



AEROSPACE MATERIAL SPECIFICATION

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AMS 2406E

Superseding AMS 2406D

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CHROMIUM PLATING Hard Deposit

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. **APPLICATION:** Primarily for use on ferrous parts for increasing abrasion resistance, increasing tool and die life, maintaining accuracy of gages, reconditioning worn or undersized parts, and increasing corrosion resistance. Plated high strength parts may require special treatments to reduce the embrittling effects of hydrogen pickup.
3. **TECHNICAL REQUIREMENTS:**
 - 3.1 Surfaces of parts to be plated shall be substantially free from blemishes, pits, tool marks, and other irregularities.
 - 3.1.1 Parts to be finished after plating shall have smooth surfaces before plating.
 - 3.1.2 Parts not to be finished after plating shall have a surface finish before plating that is equal to, or smoother than, that required on the parts after plating.
 - 3.2 Unless otherwise specified, parts having hardness higher than Rockwell C 40 and which have been ground after heat treatment shall be suitably stress-relieved before cleaning for plating. Temperatures to which parts are heated shall be such that maximum stress-relief is obtained without reducing hardness of parts below drawing limits.
 - 3.3 When magnetic particle inspection is required, parts shall be so inspected before plating except as permitted in 3.3.1, and shall be so inspected after plating and complete finishing.
 - 3.3.1 Parts having specified maximum hardness of Rockwell C 40 or lower need not be magnetic particle inspected before plating if the specified maximum plate thickness is 0.0015 in. or less.
 - 3.4 Before placing parts in plating solutions, they shall have chemically clean surfaces prepared with minimum abrasion, erosion, or pitting. Except as specified in 3.4.1 and 3.4.2, the final step in cleaning shall consist of anodically cleaning the parts in a chromic acid solution of concentration approximately equal to that of the chromic acid solution used in plating.
 - 3.4.1 For plating nickel base alloys, and for plating other alloys on which a deposit of nickel is used as an undercoating for chromium, the final step in cleaning shall consist of anodically cleaning the parts in a sulfuric-hydrofluoric acid solution (25% by volume H_2SO_4 and 4.5% by volume H_2F_2) or in a 40% (by volume) solution of sulfuric acid.
 - 3.4.2 Other methods of cleaning may be used when agreed upon by purchaser and vendor.
 - 3.5 Tight electrical connections shall be made and maintained for satisfactory plating.
 - 3.6 The plating process consists of electrodeposition of chromium from a chromic acid solution containing added sulfate or fluoride ions. Unless otherwise specified, the chromium shall be deposited directly on the basis metal without a coating of other metal underneath, except in the case of parts made of maraging steels, corrosion-resistant steels, or aluminum alloys, on which a preliminary deposit of nickel or other suitable metal is permissible.

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- 3.7 After plating, washing, and drying, steel parts shall be treated as specified on the drawing to minimize the embrittling effects of cleaning and plating; if no treatment is specified on the drawing, no treatment is required.

Note. For parts subject primarily to tensile or impact stresses in service, heating at $375\text{ F} \pm 10$ ($190.6\text{ C} \pm 5.6$) for not less than 3 hr is recommended. For parts subject primarily to fatigue stresses in service, heating for not less than 2 hr at the highest practicable temperature within the range of 600 - 750 F ($315.6 - 398.9\text{ C}$) consistent with maintaining the specified hardness or strength is recommended.

- 3.8 The finished thickness of plate shall be as specified on the drawing or in a letter of instruction.
- 3.9 The plate shall be substantially uniform in thickness on significant surfaces, except that slight build-up at exterior corners or edges will be permitted provided finished drawing dimensions are met.
- 3.10 No requirements are established for minimum thickness of plate for holes, recesses, contact areas of parts plated all over, and other areas on which a controlled deposit cannot be obtained under normal plating conditions, but such areas shall not be masked to prevent plating unless otherwise specified on the drawing. Unless otherwise noted on drawings, the resulting thickness shall be ignored except when such surfaces of parts can be touched by a sphere 0.75 in. in diameter.
- 3.11 Thickness of plate shall be determined by micrometer measurement, by stripping or dropping tests, by magnetic methods, or by other method agreed upon by purchaser and vendor. The method used shall be calibrated by microscopic examination.
- 3.12 Plate shall be firmly bonded to the basis metal, and shall be smooth and uniform in appearance and, except as noted in 3.12.1, shall be free from frosty areas, pin holes, nodules, blisters, and other imperfections detrimental to performance of parts. The method of determining satisfactory adhesion shall be as agreed upon by purchaser and vendor. Visual inspection may be aided by magnification of not greater than 5 diameters.
- 3.12.1 Pin holes and other imperfections which can be shown to be the result of failure of the deposit to bridge or fill imperfections, such as porosity, in the surface of the basis metal will not be cause for rejection.
- 3.13 The plate shall have hardness not lower than Vickers 700 or equivalent except that plate on parts heated at temperatures between 550 F (287.8 C) and 750 F (398.9 C) may have hardness not lower than Vickers 600 or equivalent.
- 3.14 Parts rejected for defective plating shall be stripped before replating. Spotting-in after plating and double plating unless evidence of satisfactory bond is established shall be causes for rejection. Parts having hardness higher than Rockwell C 40 which have been stripped for replating shall be given a short-time low-temperature stress relieving treatment before replating.

4. PRECAUTIONS:

- 4.1 Recommended maximum thickness of chromium is 0.015 in. except on tools and dies.
- 4.2 Recommended minimum thickness of chromium, when used for protection against corrosion, is 0.002 inch.
- 4.3 Grinding after plating should be done with proper coolant, never dry, and never with a very heavy cut.
- 4.4 The size and shape of parts and the thickness of plate should be considered in providing adequate racks and anodes for plating.