

## Transducer Operation in Hazardous Environments

A hazardous environment, as defined with regard to a combustible atmosphere, is one which could burn explosively with the addition of energy sufficient to cause ignition. The definition of hazardous environment 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 gasses such as acetylene, hydrogen, methane, and suspended dust and particulate such as would be found in grain elevators or other processing facilities. Independent product safety testing laboratories, such as Factory Mutual Research Corp. can evaluate and certify electrical equipment for operation in various hazardous environments.

Some vibration monitoring applications require that the transducer be installed in a hazardous environment. In these applications the transducer must be unable to ignite the surrounding atmosphere. Two characteristics for which products used in hazardous environments can be rated are intrinsically safe and explosion proof.

A transducer which is intrinsically safe cannot develop enough energy, either through heat energy or 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 barrier must be used in series with the connection. This barrier prevents fault conditions from adjunct equipment from introducing excess energy to the transducer. The barrier is excluded from the hazardous environment by being installed within an explosion proof box, or it can be 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 con-

duit to contain conductors. This conduit must also be rated as explosion proof to maintain system integrity.

Piezoelectric vibration transducers convert mechanical vibration 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 a hazardous environment, the maximum shock limit is de-rated (if necessary) in order to meet the maximum electrical energy limitations allowed by Factory Mutual intrinsic safety ratings. Furthermore, energy stored by the inductive and capacitive properties of transducer cabling may limit the cable length that a transducer can safely drive.

Wilcoxon Research transducers which are approved by Factory Mutual Research for intrinsic safety may only be powered through the barrier strip manufactured by R.H. Stahl (P/N 8903/31-315/050/70).

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Further information can be found in the following references:

- 1) National Fire Code, NFPA70
- 2) ANSI/ISA RP12.6, "Installation of Equipment in Hazardous Locations."
- 3) Approval Standard, Factory Mutual Research, Corp. "Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, II and III, Division 1, Hazardous (classified) Locations".
- 4) Approval Standard, Factory Mutual Research, Corp. "Electrical Equipment for use in Class I, Division 2; Class II, Division 2; and Class III, Divisions 1 and 2 Hazardous Locations."
- 5) Approval Standard, Factory Mutual Research, Corp., "Electrical Utilization Equipment"
- 6) "Intrinsic Safety Primer" R. Stahl, Inc., Woburn, Mass, 1-800-782-4357 or 1-800-782-7233 (in MA)
- 7) Intrinsic Safety, Instrument Society of America (Research Triangle Park, NC 22709) By E.C. Magison, ISBN 0-87664-635-6.
- 8) Intrinsically Safe Instrumentation, (Monograph 7), Instrument Society of America, (Research Triangle Park, NC 22709) Robin Garside, ISBN 0-87664-728-X.