Transducer operation in hazardous areas

A hazardous area, as defined with regard to a combustible atmosphere, is one which could burn with the addition of energy sufficient to cause ignition. Some vibration monitoring applications require the sensor to be installed in a hazardous area. In these environments, the transducer must be unable to ignite the surrounding atmosphere.

The definition of hazardous area is further broken down into subcategories by Article 500 of the National Electrical Code® in order to define conditions which can cause ignition of the combustible atmosphere. These categories include combustible gases, such as acetylene, hydrogen, or methane, plus suspended dust and particulate such as would be found in grain elevators or processing facilities. Independent product safety testing laboratories, such as Factory Mutual Research Corp., can evaluate and certify electrical equipment for operation in hazardous areas.

Two methods of protection used in designing electrical equipment for use in hazardous areas are intrinsically safe and explosion proof housing. A transducer which is intrinsically safe cannot develop enough energy, either through heat energy or through spark energy, to ignite the hazardous environment, whether operating normally or under fault conditions. A transducer approved as intrinsically safe can be installed directly in the hazardous environment. When a transducer is electrically connected to other equipment, an electrical safety barrier must be used in series with the connection. This barrier prevents fault conditions from adjunct equipment from introducing excess energy to the transducer and surrounding hazardous area. The barrier is excluded from the hazardous environment by being installed outside the hazardous environment.

Devices which cannot be designed to be intrinsically safe can be enclosed in an explosion proof housing if they are to be used in a hazardous environment. Explosion proof devices are designed so that if the internal free volume of the device were filled with the combustible atmosphere, upon ignition, the device would remain intact and would suppress ignition propagation outside the housing. Explosion proof devices, which require interconnection, use rigid conduit to contain conductors but do not require an electrical safety barrier. The conduit must also be rated as explosion proof to maintain system integrity.

Piezoelectric vibration transducers convert mechanical energy into electrical energy by stressing a piezoelectric crystal. The electrical energy output is a direct function of the transducer design and the mechanical energy input. Therefore, when a transducer is installed in

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a hazardous environment, it may need to be protected from shocks exceeding a set limit. If applicable, this limit is specified in the installation instructions. Furthermore, energy stored by the inductive and capacitive properties of transducer cabling may limit the cable length that a transducer can safely drive.

Further information on transducer installation and operation in hazardous environments can be found in the technical document “Installation guide for hazardous areas,” in Wilcoxon Research’s online knowledge desk available at www.wilcoxon.com.