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# Metallic Coatings on Aircraft Parts and Fasteners: Cadmium to Zinc-Nickel

Cadmium · zinc-nickel · IVD · anodizing · conversion coat · finish letters

## Metallic coatings at a glance

| Coating | Specification | What it is for | Figures with a public source |
|---|---|---|---|
| **Cadmium plating** | AMS-QQ-P-416 (legacy QQ-P-416) | Sacrificial corrosion protection on steel; paint base; no stick-slip on threads | Not recommended above 450 °F (232 °C, our conversion). Classes by minimum thickness: 0.0005, 0.0003 and 0.0002 in (about 13, 8 and 5 µm) |
| **Zinc plating** | ASTM B633 (legacy QQ-Z-325) | Sacrificial, like cadmium; little used on aircraft structure | Less compatible with aluminium than cadmium |
| **Zinc-nickel** | AMS 2417 | The common cadmium replacement | Provisional: nickel range, temperature types and bake rule are not confirmed here, so no figures are given |
| **IVD aluminium** | MIL-DTL-83488 | Ion vapour deposited aluminium: a non-toxic alternative to cadmium on steel | Classes by minimum thickness: 0.0010, 0.0005 and 0.0003 in (0.026, 0.013 and 0.008 mm) |
| **Conversion coat** | MIL-DTL-5541; material MIL-DTL-81706 | Chemical conversion on aluminium (Alodine, Iridite): corrosion resistance and a paint base; Class 3 keeps the electrical resistance low | 168 h of 5 % neutral salt spray (ASTM B117) required |
| **Anodizing** | MIL-PRF-8625 | An oxide film on aluminium, a good paint base, can be dyed | Types I and IB: 0.5–18 µm (0.00002–0.0007 in). Type II: 1.8–25 µm (0.00007–0.001 in) |
| **Passivation** | AMS 2700; ASTM A967, A380 | Stainless steel: removes free iron and restores the oxide film. Not a coating | Nitric or citric acid, ambient to 60 °C (140 °F, our conversion), usually 20 to 30 minutes or more |
| **Chromium and nickel** | QQ-C-320; QQ-N-290 | Barrier and wear coatings on high-strength steel, such as landing-gear journals | Light buffing only, never below the minimum thickness |
| **Silver plating** | AMS-QQ-S-365 | Locknuts at higher temperature; resists galling | Resists heat to 1,400 °F (760 °C, our conversion) |
| **Black oxide** | MIL-DTL-13924 | Minimal corrosion protection; needs oil or wax | Class 1 for carbon and low-alloy steel, Class 4 for 300-series stainless |
| **Dry film lubricant** | MIL-PRF-46010 | Controlled torque; over cadmium or silver it stops thread seizing | Cure: Type I 150 ± 3 °C (302 °F), Type II 204 ± 3 °C (399 °F), °F our conversion |
| **Thermal spray** | Process, no single specification | Flame, wire-arc, plasma, HVOF and cold-spray coatings | About 20 µm to several mm thick. Aerospace uses are not confirmed here |

## Finish letters in fastener numbers

| Letter | Usually means | Where |
|---|---|---|
| **W** | Cadmium plated | NAS1919 and NAS1921 blind rivets: cadmium on the rivet sleeve. NAS1398 and NAS1399 write CW for stainless, cadmium plated |
| **P** | Lubricated | NAS1919 and NAS1921. Some supplier suffixes use P for passivated: that is a supplier convention, not a standard |
| **J** | Chemical conversion coat (Alodine type) | ASNA solid rivets in 2017A-T4 (DX) and 2117 (DC) |
| **No letter** | Depends on the standard | Many NAS bolts imply cadmium (QQ-P-416 Type II) when no finish letter is added; NAS1580 listings cite cadmium plus chromate, or passivation, depending on the material |

## Key points

- **Cadmium:** sacrificial; not recommended above 450 °F (232 °C); classes 0.0005 / 0.0003 / 0.0002 in.
- **IVD aluminium:** classes 0.0010 / 0.0005 / 0.0003 in; salt-spray hours not published.
- **Conversion coat:** Class 1A best corrosion resistance, Class 3 low resistance; 168 h salt spray.
- **Anodic film does not conduct;** strip it where a joint is bonded.
- **Carbon fibre is cathodic** against aluminium and cadmium: they corrode.
- **Specification and drawing govern.** Figures are public summaries.

## Step by step

1. Find the coating on the drawing or the part number.
2. Look up its specification and class.
3. Check heat, galvanic partner and bonding needs.
4. Restore with the approved process.

**SOURCES** · FAA AC 43.13-1B, Change 1, Chapters 6 and 7 · FAA-H-8083-31B, Aviation Maintenance Technician Handbook: Airframe · Alumiplate, MIL-DTL-5541 approvals page · MIL-DTL-83488D, third-party mirror · Wikipedia: Cadmium plating; Anodizing; Chromate conversion coating; Passivation; Thermal spraying · Distributor finish guides

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Educational reference only, not approved data. Always consult the applicable SRM, AMM, or AC 43.13-1B and your certifying authority.