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Application of Conductive Mounting Pads for Vibration Analysis in Intrinsically Safe Environments

Abstract:

The installation of accelerometers to measure machine vibration in an intrinsically safe environment requires that the case of the accelerometer be at the same electrical potential as the machine to which it is mounted. Typically this is earth ground. Electrical details are illustrated and discussed in CTC application note *“Intrinsically Safe Sensors and Accessories, About Intrinsic Safety (IS) – What is IS?”* pages IS-1.A and IS-2.A.

The normal method of mounting accelerometers in intrinsically safe environments is to drill, spot face, and tap a threaded hole in the machine. This allows the accelerometer to be stud mounted and have direct metal to metal contact insuring conductivity between the sensor and the machine.

As shown in Figure #1, a small circular flat is machined on the surface of the machine. A hole is drilled and tapped (1/4-28) in the center of the machined surface. The accelerometer is then attached to the machine by a threaded stud and tightened with a mounting torque of 2 to 5 ft lbs.

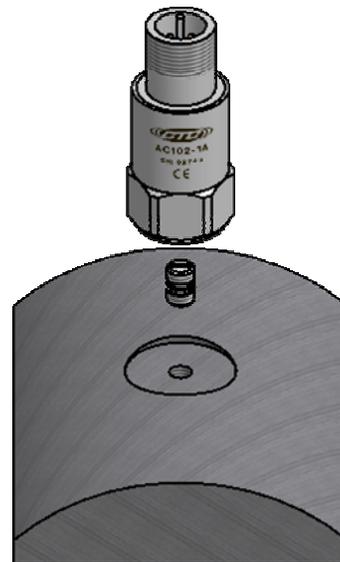


Figure #1

Unfortunately, some motor manufacturers are objecting to the modification of the motor case on an explosion proof motor. The motor manufacturers feel that the small spot faced surface and tapped hole may create a potential failure in the motor case. Since the motor manufacturers also need to meet rigid intrinsic safety requirements, but also understand the benefits of monitoring machine vibrations, an alternate mounting method is required. This application note describes one such method.

Fin Mount Pads:

The Fin Mount Pad is a universally accepted method of mounting accelerometers on motors and is available in various sizes as shown in Figure #2. The Fin Mount Pad is seated in the valley between two cooling fins on the motor, and by applying an epoxy held in place as shown in Figure #3. The accelerometer is then stud mounted or magnet mounted to the Fin Mount Pad to measure the vibration of the motor as shown in Figures #4 and #5. A typical epoxy used in this case is the Devcon Plastic Welder. Although it has very good adhesive properties, and a shore D hardness of 78 providing good transmission of vibration, it is an insulator and will not meet the requirements for intrinsic safety.



Figure #2

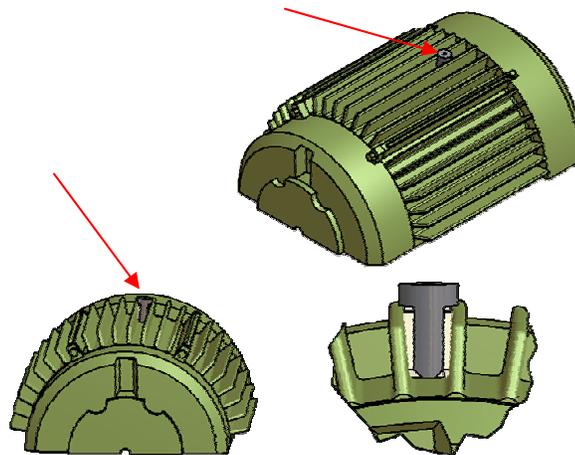


Figure #3



Figure #4



Figure #5

Using a Conductive Epoxy:

Since the typical Devcon Plastic Welder is an insulating epoxy, it is not possible to maintain a conductive bond between the accelerometer, fin mount pad, and motor. The issue of conductive mounting can be solved through the use of a conductive epoxy.

An example of a conductive Epoxy was provided by Resin Technology Group, LLC, 28 Norfolk Avenue, Easton Industrial Park, South Easton, Massachusetts 02375. The product known as TIGA 901 is described as “*an electrically conductive, silver filled epoxy adhesive recommended for electronics bonding and sealing applications that require a combination of good mechanical and electrical properties. This two-part smooth paste formulation of refined pure silver and epoxy is free of solvents and copper or carbon additives. It develops strong, durable, electrically and thermally conducting bonds and coating between many different and dissimilar materials such as metals, ceramics, glass and plastic laminates. TIGA 901 cures at room temperature and can be used as a “cold solder” for heat sensitive components where hot soldering is impractical.*”

The TIGA 901 was provided in a 2.5 gram burst pack that made for very easy mixing of the two parts. Although the required cure time at room temperature is 24 hours, it has a shore D hardness of 85 and should be excellent for the transmission of vibration.

Mounting Procedure:

Once the location on the motor has been identified to place the fin mount pad, the valley between the motor fins needs to have the paint removed so that there is a bare metal surface to work with. This surface preparation must include the valley between the fins and both inside walls of the fins. A sharp bladed scraper or a wire wheel in a drill motor will assist with the surface preparation.

Mix the TIGA 901 and apply it to the valley between the two motor fins. Set the tip of the fin mount pad in the TIGA 901 and temporarily fix it in place for the 24 hour curing cycle. Make sure that only the tip of the fin mount pad is touching the motor case, and that clear space exists on the sides and top of the fin mount pad. An example of this is shown in Figure #6.



Figure #6

After the 24 hour curing cycle, the Devcon Plastic Welder can be added to fill the voids between the walls of the motor fins and the fin mount pad. This provides added strength to the mounting, but does not compromise the conductive bond that was established with the TIGA 901. This secondary epoxy fill will reduce mounting costs and provide side wall support for the fin mount pad as shown in Figure #7.



Figure #7

In tight locations the Devcon Plastic Welder could be applied with a syringe and taper tip to facilitate filling the voids between the walls of the motor fins and the fin mount pad. Once the Devcon Plastic Welder has cured (approximately 5 – 10 minutes), any bare metal may be painted, and the accelerometer mounted.

Figures #8 and #9 are examples of mounting a top exit or side exit accelerometer on the motor fin mount pad.



Figure #8



Figure #9

Summary:

A successful accelerometer mounting has been achieved without altering the physical structure of the motor. Utilizing the TIGA 901 and Devcon Plastic Welder has provided a conductive mounting method at the lowest possible cost with added strength to support the fin mount pad. The actual measured resistance between the fin mount pad and the motor case ranged from 0.1 to 0.2 ohms, and provides safe mounting of the accelerometer in an intrinsically safe environment.