EFFECTS OF CONCRETE POWDER ON ELECTRONICS

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Dry cleaning of components is not recommended; firstly because the process can create an electro static discharge damage and potentially damage sensitive sub components, and secondly because this process will not effectively remove contamination from underneath close tolerance components or from within inaccessible areas of the equipment.

Constituents of Concrete Powders

Concrete powders usually contain calcium, aluminium and iron salts of oxides, (hydrogen) carbonates and silicates. The percentage composition of the various powders (of domestic and foreign origin) varies so widely that a general statement can be made only with considerable difficulty. On average, the composition could be listed approximately as follows (weight %).

- Ca 47.2%
- Si 12.1%
- Al 6.4%
- Fe 3.5%

Concrete also contains oxides of magnesium and manganese in lower concentrations and additional salts can be added during preparation. Concrete powder is soluble in 1% water or less.

Particle Size

The average particle size distribution ranges from 10 to 500 µm (0.010-0.5mm).

Corrosive Effects of Concrete Powders

Dry concrete powder is not corrosive, the main constituents - carbonates, sulphates and silicates do not have corrosive effects equal to those of chloride, but these anions can also form a very conductive electrolyte on wet surfaces, which can cause not only corrosion but also creep currents and altered transition resistances. Where chloride, in principle, can eternally continue to react corrosively, sulphate can re-enter into the corrosion process on iron at least up to eight times before it is chemically bound up in insoluble corrosion products.

Dry silicates are not corrosive like chloride, but in water they enhance the pH (concentration of hydroxyl anions) to about 10-12 resulting in a highly conductive solution.

Additional Effects of Concrete Powders

The various additives or fillers in concrete agents can also directly damage electronic systems. The added sand, which contains very small, hard, crystalline particles, can become widely distributed. The principal hazard from this contamination is mechanical abrasion on moving parts (bearings, potentiometers, contact areas, etc.) causing higher than normal wear related failures. Additionally, lubrication systems can become blocked and contact problems may occur due to the pure, electrically insulating salt in the concrete powder or to distribution of other additives. From an appearance point of view, scratches or abrasion damage can severely mark external surfaces and damage protective plating or coating lead to surface corrosion.

Damage ranging from severe operational impairment to permanent damage and total loss of contaminated equipment can be anticipated. The electrical reliability of electronic systems is incalculably reduced by the scattering and release of abrasive crystalline components of concrete powder and if the powder is exposed to moisture it can become extremely conductive.

Building Dust

Building dust can contain an assortment of particles:

- Natural building materials such as gravel and sand, quartz silica etc.
- Synthetic materials such as abrasive residues, ceramic materials such as tiles, clinker, brick and ceramics.
- Bonding agents such as plaster, lime, mortar, cement and various epoxy resins.
- Insulation materials such as glass wool, mineral wool and foamed materials.
- Various auxiliary building materials, sealants, timber treatment chemicals and fire protection materials.
- Metallic particles from blasting media, grinding and welding activities.

When construction work is carried out during renovations, a very wide spectrum of dusts of various particle sizes will almost certainly arise, sometimes including very large particles. Due to the extreme hardness of such crystals (e.g. calcium sulphate, calcium and aluminium silicate, sand), mechanical damage is much more pronounced than with normal environmentally sourced dusts.

Building dust is not normally hygroscopic (water-attracting) in nature which means that its fine dry crystals are not caught, as often is the case with 'factory' dust, in a more or less sticky matrix of contamination, but will tend to be agitated and redistributed for several months following renovation work.

Even when freshly distributed, building dust cannot initially penetrate the direct contact areas of internal electrical connectors or printed circuit boards (PCB's). When the connector or PCB is removed and reinserted, scratches can easily occur on plated contacts resulting in increased susceptibility to corrosion and electrical contact problems due to electrically insulating dust entering the connector receptacles.

Plaster Board Dust

Due to its extreme insolubility in water, less than 0.1% soluble, the calcium sulphate in plaster board dust can only be completely removed from PCB components, particularly those with close tolerance surface mount sub components, by utilising a high pressure aqueous cleaning processes.