		(n, nA, nB, nL, nC)						Prevention by design e.g. Luminaires	
Flameproof	60079-1		d	d					Prevention of propagation of internal explosion e.g. DC motors	
Intrinsic safety	60079-11	ia	ib	ic		ia	ib	ic	Low energy equipment e.g. Instrumentation	
Intrinsically safe electrical system	60079-25								Considers combinations of intrinsically safe apparatus	
Fieldbus Intrinsically safe concept	60079-27								Defined safety of apparatus, systems and installation (FISCO system requirements being moved to 60079-25)	
Optical radiation	60079-28	op Ia, op pr, op sh	op Ib, op pr, op sh	op Ic, op pr, op sh					Equipment and transmission systems using optical radiation (EPL is determined by type of protection employed)	
Protection by enclosure	60079-31					ta	tb	tc	Protected by enclosure and temperature limitation	

Note. The above table shows the latest standards applicable for combustible dust equipment. For reference the earlier IEC and CENELEC editions are shown below

IEC Standards	Number	Symbol	REMARKS
General requirements	61241-0		General requirements for equipment design for use in dusts
Protection by enclosure	61241-1	tD	Enclosure protected, temperature limitation - construction and testing
Pressurisation	61241-4	pD	Enclosure and control using pressurisation
Intrinsic safety	61241-11	iD	Intrinsic safety typically IIB energy levels
Selection and installation	61241-14		Code of Practice for installation activities
Inspection and Maintenance	61241-17		Withdrawn
Encapsulation	61241-18	mD	Apparatus protected by encapsulation

## Explosion Protection - Europe

	CEN	REMARKS
Explosion prevention & protection	EN 1127-1: 2007	Part 1 - Basic concepts & methodology for all industries except mining
Explosion prevention & protection	EN 1127-2: 2002 + A1: 2008	Part 2 - Basic concepts & methodology for mining

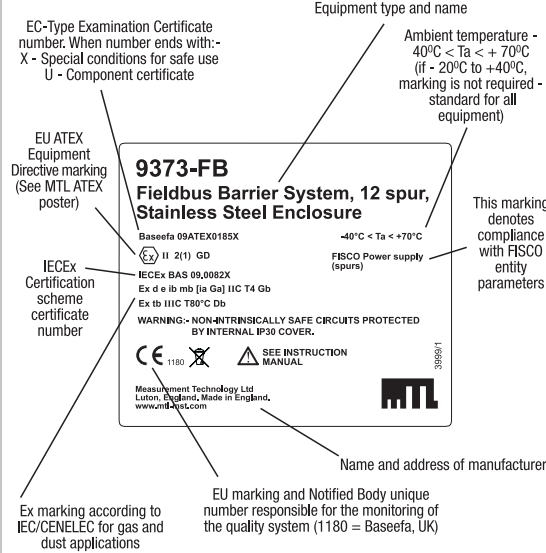
## Codes of Practice - Selection, installation, inspection and maintenance

Subject	IEC and CENELEC	CENELEC Dusts	REMARKS
Classification of area - Explosive gas atmospheres	60079-10-1		Gas, vapours and mists
Classification of area - Combustible dust atmospheres	60079-10-2	61241-10	Combustible dust, fibres and flyings
Electrical installation design, selection and erection	60079-14	61241-14	2007 edition combines gas and vapours and incorporates requirements for dusts
Repair and overhaul	60079-17	61241-17	Covers gas, vapours, mists, dust and fibres and flyings
Material characteristics gas and vapours - test methods and data	60079-20-1		Combines 60079-20 and 60079-4 and 4A
Combustible dust		61241-2-2	Test method - electrical resistivity

## Group II Electrical Apparatus for combustible dusts 'D' (earlier version)

	Code	CENELEC EN	IEC 61241	Permitted Zone ATEX category			REMARKS
				20	21	22	
Electrical apparatus for dusts	-	50281-1-1	-1-1 : 1999				Enclosure protected - construction and testing
Electrical apparatus for dusts	-	50281-1-2	-1-2 : 1999				Enclosure protected - selection, installation and maintenance
Electrical apparatus for dusts	-	50281-2-1	-2-1 : 1994				Method for determining minimum ignition temperatures for dust
Electrical apparatus for dusts	-	50281-3	-3 : 1997				Classification of areas where combustible dusts present
Electrical apparatus for dusts	'pD'	-	-4 : 2001				Type of protection 'pD' - pressurised

## Typical Certification Marking



## INTRINSIC SAFETY

### Thermal ignition compliance

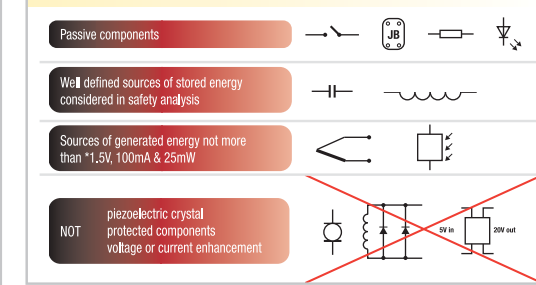
Small component relaxation for Group II T4 temperature classification

SURFACE AREA	GROUP II T4 MAXIMUM SURFACE TEMPERATURE °C
<20mm²	275
≥20mm² ≤10cm²	200
>10cm²	135

Variation of matched power dissipation with ambient temperature For Group II components of surface area not less than 20mm²

Max Ambient Temperature °C	40	50	60	70	80
Max Power Dissipation W	1.3	1.25	1.2	1.1	1.0

### Simple Apparatus



\*Note: North America still uses 1.2V and 20 microjoules

## Functional Safety

IEC 61508 (2nd Edition Published)

Safety Instrumented systems are widely used in industrial process plants where there is threat to life or environment should something go wrong. The IEC 61508 set of standards 'Functional safety of electrical/electronic/programmable electronic safety-related systems' are now considered industry 'good practice' for both manufacturers and users designing products and systems for safety related applications.

The MTL Application Note AN9025 provides an introduction to the subject. MTL Instruments are members of 'The 61508 Association'



## Fieldbus in hazardous areas

The Fieldbus Intrinsically Safe Concept (FISCO) IEC 60079-27 has now moved to 'Standard' status. The benefits from FISCO were extended to include similar levels of flexibility in Zone 2 and Division 2 and known as Fieldbus non-incendive concept (FINCO). However since the introduction of Intrinsic Safety 'level of protection 'ic' the FINCO concept has now been replaced and is dealt with in the IS standards e.g. IEC 60079-11, IEC 60079-25. The latest edition of IEC 60079-25:2010 does include the system requirements of IEC 60079-27. Eventually IEC 60079-27 will be withdrawn.