

TECHNICAL BULLETIN



AUSTRALIAN ALUMINIUM FINISHING

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FARADAY CAGE EFFECT

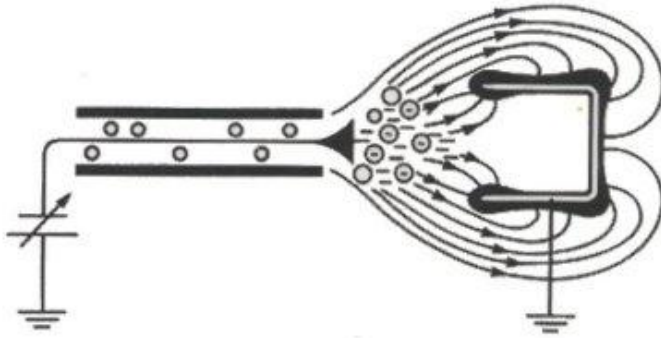
The “Faraday cage” is a term used to describe the fact that a charge applied to conductive material (usually metal) resides only on its surface and has no influence on anything enclosed within it. In 1836, Michael Faraday demonstrated this fact by building a device, later termed the “Faraday cage”.



In day-to-day application, this phenomenon is not visible. However, in a recent scale up version of Faraday’s experiment, it can be seen in the above photo, that the man is protected from the electric arcs by the “Faraday cage”.

APPLICATION TO POWDER COATING

This phenomenon has important relevance to powder coating. In Powder coating, the powder is charged and is attracted to the grounded metal work piece. The charged powder particles tend to follow the electrical field lines between the nozzle of the spray gun and the object.



The diagram above depicts how the electric field lines are preferentially attracted to the outer edges and less attracted to inner corners and recesses. These field lines tend to favour the nearest points of the metal object and become concentrated at exterior corners and outer edges of an opening.

THE EFFECT

The Faraday cage is like an invisible screen that prevents charged powder particles from reaching internal corners and recesses. Charged powder particles tend to favour the closest grounded surface. As a result, the deposit of powder is not even across the metal parts surface.

Generally, it affects powder coating in two ways;

Tendency to have a lower powder coverage inside corners and recesses

Tendency to have a higher powder build on outer edges and surfaces. This also results as an effect of needing to increase powder delivery to try to improve coverage in an adjacent recess area.

THE RISKS

Typically, the more complex the shape, the more likely that the coating thickness will vary across its surfaces.

As a general rule, the deeper a recess (and/or the narrower an opening), the lower, the likelihood of coverage in that recess. If a recess is deeper than its opening, then full coverage is not likely to be achieved in that recess.

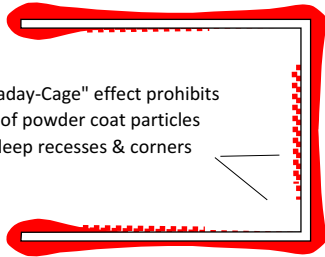
Although exaggerated for illustrative purposes, the images below represent the relative build-up of powder on profiles with recessed areas.

Auto-Spray Coating (only)

Coating on outside is in normal range
Minimal coverage inside recess
Orange-Peel appearance is not pronounced



Wider Opening
Shallower Recess



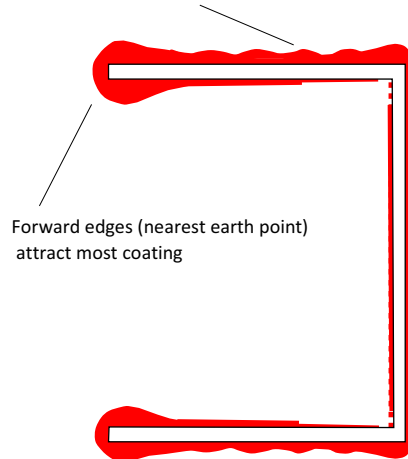
The "Faraday-Cage" effect prohibits majority of powder coat particles coating deep recesses & corners



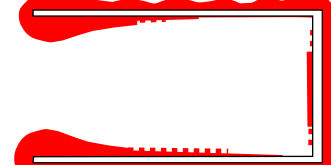
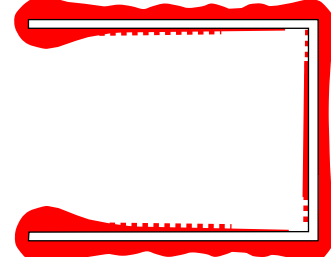
Narrow Opening
Deep Recess

With Extra Hand Touch-up

Little more coverage inside recess
Much more coating on outside of profile
Orange-Peel appearance is more pronounced



Forward edges (nearest earth point) attract most coating



RISK REDUCTION

As detailed in Australian Standard AS3715, in section 1.3.5; *"The Significant surface does not include edges, deep recesses & secondary surfaces"*.

This is recognition of the fact that powder coating is an electrostatic process and is subject to various phenomena including "Faraday Cage Effect".

The following are measures that may help reduce, though not eliminate, the effects of the "Faraday Cage".

- Application equipment (AAF has researched and invested heavily)
- Application control (experienced personnel)
- Addition of manual touch-up, required to try and compensate recess areas. It's reasonable to expect increased variability in thickness and appearance.
- Powder manufacturers' formulating powders that are more "Faraday Cage" friendly
- Part and profile manufacturers designing parts that are more coating friendly
- Discuss with AAF, any particular needs of specific profiles to achieve a certain level of coating. Where we are able to accommodate, we are happy to improve our systems ability to achieve the requirements of our customers.

Note, the appearance of sub-coverage is generally less noticeable with pastel and lighter colours, conversely more noticeable with darker colours.

NOTE

Details contained herewith do not constitute specific advice, merely they are provided as a matter of courtesy and as general information only. You should seek your specialist's advice, to ensure that any information or suggestion meet your specific requirements. Reference should be made to the respective standards for the finish concerned as well as Australian Aluminium Finishing Pty Ltd (AAF) Terms and Conditions of Sale. Latest releases of Australian Standards are available for purchase via the following website; www.standards.com.au

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