

## Hazardous Areas Require Special Attention and Stringent Grounding



Many of the projects we work on have areas in the plant that are considered by the National Electrical Code to be hazardous, either from flammable vapors that might be present (Class I), or fine-grain dust in the air (Class II). In these hazardous areas, equipment grounding becomes even more important than ever.

What is the most dreaded thing in these hazardous areas? An ignition source - an arc or a spark.

How does a poor equipment grounding system contribute to this? First of all, if we have a fault in the electrical system, there is likely to be an arc. If the insulation on a conductor wears through or a motor fails, the arc should be contained inside the conduit system initially. What we want is for the circuit to clear as quickly as possible. How quickly depends largely on just how good the equipment grounding system is. A few ohms, or perhaps only a few tenths of ohms, introduced by a loose connection, a rusted coupling, a poor flex connection, etc., could stretch out the operating time of the circuit breaker. These few seconds of extra time could allow the arc of the fault to burn through the conduit system or the motor housing, and then expose the arc to the hazardous atmosphere.

The result is a big fire and another fire marshal's report that found the cause to be "faulty wiring."

In these hazardous areas there are special, more stringent rules regarding equipment grounding. If the motor is located in the hazardous area, we are not allowed to rely on liquid-tight flexible metal conduit to make the required ground connection. It must be bonded with a properly-terminated conductor -- a "jumper bond" -- either inside or outside of the flex. Also, standard knockouts, locknuts or bushings cannot be relied upon for good connections all the way back to where the equipment ground bus ties to the neutral bus, usually at the main switchboard. All these intervening connections must be bonded with a properly-sized conductor and proper terminations.

As stated above, the jumper bond must be sized properly. In each case, there is a circuit breaker somewhere in a properly-designed circuit that should operate if there is a fault. As described earlier, the fault path resistance will determine how much fault current will flow, and the circuit breaker time-current curve will determine how much time it will take for the circuit to clear. The bonding jumper must carry this current for that length of time without melting, or we still won't clear the fault. Too many times not enough consideration is given to properly sizing bonding conductors.

Most circuits we deal with are AC or alternating current. Without going into a detailed engineering description of what's involved, let me generalize by saying that wires conducting AC current have magnetic properties that have to be taken into consideration during design and installation. The general rule that affects grounding is that the resistance to current flow will increase if all the circuit conductors are not near each other. During a fault, that also includes the equipment grounding conductor. That is why we can't just tie equipment to the nearest steel beam or drive a ground rod next to each light pole to consider them grounded.

**-We ground systems (literally tie them to earth with a conductor) to limit the potential on the grounded object to, at, or near earth's zero potential.**

**-We connect the non-current carrying metal parts of equipment to ground to minimize shock hazard and to minimize damage.**

**-The reaction time of a circuit protective device depends heavily on the resistance of the grounding path. The resistance must be maintained at a very low number to assure proper circuit protection.**

**-Hazardous areas require special attention to the National Electrical Code rules for the grounding to minimize the potential for explosion and fire. Routing of grounding conductors is very important to assure the proper operation of the circuit protective devices.**

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**For more information...**

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