CONNECTION TECHNOLOGY CENTER, INC.

LEVEL 2 – LESSON 5

MEASURING VIBRATION IN A HAZARDOUS AREA: GUIDELINES FOR INTRINSIC SAFETY

INTRODUCTION

Welcome to **Level 2, Lesson 5** of CTC's free online vibration analysis training. We're glad you have taken the time to view this self-paced lesson on monitoring machinery vibration using dynamic and process control signals. We hope you enjoy the training and will continue to build your vibration analysis knowledge as you progress through Level 2.

OBJECTIVES

After completing this training module you will understand:

- ❑ What classifies as a **hazardous area**
- ❑ **Intrinsic safety** standards and operating procedures in hazardous areas
- ❑ How to choose the **correct vibration analysis product for your specific hazardous area**

LOCAL REGULATIONS AND AUTHORITIES

The information given in this presentation is intended as a general guideline to hazardous area best practices and intrinsic safety standards.

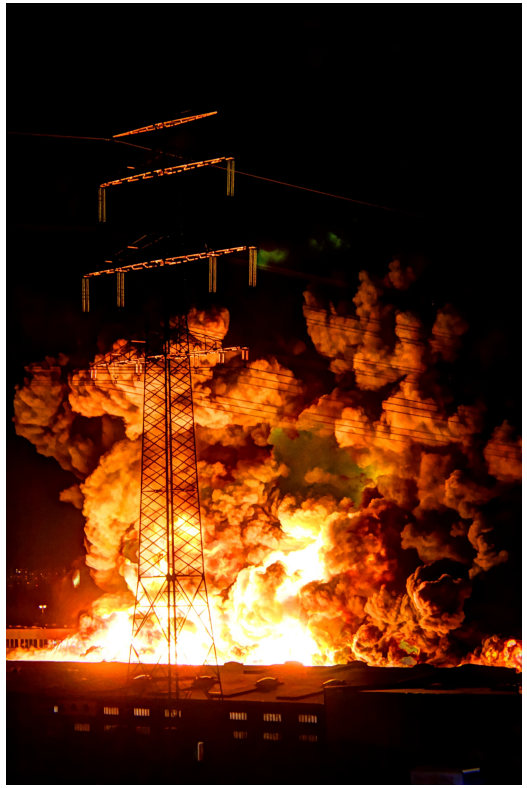
The suitability of final installation of any equipment or instrumentation in any hazardous area is to be determined by the authority having local jurisdiction.

Regulations, standards, and operating procedures can vary between countries, regions, cities, and even between similar plants within the same city.

Please consult with local standards prior to operating in a hazardous area.

HAZARDOUS AREAS - DEFINITION

These pictures serve as powerful examples of why it is so important to understand and follow intrinsic safety standards and operating procedures in hazardous areas.



HAZARDOUS AREAS - DEFINITION

In industrial processes where flammable materials are handled, any leak or spillage may give rise to an explosive atmosphere.

To protect both personnel and facilities, precautions must be taken to ensure that this atmosphere cannot be ignited.

The areas at risk are known as **hazardous areas**, and the materials that are commonly involved include (but are not limited to):

- ❑ **Crude oil and its derivatives**
- ❑ **Natural and manmade process gasses**
- ❑ **Alcohols**
- ❑ **Plastics**
- ❑ **Metal dusts**
- ❑ **Carbon dust**
- ❑ **Flour**
- ❑ **Starch**
- ❑ **Grain**
- ❑ **Fibers**

INTRINSIC SAFETY - DEFINITION

Intrinsic safety is based on the principle that the electrical energy in hazardous area circuits is deliberately restricted. Any electrical sparks or hot spots that may occur in the hazardous area must be too weak to cause ignition.

Operating within intrinsic safety standards will ensure that analysts are limiting the voltage and current that can reach the hazardous area, thereby minimizing the risk of accidental ignition of the surrounding environment.

ENTITY – SYSTEM vs. COMPONENT CERTIFICATION

System certification lists components (sensor, cable, and barrier, for example) that are certified for use together in a hazardous area. All components must be used together as defined in the system. The system is tested and certified as a whole, and therefore, substitutions of components is not permitted.

Component certification tests and certifies an individual component for use in a hazardous area when used with other components which meet specific criteria. For example: sensors are rated for use with barriers which must match certain entity parameters.

Entity parameters are a specific set of electrical specifications that are used to define compatible components for use in a hazardous area.

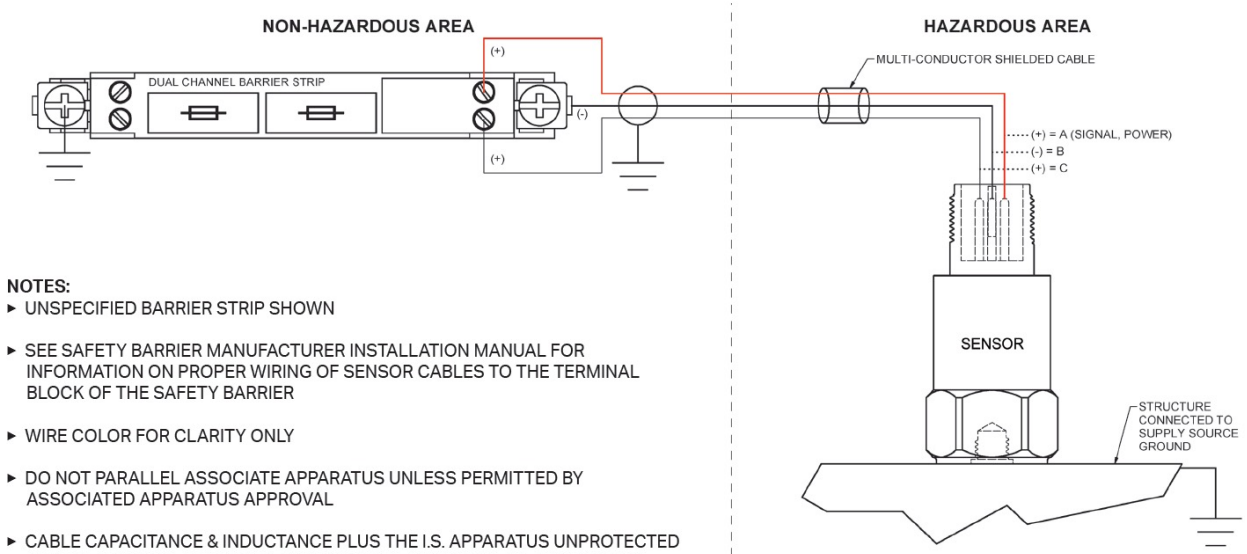
CONTROL DRAWING – TYPICAL ACCELEROMETER INSTALLATION

It is critically important to consult the **control drawing** associated with any instrumentation to be used in a hazardous area.

This is an example of the control drawing for a vibration sensor. It shows the placement of the sensor and barrier relative to the hazardous and non-hazardous areas.

It also shows grounding requirements and lists the relevant entity parameters for:

- ❑ **Maximum voltage** (**V**)
- ❑ **Total allowable capacitance of the circuit** (**nF**)
- ❑ **Maximum allowable current** (**mA**)
- ❑ **Total allowable inductance of the circuit** (**µH**)



SAFETY BARRIERS OR GALVANIC ISOLATORS – GROUNDING

Proper **grounding** is important in intrinsically safe applications:

- **Stud mounting** is the only acceptable method of mounting a sensor, since the case of the sensor must be grounded. **Do not use epoxy pads**.
- It is also critical that the **cable and barrier are grounded in the non-hazardous area**.

SAFETY BARRIERS OR GALVANIC ISOLATORS – SAFETY BARRIERS

Intrinsically safe accelerometers and loop power sensors typically require use of an **energy limiting barrier** (such as a Zener Diode Barrier or Galvanic Isolator) to restrict the amount of voltage and current which can enter the hazardous area. The barrier allows the power and signal to pass in either direction as required.

The power source and barrier must be located in a non-hazardous area or approved enclosure.

The entity parameters of the appropriate barrier for a given sensor will be specified in the control drawings for each sensor. It is important that the proper barrier is used. For this reason, **CTC provides compatible barriers, specified to match applicable entity parameters**.

CABLING

Compatible **cabling** must be used to transmit the power and signal to and from the sensor and barrier.

Due to limitations on total capacitance allowable between components, **cable length between the sensor and the barrier is limited to approximately 200 feet** based on cable properties.

Local codes and standards may permit approved enclosures to house barriers and power closer to the sensor. **Consult barrier enclosure specifications, local codes, and proper installation instructions to ensure safe installation**.

REGULATORY MARKINGS & STANDARDS - NORTH AMERICAN STANDARDS

The **CSA listing** with both "US" and "C" identifiers, at the 4 o'clock and 8 o'clock positions respectively, signifies that the product bearing the mark complies with US and Canadian standards for intrinsic safety (Class 1, Division 1).

Canadian product safety standards (Canadian Standards Association – CSA C22.2 NO 157-92-CAN/CSA – Intrinsically Safe and Non-Incentive Equipment for Use in Hazardous Locations General Instructions No 1)

Complies with U.S. product safety standards (Factory Mutual – FM 3610 – Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division 1 Hazardous Locations)

REGULATORY MARKINGS & STANDARDS - EUROPEAN STANDARD

The **ATEX Directive** is the Explosive Atmosphere Directive for the European Union (EU).

The ATEX Directive (from the French “ATmospheres EXplosible”) became mandatory beginning July 1, 2003, when it replaced CENELEC as the European Standard for intrinsic safety.

A product bearing the EX mark signifies that it was tested and meets the requirements of prescribed product safety standards.

ATEX EN 50014 – Electrical Apparatus for Potentially Explosive Atmospheres – General Requirements

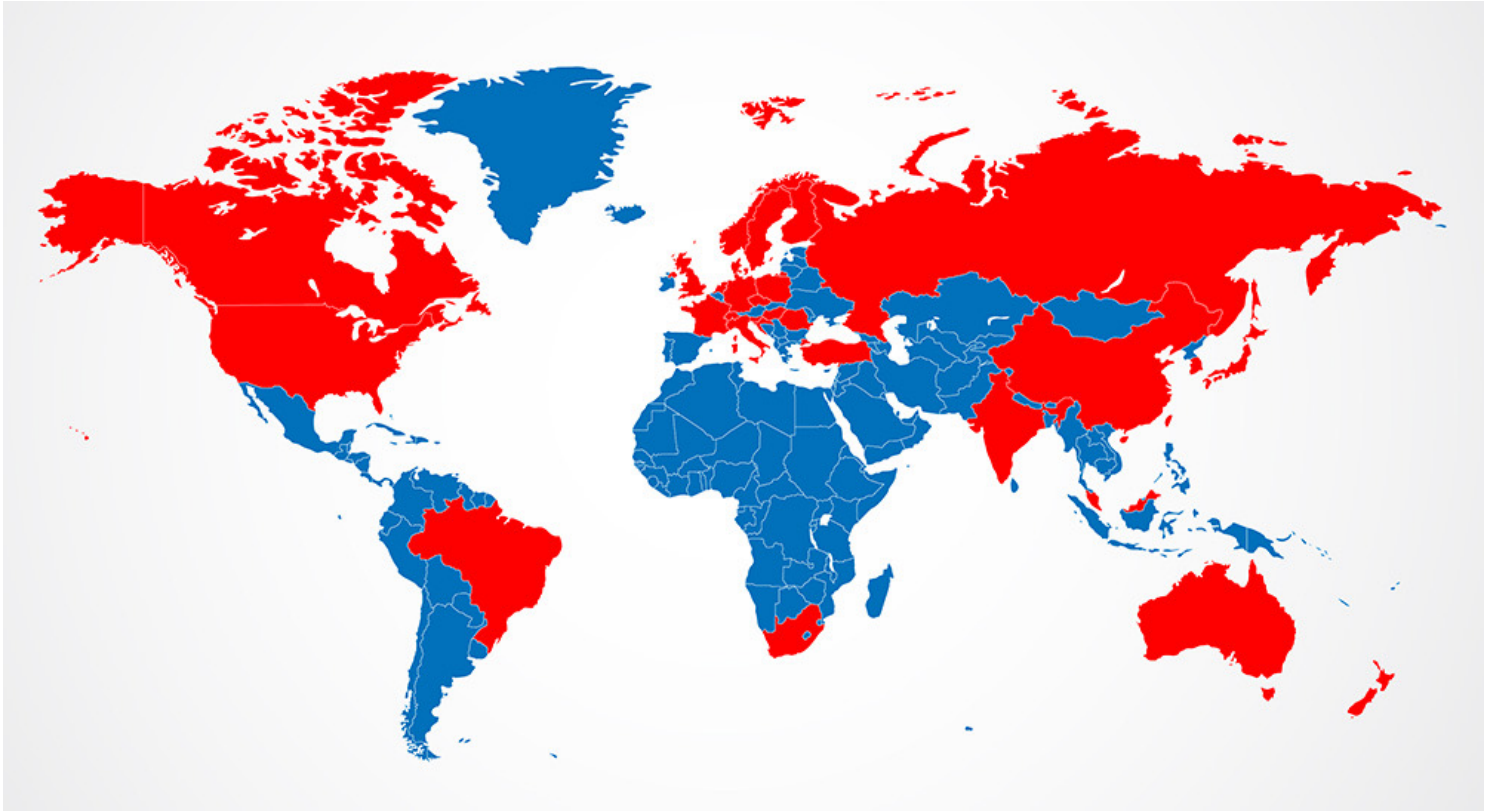
ATEX EN 50020 – Electrical Apparatus fro Potentially Explosive Atmospheres – Intrinsic Safety “I”

REGULATORY MARKINGS & STANDARDS - INTERNATIONAL STANDARD

IECEx certified products comply with the standards set forth by the International Electronics Commission (IEC).

IECEx is an international standard for hazardous area equipment. Many countries have begun to accept the IECEx standard as a substitute for their local standards.

The **locations indicated in red on the map accept the IECEx** standard.



REGULATORY MARKINGS & STANDARDS - COMPARISON

The following chart is for reference only. It compares the three major intrinsic safety standards.

Regulatory Approvals	**US & Canada**	C SP® US	Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III; CL1, Zone 0; Temperature Code T3; ambient temperature range -40 °C - +121 °C Canada: Ex iA IIC T3 Ga USA: AEx nA IIC T3 Ga
	ATEX	Ex II 1 G D	Ex iA IIC T3 Ga Temperature Code T3; ambient temperature range -40 °C - +121 °C
	IECEx	**IECEx**	Ex ia IIC T3 Ga Temperature Code T3; ambient temperature range -40 °C - +121 °C

REGULATORY MARKINGS & STANDARS – ENERGY LIMITING UNDER ABNORMAL CONDITIONS

Some sensors will carry a similar certification to intrinsic safety. **Class 1, Division 2 or ATEX Zone 2 sensors** are approved for use in hazardous areas which do not normally contain explosive gases, dust, or fibers.

These sensors do not typically require energy limiting barriers, and instead utilize strict controls on cable and connectors used.

SUMMARY

Intrinsic safety standards are intended to limit the electrical energy in hazardous area circuits, thereby preventing ignition.

Consult control drawings and entity parameters to be sure that components are compatible for use in the proposed environment.

- ❑ **Sensors mounted in a hazardous area must be case-grounded** to the machinery to prevent static build up
- ❑ **Safety barriers** (**such as Zener Diode Barriers or Galvanic Isolators**) **must be used** to limit the amount of energy which can enter the hazardous area
- ❑ **Barriers and cables must be properly grounded**

Not all intrinsically safe sensors are approved in all intrinsically safe environments. Be sure that the sensor you intend to use is rated for your application's environment, and meets your country's regulatory standards.

SUMMARY

THIS PRESENTATION HAS BEEN A GENERAL OVERVIEW OF INTRINSIC SAFETY AND IS NOT INTEDED TO BE A SUBSTITUTE FOR CONSULTING AND UNDERSTANDING THE LOCAL REGULATORY STANDARDS.

PLEASE CONSULT THE REGULATORY STANDARDS IN YOUR REGION FOR SPECIFIC INFORMATION ON YOUR INSTALLATION, AS SUITABILITY OF FINAL INSTALLATION IS TO BE DETERMINED BY THE AUTHORITY HAVING LOCAL JURISDICTION.

SUMMARY

Thank you for taking the time to review this training lesson. We hope that you learned something that will help you to collect more accurate and quicker data, to allow you to make better "calls."

For more technical information, additional white papers, and training materials, we invite you to visit our website at **www.ctconline.com**.

SUMMARY

CTC offers a full range of vibration analysis hardware and process and protection instruments for industrial use. Our customers choose us time and time again based on:

- ❑ **Superior durability**
- ❑ **Accuracy and performance**
- ❑ **Quick service (shipping most orders in 3 days)**
- ❑ **Knowledgeable support staff**
- ❑ **Industry's only UNCONDITIONAL LIFETIME WARRANTY on all CTC Line products**

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