

WHAT IS A ZONE?

The IEC has defined three areas of hazardous gas or vapor release as follows:

ZONE 0	ZONE 1	ZONE 2
<p>Explosive atmosphere is continuously present.</p> <p>Zone in which an explosive mixture of gas, vapor or mist is continuously present.</p>	<p>Explosive atmosphere is often present.</p> <p>Zone in which an explosive mixture of gas, vapor or mist is likely to occur during normal operations.</p>	<p>Explosive atmosphere may be present.</p> <p>Zone in which an explosive mixture of gas, vapor or mist is not likely to occur in normal operation and if it occurs, it will only exist for a short time (leaks or maintenance).</p>

COMPARING IEC ZONES AND NEC® DIVISIONS



DETERMINING A “ZONE” REQUIRES ANSWERING 4 ESSENTIAL QUESTIONS

- What is emission level of gas/vapor?
 - continuous
 - first level emission (released during normal operation)
 - second level emission (released during abnormal operation)
- What type of openings currently exist?
 - continuously-open
 - normally closed
 - weatherproof
 - emergency open only
- What is ventilation?
 - very good
 - good
 - poor
- What is level of ventilation?
 - high
 - average
 - weak

CHARTS COMPARING IEC VS. NEC®/CEC

Chart 1 – Area Classification – IEC vs. NEC®/CEC (Class/Division/Group)

INFLAMMABLE MATERIAL	IEC/CENELEC				NEC®/CEC		
	PROTECTION	ZONE	GROUP	SUBDIVISION	CLASS	DIVISION	GROUP
Gases & Vapors							
Acetylene	D and/or E	1 or 2	II	C	I	1 or 2	A
Hydrogen	D and/or E	1 or 2	II	C + H ²	I	1 or 2	B
Propylene Oxide							
Ethyl Oxide, Butadiene	D and/or E	1 or 2	II	B	I	1 or 2	B
Cyclopropane							
Ethyl Ether, Ethylene	D and/or E	1 or 2	II	B	I	1 or 2	C
Acetone, Benzene,							
Butane, Propane,	D and/or E	1 or 2	II	A	I	1 or 2	D
Hexane, Paint Solvents							
Natural Gas							

CHARTS COMPARING IEC VS. NEC®/CEC

CHART 2 – IEC VS. NEC® TEMPERATURE CLASSIFICATION COMPARISON

CLASSIFICATION		
TEMPERATURES IN °C (°F)	IEC	NORTH AMERICA
85° (185°)	T6	T6
100° (212°)	T5	T5
120° (248°)	T4	T4A
135° (275°)		T4
160° (320°)	T3	T3C
165° (329°)		T3B
180° (356°)		T3A
200° (392°)		T3
215° (419°)		T2D
230° (446°)	T2	T2C
260° (500°)		T2B
280° (536°)		T2A
300° (572°)		T2
450° (842°)	T1	T1

CHART 3 – SAFE EQUIPMENT OPERATING TEMPERATURE

SPONTANEOUS IGNITION TEMPERATURE OF THE GASES (T°)	TEMPERATURE CLASS OF THE EQUIPMENT					
	T6 85° (185°)	T5 100° (212°)	T4 135° (275°)	T3 200° (392°)	T2 300° (572°)	T1 450° (842°)
85° (185°) ≤ T° ≤ 100° (212°)						
100° (212°) < T° ≤ 135° (275°)						
135° (275°) < T° ≤ 200° (392°)						
200° (392°) < T° ≤ 300° (572°)						
300° (572°) < T° ≤ 450° (842°)						
450° (842°) ≤ T°						

Note: the temperatures given in °C (°F)

- Explosion danger
- Equipment safe to use

CHART 4 – IEC-NEC® GAS GROUPS

IEC	NEC®/CEC	Gas or Vapor
II C	A	Acetylene
II C	B	Hydrogen
II B	C	Ethylene
II B	C	Ethyl Ether
II B	C	Cyclopropane
II B	C	Butadene 1-3
II A	D	Propane
II A	D	Ethane
II A	D	Butane
II A	D	Benzene
II A	D	Pentane
II A	D	Heptane
II A	D	Acetone
II A	D	Methyl Ethyl
II A	D	Methyl Alcohol
II A	D	Ethyl Alcohol

CHART 5 – IEC-NEC® EQUIPMENT STANDARDS

EQUIPMENT	IEC	CENLEC	NEC® (UL)	CEC (CSA)
Fixed Luminaries for General Use			UL 844	C22.2 No. 4
			UL 844 UL 781	C22.2 No. 4 C22.2 No. 137
Portable Equipment	60 079.0	EN 50 014 EN 50 018	UL 844 UL 783	
Floodlights and Lamps	60 079.1 60 079.7	And /or EN 50 019	UL 844 UL 783	
Luminaries with Fluorescent Lamps	60 598.1	EN 60 598.1	UL 844 UL 1570	
Luminaries with Incandescent Lamps			UL 844 UL 1571	C22.2 No. 4 C22.2 No. 9
Power Outlets	60 079.0	EN 50 014	UL 1010 UL 1982	C22.2 No. 159 N/A
	60 079.1	EN 50 018		
	60 079.7	and/or 019		
	60 309.1	EN 60 309.1		
	60 309.2	EN 60 309.2		
Switches	60 079.0	EN 50 014	UL 508	C22.2
	60 079.1	EN 50 018	UL 98	N/A
	60 079.7	and/or 019	UL1087	C22.2 No. 5.2
	60 947.1	EN 60 947.1	UL894	C22.2
	60 947.3	EN 60 947.3		No. 25&30

CHARTS COMPARING IEC VS. NEC®/CEC

CHART 6 – PROTECTION TECHNIQUES BY IEC, NEC® AND CEC

PROTECTION METHOD	IDENTIFICATION LETTERS	GROUP DIVISION	PERMITTED ZONE	PRINCIPLE
Flameproof	d	2	1 or 2	Containment
Intrinsic Safety (Zone 0)	ia	1 or 2	0, 1, 2	Energy-Limited
Intrinsic Safety (Zone 1)	ib	2	1 or 2	Energy-Limited
Pressurization	p	1 or 2	1 or 2	Expels Vapor
Increased Safety	e	2	1 or 2	No Arcs
Immersed in Oil	o	1 or 2	1 or 2	Arc Immersion
Filled with Powder/Sand	q	2	1 or 2	Arc Immersion
Encapsulated	m	2	1 or 2	Hermetic Seal
Apparatus with “n” protection	n	2	2	No Sparking

*Includes non-sparking (nA), restricted breathing (nR), hermetically-sealed non-incendive (nC)

UNDERSTANDING IEC MARKINGS

Ex
Explosion-Protected
 Meets IEC Standards
 Eex = Meets CENELEC Standards
 AEX = Equipment conforms to NEC®

d
Type of Protection
 d = Flameproof

II
II Gas Group -
 Surface Gases

c
Gas Subdivision
 Group c = Hydrogen

T6
Temperature Class
 T6 = Max 85°C (185°F)

Ex
 Distinctive CENELEC mandatory marking for equipment useable in explosive atmospheres. Sometimes broadly used for IEC Ex equipment.

MAIN PROTECTION TECHNIQUES

FLAMEPROOF “D”



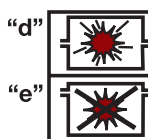
- Contain internal explosion
- Control external temperature of enclosure
- Similar to NEC® explosion-proof

INCREASED SAFETY “E”



- High-impact-resistant enclosures – FRP, GRP, sheet steel/aluminum
- Will not hold static charge
- Use approved components
- Control internal and external temperature
- Maintain minimum of IP54 ingress protection
- No arcs or sparks

FLAMEPROOF PLUS INCREASED SAFETY “DE”



- Location of arcing has “d” protection (flameproof)
- Connection terminals have “e” protection (increased safety)
- Typical use in switches, lighting, power outlets – where arcs can normally occur
- Control internal and external temperature

NON-SPARKING “N”



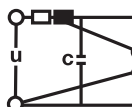
- Equipment has no normally-arcing parts
- Thermal effects incapable of ignition
- nA = non-sparking
- nR = restricted breathing
- nC = hermetically-sealed non-incendive

PRESSURED APPARATUS “P”



- Expels ignitable vapor/gas
- Maintains positive enclosure pressure

PRESSURED APPARATUS “P”



- Incapable of releasing energy to cause an explosion

NOTE: Temperature given in °C (°F)

EXAMPLES OF ZONE CLASSIFICATION SITUATIONS

ZONE 0	ZONE 1	ZONE 2	NON-HAZARDOUS ZONE
<p>Zone Example 1</p> <p>CONDITIONS</p> <ol style="list-style-type: none"> All-manual ventilation Zone 0 Zone 1 Non-hazardous area <ul style="list-style-type: none"> Open-air mixing tank No mechanical ventilation Products stored in work area 	<p>Zone Example 2</p> <p>CONDITIONS</p> <ol style="list-style-type: none"> Hood over tank Zone 0 Zone 1 Zone 2 Non-hazardous area Mechanical ventilation Stored products separated from work area 	<p>Zone Example 3</p> <p>CONDITIONS</p> <ol style="list-style-type: none"> Tank closed Mechanical ventilation Zone 0 Zone 2 Non-hazardous area <ul style="list-style-type: none"> Operations control outside zones 	

EXAMPLES OF CLASS 1, DIVISION 1 AND 2 SITUATIONS

ZONE 0	ZONE 1	ZONE 2	NON-HAZARDOUS ZONE
<p>Division Example 1</p> <p>CONDITIONS</p> <ol style="list-style-type: none"> Class 1, Division 1 hazard exists during normal operating conditions <ul style="list-style-type: none"> Open-air mixing Products stored in work area Area classified based on properties of vapors present Electrical equipment must use approved Div. 1 NEC® protection techniques and wiring methods 	<p>Division Example 2</p> <p>CONDITIONS</p> <ol style="list-style-type: none"> Division 2 area can exist where vapors normally exist in closed system or containers Division 1 and 2 areas separated by barrier or space <ul style="list-style-type: none"> Hazardous areas properly documented Div. 2 must use approved NEC® wiring methods and products Stored products outside Div. 1 work area Non-hazardous area 	<p>Division Example 3</p> <p>CONDITIONS</p> <ol style="list-style-type: none"> Closed tank and piping confines Div. 1 Yellow area qualifies as Div. 2 Stored products not present Purged/pressurized control room qualifies as “non-hazardous” is sealed off from Div. 2 area Electrical equipment in Div. 2 must use approved Div. 2 protection techniques and products 	