



AEROSPACE INFORMATION REPORT

AIR5885™**REV. A**

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Superseding AIR5885

(R) Landing Gear Common Repair

RATIONALE

This report provides information regarding the most common repairs performed on landing gear structural components made of metallic alloys during overhaul or new manufacture. This document will require periodic review in order to stay up to date with latest repair technologies and processes.

AIR5885A has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This document outlines the most common repairs used on landing gear components. It is not the intention of this AIR to replace overhaul/component maintenance or technical order manuals, but it can serve as a guide into their preparation. Refer to the applicable component drawings and specifications for surface finish, thickness, and repair processing requirements. This document may also be used as a guide to develop an MRB (Material Review Board) plan.

The repairs in this document apply to components made of metallic alloys. These repairs are intended for new manufactured components and overhauled components, including original equipment manufacturer (OEM)/depot and in-service repairs. The extent of repair allowed for new components as opposed to in-service components is left to the cognizant engineering authorities.

Reference could be made to this document when justifying repairs on landing gears. For repairs outside the scope of this document, a detailed justification is necessary. Landing gear repair is often a combination of several repair types defined herein.

It must be understood that all the repairs listed in this document are not to be applied without the involvement of the cognizant engineer.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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Documents

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2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AMS2404	Plating, Electroless Nickel
AMS2406	Plating, Chromium, Hard Deposit
AMS2438	Plating, Chromium, Thin, Hard, Dense Deposit
AMS2460	Plating, Chromium
AMS2759/9	Hydrogen Embrittlement Relief (Baking) of Steel Parts
AMS2759/11	Stress Relief of Steel Parts
AMS-QQ-N-290	Nickel Plating (Electrodeposited)
AIR5913	Landing Gear Component Heat Damage
ARP4462	Barkhausen Noise Inspection for Detecting Grinding Burns in High Strength Steel Parts
ARP4915	Disposition of Landing Gear Components Involved in Accidents/Incidents
ARP5935	Use of HVOF Thermal Spray Coatings for Hard Chrome Replacement in Landing Gear Applications

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E1417	Standard Practice for Liquid Penetrant Testing
ASTM E1444	Standard Practice for Magnetic Particle Testing

2.1.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-STD-865	Selective, Brush Plating, Electro-Deposition
MIL-STD-867	Temper Etch Inspection
MIL-STD-868	Nickel Plating, Low Embrittlement, Electrodeposition (sulfamate)
MIL-STD-870	Cadmium Plating, Low Embrittlement, Electrodeposition
MIL-STD-1501	Chrome Plating, Low Embrittlement, Electrodeposition
MIL-STD-1504	Abrasive Blasting of Aircraft Components
MIL-STD-8625	Anodic Coatings for Aluminum and Aluminum Alloys

USAF drawings available from Hill AFB, Landing Gear Engineering Office.

20157831	Restoration of Dimensional Surfaces of ID Aluminum Cylinders Using Magnetron Sputtering Deposition
200310641	High Velocity Oxygen Fuel (HVOF) Coating Application
201027456	Low Hydrogen Embrittlement Plating Process Specification Zinc-Nickel

2.2 Definitions

ACCEPTABLE AS IS: An engineering disposition given to a part with a departure from its drawing requirements when it is judged that such deviation will have no effect on its functional and structural integrity, as well as on its reliability, interchangeability, and maintainability.

DEPOT REPAIR: Material maintenance or repair requiring the overhaul, upgrading, or rebuilding of parts, assemblies, or subassemblies, and the testing and reclamation of equipment as necessary. Typically performed in a dedicated repair facility.

IN-SERVICE REPAIR: A repair performed on a component that can be accomplished by the aircraft operator, or authorized source, without full disassembly or removal of all coatings.

ORIGINAL EQUIPMENT MANUFACTURER (OEM): Company that designed the component or subsystem.

OVERHAUL MANUAL (OHM)/COMPONENT MAINTENANCE MANUAL (CMM): Repair instructions for a component or subsystem.

REPAIR: An engineering disposition to restore a component to within acceptable limits of its design requirements without adversely affecting its interchangeability, reliability, and maintainability while maintaining its functional and structural integrity.

REWORK: An engineering disposition to restore a component to within its drawing requirements.

3. CLASSIFICATION

Type I: Depot repair with functional plating, coating, surface modification

Type II: Repair with bushing

Type III: Repair of damage marks

Type IV: Repair of localized heat damaged surface

Type V: Localized repair of damaged plating

Type VI: Repair of damaged threads

Type VII: Repair of lubrication hole

Type VIII: Repair of lugs with spherical bearing

Type IX: Repair of plastically deformed surface

Type X: Repair of mis-located features

Class 1: Ferrous alloys

Class 2: Aluminum alloys

Class 3: Titanium alloys

4. REPAIRS

4.1 Type I (Depot Repair with Functional Plating, Coating, Surface Modification)

4.1.1 Plating

The cognizant engineering authority should evaluate each application to determine the appropriate repair. There are different types and classes of surface coatings which can affect the reliability and maintainability of the components being repaired. Reference to reliable data on the fatigue impact due to the application of the coating is recommended for any plating repair.

Shot peening (or other residual compressive surface stress process) of reworked areas prior to plating is required. Stripping and re-plating is recommended rather than attempting to plate over breakthroughs or damaged areas. Caution should be given to minimize amount of repeated electro-plated operations for high-strength Class 1 materials to mitigate risk for hydrogen embrittlement. Peening layer integrity after multiple strip/replate operations should also be considered, depending on shot peen intensity.

Electro or electroless plating on Class 3 materials is not often done because of difficulty achieving proper adhesion, but it can be successfully accomplished by some repair facilities.

Be sure to account for masking allowance and plating/coating runout (plating/coating taper from full thickness to zero thickness) at the boundaries of the plated area in your repair definition. Masking tolerance and plating/coating runout may consume as much as 0.080 inch of surface length at each end of the plating.

4.1.1.1 Repaired surfaces of cylinders and rods that have dynamic seals and bearings running against them should be repaired in such a way that they meet the original requirements for surface finish chrome plating.

Chrome plate repairs are typically limited to a deposited thickness of 0.012 inch (0.3048 mm), since a heavier plating thickness could severely affect the fatigue life of the part, due to the residual tensile stresses induced at the base metal surface. It may also be necessary to limit chrome plating thickness to avoid delamination and excessive mud cracking for items under high stress/strain/reverse-high-loading conditions. In general, increased-thickness chrome plate repair should be used only in locations where plating already exists or where the Overhaul Manual (OHM)/Component Maintenance Manual (CMM) allows it.

This repair is used when a hard, wear-resistant, and low-friction surface is required. It can be used over other softer plating, like sulfamate nickel, when a hard wear surface is required. Thick chrome repairs, requiring post-plating grinding operations, in reworked areas for high-pressure nitrogen seal applications, are not typically recommended.

Chrome plating is widely used on all Class 1 materials, including low alloy high strength up to 300 ksi (2068 MPa). Precautions are often taken when applying on stainless steel components due to adhesion difficulties. For Class 2 materials, because of their metallurgical surface characteristics, multiple undercoatings are normally required, such as zinc, copper, and nickel.

Components using the chrome plate process on Class 1 materials are hydrogen embrittlement relief baked per the applicable specification.

4.1.1.2 Sulfamate Nickel Plating

The allowable thickness for sulfamate nickel plating is limited by the amount a particular plating shop can apply. Achievement of thick coating will normally require multiple plate-machine-plate operations. Machining rather than grinding is advised because the relatively soft coating can smear. Shot peening (or other residual compressive surface stress process) prior to plating is required.

Plating thickness should be evaluated for strength impacts and potential hydrogen embattlement effects for thicker plating applications greater than 0.012 inch thick. Typically, the strength of the plating becomes less as thickness increases.