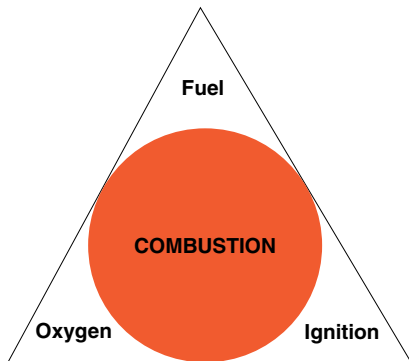


INTRINSIC SAFETY

INTRODUCTION

Intrinsically safe equipment is defined as “equipment and wiring which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration.” (ISA-RP12.6) This is achieved by limiting the amount of power available to the electrical equipment in the hazardous area to a level below that which will ignite the gases.

In order to have a fire or explosion, fuel, oxygen and a source of ignition must be present. An intrinsically safe system assumes the fuel and oxygen is present in the atmosphere, but the system is designed so the electrical energy or thermal energy of a particular instrument loop can never be great enough to cause ignition.

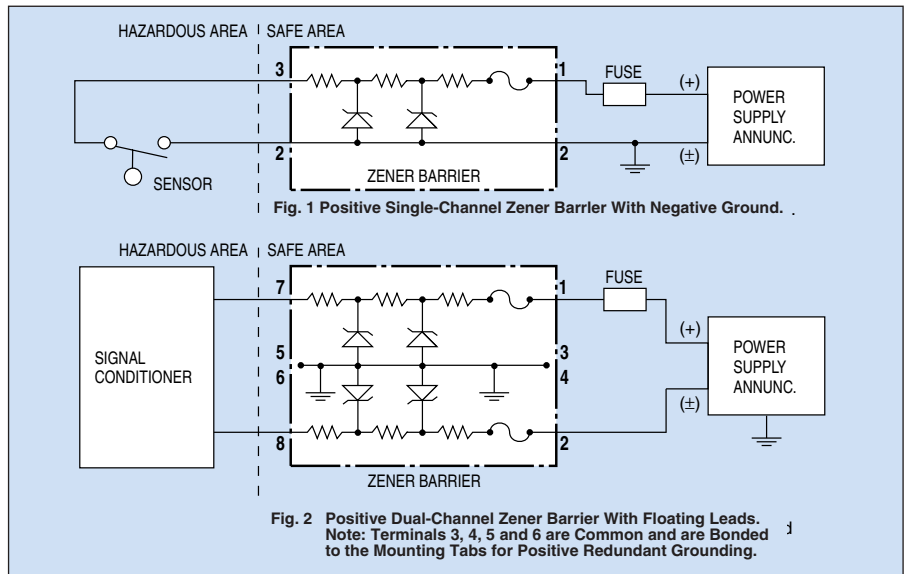


Traditionally, protection from explosion in hazardous environments has been accomplished by either using EXPLOSION PROOF apparatus which can contain an explosion inside an enclosure, or PRESSURIZATION or purging which isolates the explosive gas from the electrical equipment. Intrinsically safe apparatus cannot replace these methods in all applications, but where possible can provide significant cost savings in installation and maintenance of the equipment in a Hazardous area.

The basic design of an intrinsic safety barrier uses Zener Diodes to limit voltage, resistors to limit current and a fuse.

APPLICATIONS

A Hazardous Area may contain flammable gasses or vapors,



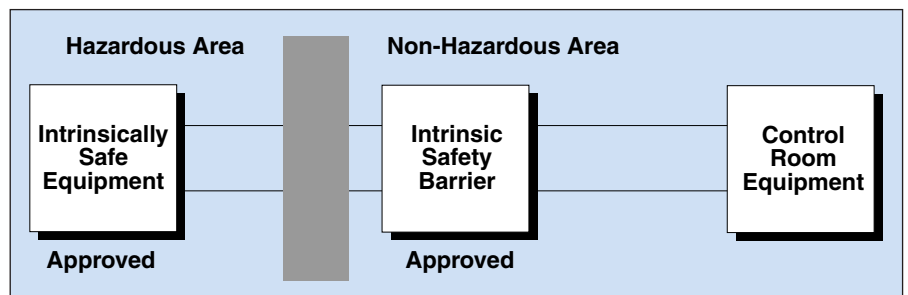
combustible dusts, or ignitable fibers or flyings. There are different systems used in Europe or the United States to classify the type of hazard and whether the Hazard is always present or only present in an emergency condition such as a spill or failure of venting equipment. (refer to Pages Z-93, 94 in The Complete Temperature Measurement and Control Handbook and Encyclopedia® for U. S. Classifications). In most cases the equipment is designed for the worst case, which would be to assume the explosive atmosphere is always present and the electrical or thermal energy is the lowest required to cause a fire or explosion.

Most applications require a signal to be sent out of or into the hazardous area. The equipment mounted in the hazardous area must first be

hazard is not and will not be present. Equipment which has been designed for and is available for use in hazardous areas with intrinsically safe barriers includes:

- 4-20 mAdc Two Wire Transmitters
- Thermocouples
- RTD's
- Strain Gages
- Pressure, Flow, & Level Switches
- I/P Converters
- Solenoid Valves
- Proximity Switches
- Infrared Temperature Sensors
- Potentiometers
- LED Indicating Lights
- Magnetic Pickup Flowmeters

Most of the apparatus that is mounted in the Hazardous area will have to be approved and certified for use in the Hazardous area with an approved barrier designed for use with that



approved for use in an intrinsically safe system. The barriers designed to protect the system must be mounted outside of the hazardous area in an area designated as Non-hazardous or Safe in which the

apparatus. Some simple devices like thermocouples, RTD's, LED's and contacts can be used in the hazardous area without certification as long as it is wired in conjunction with an approved barrier.

APPROVALS

Intrinsic safety equipment must have been tested and approved by an independent agency to assure its safety. The customer should specify the type of approval required for their particular application. The most common Agencies involved are as follows:

COUNTRY	AGENCY
USA	FM, UL
CANADA	CSA
GREAT BRITAIN	BASEEFA
FRANCE	LCIE
GERMANY	PTB
ITALY	CESI
BELGIUM	INEX

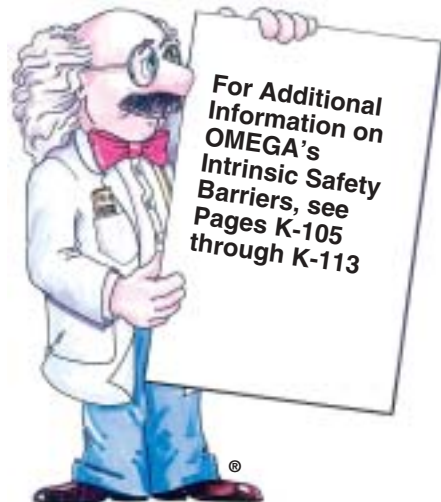
NOTE: approval by any of the above European Agencies constitutes a CENELEC approval allowing the units to be considered approved in many of the European countries.

Products to be mounted in the hazardous area can be approved either under the LOOP or ENTITY approval concept.

The LOOP concept specifies the exact part number and products that can be used in the loop. No deviation from the specified units is allowed.

The ENTITY concept specifies parameters which any approved intrinsic safety barrier must meet. This allows the user to select barriers from different approved manufacturers.

Under entity approval two items may be interconnected if the following conditions are met (refer to chart at right):



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HAZARDOUS AREA

NON-HAZARDOUS (SAFE) AREA

Intrinsically Safe

Approved Apparatus

must be

Intrinsically Safe Barrier

V_{max}

less than

V_{oc}

I_{max}

less than

I_{sc}

L_a

greater than

L_i + L_w

C_a

greater than

C_i + C_w

Where:

V_{max} = Maximum Open Circuit Voltage

I_{max} = Maximum Short Circuit Current

L = Maximum Unprotected Inductance

C_i = Maximum Unprotected Capacitance

V_{oc} = Maximum Open Circuit Voltage (barrier)

I_{sc} = Maximum Short Circuit Current (barrier)

L_a = Maximum Allowed Inductance (barrier)

C_a = Maximum Allowed Capacitance (barrier)

L_w = Inductance of interconnecting wiring

C_w = Capacitance of interconnecting wiring

In all cases the intrinsically safe barriers and equipment MUST be wired per an approved drawing. Capacitance and inductance of the wiring and cables must be included in the loop evaluation.



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• Flow and Level

Air Velocity Indicators, Doppler Flowmeters, Level Measurement, Magnetic Flowmeters, Mass Flowmeters, Pitot Tubes, Pumps, Rotameters, Turbine and Paddle Wheel Flowmeters, Ultrasonic Flowmeters, Valves, Variable Area Flowmeters, Vortex Shedding Flowmeters

• pH and Conductivity

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• Heaters

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