Hazardous Area Classifications
Objectives & Takeaways

Learn the basics of why and how hazardous areas are labeled and classified

Learn how to breakdown the alphabet soup of labels, markings, agencies and regulations

Put it all together with an analysis of 2 real world labels
Agenda

1. Why classify an area as hazardous
2. Definition of a Hazardous Location
3. Classification – Div, Area, Class
4. Markings and Specifications
5. Methods of protection
Getting to know you

- Where are you located?
- What is your industry?
- What is your level of expertise?
Why Classify an Area as Hazardous

- Potential for an explosion
- Safety of personnel
- Property damage
Elements Necessary for an Explosion

- **Ignition source** (spark, high heat, open flame, etc.)
- **Oxidizer** (usually the Oxygen in air)
- **Flammable substance**
  - Flammable gas, i.e. Hydrogen
  - Flammable liquid or vapor, i.e. gasoline, acetone, kerosene
  - Flammable solids, i.e. dust, fibers, etc.
Typical Locations where explosions occur

- Paint shops
- Corn or flour mills
- Refineries
- Chemical plants
- Liquid Transfer Terminals
- Tanks
3 ways to prevent the explosion

- Contain the explosion with explosion proof devices and enclosures
- Remove the possibility of a spark or other potential source of ignition.
- Isolate the explosive substance
Regulations, guidelines & laws

- OSHA
- National Electrical Code NEC (US)
- Canadian Electrical Code CEC (CA)
- National Fire Protection Association NFPA
- Insurance requirements
Certifying Agencies
North American Agencies

- **Factory Mutual (FM)**
  - Private insurance organization
  - Popular US industry standard
  - Tests products for approval

- **Underwriters Laboratories (UL)**
  - Private standards testing organization
  - Popular US industry standard
  - Tests products for approval
  - CSA inter-agency agreements

- **Canadian Standards Association (CSA)**
  - Government-driven organization
  - Tests products for approval
  - Recently purchased SIRA for global reach
  - UL inter-agency agreements
Outside North America

- **ATEX (Appareils destinés à être utilisés en Atmosphères Explosives)**
  - European Union (EU) and other worldwide countries
  - Set of harmonized standards
  - Testing performed by Notified Bodies
  - What ATEX means to US companies
    - Applicable to international business/companies

- **IEC (International Electrotechnical Commission)**
  - HQ Geneva
  - European Union (EU) and other worldwide countries
  - Competitor to ATEX
  - Testing performed by Notified Bodies
  - What IEC means to US companies
  - Applicable to international business/companies
Getting to know you

- What is your primary application?
Questions?

- Please enter your questions in the ‘Questions’ window
Hazardous area ratings

- Area classifications
- Division and/or zone
- Equipment group
- Temperature class
- Protection concepts (application area and standard)
- NEMA/IP Codes
Class definition

Class I
Areas where flammable vapors or gases may be present

- Oil refinery
- Paint shops
- Offshore oil Rig

Class II
Areas where combustible dust may be present

- Coal mine
- Grain silo
- Hay storage

Class III
Areas where ignitable fibers or flying debris may be present

- Paper mill
- Textile mill
- Woodworking facility
Area classification guidelines

- Classifications describe the frequency of the presence of combustible gasses and dusts within the hazardous area.
- Area Classifications Include
  - Divisions
  - Zones – More detailed than Divisions, including different classifications for gasses and dusts.
Divisions (or Zones)

- **Division 1**
  Hazardous or ignitable substance present or expected to be present for long periods of time under normal operating conditions.

- **Division 2**
  Hazardous or ignitable substance only present under abnormal conditions (i.e. leaks)

- **Zones**
  Are newer (late 1990’s) classifications to North America, based on more international standards.
Gas and dust area classifications

<table>
<thead>
<tr>
<th>Flammable Material</th>
<th>Present Continuously</th>
<th>Present Intermittently</th>
<th>Present Abnormally</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC / EU</td>
<td>Zone 0</td>
<td>Zone 1</td>
<td>Zone 2</td>
</tr>
<tr>
<td>US NEC 505</td>
<td>Zone 0</td>
<td>Zone 1</td>
<td>Zone 2</td>
</tr>
<tr>
<td>US NEC500</td>
<td>Division 1</td>
<td>Division 2</td>
<td></td>
</tr>
<tr>
<td>CA CEC Section 18</td>
<td>Zone 0</td>
<td>Zone 1</td>
<td>Zone 2</td>
</tr>
<tr>
<td>CEC Annex J</td>
<td>Division 1</td>
<td>Division 2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Combustible Dust</th>
<th>Present Continuously</th>
<th>Present Intermittently</th>
<th>Present Abnormally</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC / EU</td>
<td>Zone 20</td>
<td>Zone 21</td>
<td>Zone 22</td>
</tr>
<tr>
<td>US NEC 505</td>
<td>Zone 20</td>
<td>Zone 21</td>
<td>Zone 22</td>
</tr>
<tr>
<td>US NEC500</td>
<td>Division 1</td>
<td>Division 2</td>
<td></td>
</tr>
<tr>
<td>CA CEC Section 18</td>
<td>Division 1</td>
<td>Division 2</td>
<td></td>
</tr>
</tbody>
</table>

IEC classification per IEC 60079-10
EU classification per EN 60079-10
US classification per ANSI/NFPA 70 National Electrical Code® (NEC®) Article 500 or Article 505
Reprinted from Guide to Hazardous Locations, CA classification per CSAC22.1 Canadian Electrical Code (CEC) Section 18 or Annex J
Explosive Gas Atmospheres, FM Approvals, © 2008

US classification per ANSI/NFPA 70 National Electrical Code® (NEC®) Article 500 or Article 506
CA classification per CSAC22.1 Canadian Electrical Code (CEC) Section 18 or Annex J
EU classification per EN 61241-10
Reprinted from Guide to Hazardous Locations, IEC classification per IEC 61241-10
Explosive Dust Atmospheres, FM Approvals, © 2008
Groups – traditional U.S. and Canada

US NEC® 500 or CA CEC Annex J Groups

- Group A – Acetylene
- Group B – Hydrogen, Butadiene, Ethylene Oxide, Propylene Oxide
- Group C – Ethylene, Cyclopropane, Ethyl Ether
- Group D – Propane, Acetone, Ammonia, Benzene, Butane, Ethanol, Gasoline, Methanol, Natural Gas
Groups - international

US NEC® 505 or CA CEC Section 18, EU, IEC

• Group IIC – Acetylene
• Group IIB + H2 – Hydrogen
• Group IIB – Ethylene
• Group IIA – Propane
• Group I - Methane
Maximum ambient surface (under dust) temperature the device can reach.

Rated to prevent combustion

Varies based on the internal heating elements of the device

Examples:
- T1: 450 °C
- T3: 200 °C
- T4: 135 °C
- T6: 85 °C

Note: Traditional US and Canadian systems may include T2A, T2B, T3C, etc. for more precise temperature ratings.
Protection concepts

- Protection concepts and example protection concepts include:
  - No arcs, sparks, or hot surfaces
    - Increased Safety, Non-Incendive)
  - Containing the explosion and extinguishing the flame
    - Explosion-proof, flame-proof, powder-filled
  - Limiting energy of spaces and surface temps
    - Intrinsically Safe
  - Keeping flammable materials out
    - Pressurized, encapsulation, oil emersion, fiber & flying protection, protection by enclosure
  - Markings such as AEXd (Flameproof C1 Z1) and Ex ia (I.S. CI Z0)
• NEMA – Generally accepted in North America
• Ingress Protection (IP) Code – Generally accepted worldwide
• Both indicate physical protections against water and material ingress, but are slightly different. Not harmonized, and no exact cross-over is possible.
• Most often, NEMA is used for protection against water and corrosion
• Additional NEMA classifications can include hazardous area protections, NEMA 7, 8, 9, 10
NEMA/IP environmental codes

NEMA 4
Indoor/outdoor protection to personnel against access to hazardous parts, protected against solid foreign objects (falling dirt, blown dust, etc.), ice, and hose-directed water.

NEMA 4X
Similar to NEMA 4, with the addition of corrosion resistance.
- IP 55: Protection against dust and liquid such as water jets.
- IP 65: Dust-tight and protected against water jets.
- IP 66: Dust-tight and protected against powerful water jets and high seas.
Marking, symbols & specifications

- FM APPROVED
- FM C US APPROVED
- FM C US
- CSA®
- Ex ATEX
- IEC
- Ex
Explosion-Proof Label Sample

**PRECISION DIGITAL**

**MODEL:** PD8-XXXX-XXX

**ProtEX-MAX**

**S/N:** YYMM-XXXXXXXX

**POWER:** 85 - 265 VAC 50/60 Hz, 20 VA
90 - 265 VDC, 20 Watts

**WARNING:** Do not open when an explosive atmosphere is present. Install conduit seals within 18 in. (450mm) of enclosure. Wiring in this compartment may reach 90°C in an ambient of 65°C. Cable must be suitable for 90°C. For Canada: All input circuits must be derived from a Class 2 Certified power supply.

**Patent 8,227,692**

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**ATEX Certified**

**CE Compliant**

**Agency Required Warnings**

**Equipment Group II (all areas but mines)**

**Environment**

G: Gas
D: Dust

**IEC Ex Approved (logo optional)**

**FM / CSA**

Class I, Division 1, Groups B, C, D
Class II, Division 1, Groups E, F, G
Class III, Division 1

**Certification Numbers**

**FM Approved**

**CSA Certified**

**Temp Codes**

**Allowable Ambient Temp**

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**NEMA & IP per ATEX & IEC**

**FM / CSA Groups / Div**

**Groups**

**FM / CSA per FM & CSA**

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**Class I Zone 1**

Ex d IIC T5/T6
Ta = -40°C to +100°C

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**FM: Class I Zone 1**

Ex d IIC Gd, T5/T6

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**CSA: Zone 1**

Ex tb IIIC T90°C Ta = -40°C to +65°C

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**FM: Zone 21**

Ex tb IIIC T90°C Ta = -40°C to +65°C

---

**CSA: Zone 21**

Ex tb IIIC T90°C Ta = -40°C to +65°C

---

**FM: Zone 21**

Ex tb IIIC T90°C Ta = -40°C to +65°C

---

**T5/T6 Ta = -40°C to +65°C**

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**T5 Ta = -40°C to +65°C**

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**Patent 8,227,692**

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**AEx = Explosion Protection, Cl, Z1 & 2 CAN**

**Ex = Explosion Protection, Cl, Z1 & 2**

**tb = Protection by Enclosure**

**IIC = Gas type IIC**

(Acetylene, Hydrogen, Carbon Disulfide)

**IIIC = Dust type IIIC (Conductive)**
Intrinsically Safe Label Sample
Summary

1. Why classify an area as hazardous
2. Definition of a Hazardous Location
3. Classification – Div, Area, Class
4. Markings and Specifications
5. Methods of protection

For more information, contact your local Agency representative. Posters, pamphlets, and other documentation is available to demystify the approvals.
Getting to know you

• How often do you specify digital displays?
Q & A

- Please enter your questions in the ‘Questions’ window
- Apologies if we do not get to your question today. We’ll contact you offline with a response as soon as possible.
Reducing Signal Noise

- Signal noise is an all too common complaint in industrial environments. In this webinar we'll discuss the problem behind high noise signals, best practices you can employ to reduce signal noise and show a couple of real life examples where signal noise is typically a big problem and how the noise problem is mitigated.

Next Webinar – March 24
Helping you become more proficient with process signals connections and communications.

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- Loop-Powered Meters
- Digital Panel Meters
- Explosion-Proof Instruments
- Large Display Meters
- And more
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