Using the Xgen platform in harsh environments and the use of conformal coating.

Abstract: Conformal coating can be used to increase environmental pollution degrees in which the Xgen series can be designed into. Not only will it prevent short circuits and corrosion of conductors and solder joints, it will minimize dendritic growth and the electromigration of metal between conductors. This paper will give the reader an insight into how Excelsys Technologies incorporates the use of conformal coating, how we have selected the correct coating for our designs, and how they extend the usability of the Xgen platform in harsh environments.

Introduction:

The presence of unexpected particles an electronic assembly can have detrimental affects on the functionality and/or long term reliability. It is critical that such contaminants be quickly isolated and identified so that possible sources can be traced and corrective actions applied to the process. If this is not feasible then the alternative is to incorporate a mechanism onto your design to make the final solution more resistant to such particles. Conformal coatings are materials that are applied in thin layers onto printed circuit boards, electronics components or finished electrical goods. They provide environmental protection than can significantly extend the life of the components and circuitry. In addition, the use of conformal coatings protects circuits and components from abrasion and solvents.

Sources of Contaminants:

Contaminants can come from many sources, such as moisture, dust, airborne particles etc. If these can ingress onto an electrical assembly, while they may not cause an unintentional short, for example, they might have an impact on safety issues such as creepage and / or clearance. The main sources of contaminants would be ionized particles dissolved in moisture, chemicals that may be in the vicinity of the power supply, or airborne compounds which may cause damage. We look at one of these in detail which can have a detrimental impact on electrical design, namely Hydrogen Sulphide.

Hydrogen Sulphide:

Hydrogen sulfide is an extremely hazardous, toxic compound. The gas occurs naturally as a product of decaying sulfur-containing organic matter, particularly under low oxygen conditions. It is always found in in coal pits, sulfur springs, and gas wells.

Studies have shown that hydrogen sulfide (H_2S) contaminants in concentrations as low as 10 ppm may attack surface mount (SMT) electronic components. Long filaments of silver sulfide known as "silver whiskers" can form on the surface of the silver electrical contacts of these electronic components, when exposed to environments containing low levels of H_2S**.**

The presence of heat, chemicals and moisture can accelerated these formations.

Types of conformal coating:

Excelsys Technologies has invested in an extensive research program in order to satisfy ourselves that we are using the most effective coating available for use with our product ranges.

We have reviewed the needs from both a manufacturing point of view, while at the same time ensuring that it is fit for purpose for use in mission critical applications. We have investigated a number of key technical points such as applicator options, methods of curing, toxicity, cost, adhesion, viscosity, suitability of use with our designs, and many more. As a result of this we have ensured that we are using the optimum part for our platform designs.

The conformal coating that is used is material that is consistent with Humiseal 1A33, military qualified coating. This is polyurethane based, which is critical, as acrylic based coating will soften with temperature. It also has a number of chemical properties, which are favourable for use with power supplies such as good dielectric

properties, low thermal resistance, good moisture and solvent resistance.

Conformal Coating process:

Conformal coatings can be applied by dipping, spraying or simple flow coating, and can either be a complete coating of the product, or by select coating, depending on the requirements.

At Excelsys we apply the conformal coating by a combination of spraying and brushing. PowerMods, due to their high number of surface mount components are *sprayed*. PowerPacs, with their larger percentage of through whole components, have their conformal coating *applied by brush.* This is a more effective way of ensuring
coverage on, in particular, the protruding legs of through whole components. After each of these steps, the coverage is verified by inspection under UV light.

How does the conformal coating extend the usability of the Xgen series?

The conformal coating offers a number of ways of protecting the PCB and components.

- If a unit starts up at particularly low temperatures (below -40°C), the subsequent heating of the air will cause condensation on the PCB. If this vapour contains even a few dissolved ions, they will act as a conductor, and may result in a failure of the part. Any ingress of H_2S as described above can result in failures.
- Any ingress of dust, which if contains any metallic substance can inadvertently change the intended circuit design, and result in a failure.
- The corrosive effect of some naturally occurring locations, such as sea air or salt water, can lead to a breakdown of components.

Conformal coating will act as a barrier between all of the contaminants above and the electrical components. There are a number of environments, which are discussed below, where the use of conformal coating can increase the robustness of our platforms in your application.

Environments where Excelsys would recommend the use of a conformally coated unit.

Based on our discussions above, there are a number of environments and industries where we would strongly recommend the use of a conformally coated power supply.

- Sewage treatment plants
- Textile Production.
- Paper manufacturing
- Petroleum Industry
- Manufacture of cosmetics
- Waste Disposal
- Sea borne applications
- Medical applications with use of strong Tesla rated magnets (>0.5 Tesla)

Summary & Conclusions:

The use of conformal coating can provide excellent resistance to external contaminants. The result of this will be an increased robustness of our power design platform for use in environments with a higher requirement of immunity to such contaminants.

The Xgen series of configurable power supplies can be ordered with the option of having parts conformally coated. Please refer to section 3.1 of our online catalogue for further details.

http://www.excelsys.com/overview/

Excelsys Technologies Ltd. is a modern world-class power supplies design company providing quality products to OEM equipment manufacturers around the world. This is achieved by combining the latest technology, management methods and total customer service philosophy with a 20-year tradition of reliable and innovative switch mode power supply design, manufacture and sales. If there are any further points you wish to discuss from this paper please contact support@excelsys.com. Further information on our products can also be found at www.excelsys.com