

# Engineering Considerations For Anodizing Aluminum

The more information the anodizer can get about the part substrate and method of manufacturing, the better we can ensure it is processed perfectly to specification. Here are some of the most important things to tell us:

- Give us the alloy and heat treat condition
- Use both a specification and the finish name, i.e. Sulfuric Anodize per Mil-A-8625, Type II, Class 2, Black.
- Give us a thickness range
- Any dimensional requirements
- Drawings always help, and if there are masking requirements, they should be highlighted on the drawing
- Sample parts always help, especially with masking

## Aluminum Alloy Selection Suggestions

**2011** – This alloy does fairly well in Type II Sulfuric Anodize, but is more likely to burn in Type III Hard Anodize. This alloy in general does not look as good as 6061 after anodizing.

**2024** – Does very well in Type II Sulfuric Anodize, and dyed various colors. Its high copper content makes it more likely to burn in Type III Hard Anodize. Sharp corners and edges can increase likelihood parts will burn in the hard anodize solution. Undyed hard anodize coating will have a slightly olive tint to it due to the copper.

**6061** – This is the most often used alloy for anodizing. Takes dye well and is also the easiest to Hard Anodize.

**7075** – As with 6061 above, also anodizes well, but is more likely to show corrosion down the road.

**Die Castings** – Die Castings do not typically anodize well due to their porosity and typically high silicon content. When dyed black, they are more likely to look grayish. If the parts need to be stripped and re-anodized for any reason, this opens up additional pores, making the finish look even worse. Bead blasting often helps the appearance.

## Other Considerations

- Any kind of marks due to machining, deburring are often more visible after anodizing
- Uneven bead blasting is much more visible after anodizing, particularly when dyed

- Sharp edges always make a part more susceptible to burning in hard anodizing as more current flows through those sharp points.
- Oil residue in deep blind holes is very hard to remove during the pre-cleaning process, and also will tend to leak out and discolor the finished coating,
- Hard anodize is dielectric and thus an excellent insulator. Threaded holes are often plugged in thicker applications.

## Typical Specifications and Thicknesses

### MIL-A-8625

- Type I Chromic Acid Anodize (0.00002-0.001")
- Type II Sulfuric Acid (Typically 0.0002-0.0006" Thick Coating)
- Type III Hard Anodize (Can vary anywhere from 0.0003" to 0.003". Standard thickness when not specified is 0.002"). Hard Anodizing is generally used for applications that need a corrosion, abrasion, or wear resistant coating. Coating appearance ranges from light to dark gray, depending on the alloy makeup of the aluminum base material, and it can also be dyed black.
- Classes (Applies to all Types)
  - Class 1 – Undyed
  - Class 2 – Dyed (Darker dye colors are better, especially black)

## Typical Anodizing Applications

- Aerospace/Aviation: wear resistance, dry lubrication, longevity and electrical insulation
- Firearms: corrosion and wear resistance
- Machinery: abrasion resistance for high-speed machine parts
- Electronics: uniform emissivity and a high dielectric
- Marine/Naval: corrosion resistance in salt-water environments
- Oil and Petrochemical: corrosion protection and wear resistance.
- Ordnance: corrosion protection, abrasion resistance and wear resistance
- Cookware: corrosion protection and non-stick properties
- Molds and Dies: improved release properties and abrasion resistance

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