Course Overview

Intrinsically Safe (IS) hardware design and certification to hazardous location standards for US, Europe and the rest of the world is an extremely challenging, time intensive and expensive process. Even the smallest oversight or design error can cost tens of thousands of dollars in lost certification fees and months of time waiting, fixing, and resubmitting a design.

Engenuics has over 15 years of experience certifying IS products globally. This course summarizes that experience and delivers the most critical information to your hardware designers to greatly de-risk the process of creating and certifying products. As with all Engenuics courses, this course packs in a lot of information and challenges participants to prove their knowledge through hands-on case studies and take-home exercises. Extensive take-home material is provided for future reference.

Course Goals

- Provide essential knowledge to embedded designers doing IS products.
- Highlight and understand the key information in the 60079 series of Hazardous Location certification standards for UL/CSA, IEC and ATEX certification.
- Build knowledge for designing hardware within the limitations of the standards.
- Gain skills to review and discover non-compliances before starting certification.
- Build strategies for successfully navigating the certification process to minimize time and cost.

Detailed Course Outline

Getting Started

- What is Intrinsic Safety and how do we achieve it?
- Standards, directives and other important jargon
- Classes, Zones, Divisions, Gas Groups, Temperature codes
- Certification labs, processes, costs, time and expectations

Navigating 60079

- Document layout
- Important Sections
- Summary guide

Fundamentals

- Capacitance and inductance
- Components on which IS depends / infallible components
- Fuses, resistors, and defying Ohm's law
- Semiconductors including Zener clamping and Schottky blocking
- Sensors / electrochemical devices, piezoelectric elements
- Batteries / power supplies
- Connection to mains
- Associated apparatus
- Clearance and creepage
- Encapsulation
- Safety factors
- Spark testing and why you never want to go there
- IS vs. good electrical design

Process and Documentation

- A suggested right way to do an IS design
    - Understanding Electrical vs. Mechanical tradeoffs in IS products
    - Power budget
    - Pretesting
- Separating what matters from what does not
- Preparing IS BOMs to minimize current and future overhead
- IS block diagrams and design overviews

Easy ways to (not) Fail

- Temperature
- Too much current
- Too much capacitance
- Too much inductance
- Not enough redundancy
- Not enough clearance
- Interpretations

Favorite parts, circuits and tricks

- Power supply isolation
- Battery charging
- Charge pumps and inductive boost converters
- Routing techniques

Case Study: Voltage Protection

- Limiting maximum assessed voltage in a circuit
- Isolating circuit sections with different voltage levels
- Applying countable and non-countable faults to voltage protection

Case Study: Power Dissipation in Protective Components

- Power limiting strategies
- Properly assessing required power handling
- Fault analysis and mitigation
- Applying countable and non-countable faults in power analysis

Case Study: Lithium Batteries

- Sourcing and testing a cell
- Modifying the cell to be certifiable
- Using the cell in the circuit
- Applying countable and non-countable fault to battery input