1 Introduction

When electrical equipment is used in locations where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitible fibers or flyings, the *National Electrical Code (NEC)®*, NFPA 70, requires special precautions to be taken in equipment construction and installation to ensure safe performance. There are several protection techniques in common use, each of which has its own set of advantages and disadvantages.

2 The intrinsic safety protection technique

For low-power applications in Division 1 hazardous (classified) locations, the safest and most easily implemented protection technique is intrinsic safety. Intrinsic safety is the use of equipment and wiring that 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. This is achieved by limiting the energy available to, and stored or generated by, the electrical equipment in the hazardous (classified) location to a level below that which can ignite the hazardous atmosphere.

3 Intrinsically safe systems

Article 504 of the *NEC®* defines an intrinsically safe system as "an assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables in which those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits." Intrinsically safe apparatus is defined in Article 504 as electrical equipment "in which all the circuits are intrinsically safe." A common example of an intrinsically safe apparatus is a 4-20 mA process transmitter that has been specially designed to be intrinsically safe.

Unless completely self-contained, as is the case with some battery-operated devices, intrinsically safe apparatus must be connected to associated apparatus. Associated apparatus is defined in Article 504 as "apparatus in which the circuits are not necessarily intrinsically safe themselves, but that affect the energy in the intrinsically safe circuits and are relied upon to maintain intrinsic safety." Associated apparatus must be installed in a location not classified as hazardous unless it has an alternative type of protection that allows it to be installed in a hazardous (classified) location.

The most common form of associated apparatus is the intrinsic safety barrier, a device designed to limit the energy available to the intrinsically safe apparatus. Intrinsic safety barriers usually are installed in locations not classified as hazardous and are connected between the intrinsically safe apparatus and other non-intrinsically safe equipment.