BOMBARDIER
LEARJET ENGINEERING SPECIFICATION

NO: LES 1048 AG

TITLE: CADMIUM PLATING SPECIFICATION - STEEL AND COPPER ALLOYS

Author: Chris Heitkamp Ext. 2454 Date Req’d: A/R

Release Date: 06-16-2008

☑ Checked By/Group Engineer Kevin D. Haas APPROVED; 5/20/2008
☐ Eng. Rep. Interiors
☐ Eng. Rep. Flt Analysis
☐ Material & Processes Richard L. Meeske APPROVED; 6/1/2008
☐ Quality Assurance John Ware APPROVED; 5/20/2008
☐ Methods Mike A. Grommesh APPROVED; 5/21/2008
☐ Procurement Denise M. Karst
☐ Configuration Control Tracy L. Goertzen APPROVED; 6/16/2008

LJL-508-AO

PROPRIETARY NOTICE
This document contains proprietary designs, specifications, data, information and technical material that are the sole property of LEARJET, INC., to be held and treated by its recipient on a confidential basis, and not to be shown or disclosed to any unauthorized organization or person.
## REVISIONS

<table>
<thead>
<tr>
<th>REV LTR</th>
<th>DATE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA</td>
<td>06/23/89</td>
<td>Revised entire specification to new P C format. For revision status of revisions A thru W, see Rev. W. Revised ¶ 5.6 to correct baking temperature.</td>
</tr>
<tr>
<td>AB</td>
<td>05/25/90</td>
<td>Revised ¶ 4.0 to add new ¶ 4.1.4 to cover requirements that parts shall be stripped prior to being replated. Revised ¶ 5.8 to update requirements.</td>
</tr>
<tr>
<td>AC</td>
<td>12/23/92</td>
<td>Added NOTE to ¶ 1.0.</td>
</tr>
<tr>
<td>AD</td>
<td>03/22/93</td>
<td>Clarified NOTE in ¶ 1.0.</td>
</tr>
<tr>
<td>AE</td>
<td>11/06/00</td>
<td>Revised entire specification to accommodate current sub-tier plating procedures and Bombardier specifications. DCP # 99-L0022.</td>
</tr>
<tr>
<td>AF</td>
<td>11/02/01</td>
<td>Revised entire specification to put into the new electronic sign-off format. Added BAPS 160-008 in ¶ 2.1. Added Bombardier Aerospace specifications in ¶ 3.0. Added BAPS 160-008 in ¶ 4.2 and ¶ 4.3. In ¶ 4.6 revised to BAPS 168-006 requirements.</td>
</tr>
<tr>
<td>AG</td>
<td>05/12/08</td>
<td>Revised entire specification to latest template. Added note to ¶4.6 to allow AMS-QQ-P-416B to be used as an equivalent. Added AMS 2750 to ¶3.1.2 and ¶5.3. Reference eRFC 100206. Effectivity N/A.</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

1.0 PURPOSE..............................................................4

2.0 SCOPE AND CLASSIFICATION.............................................4

3.0 REFERENCES...........................................................4
3.1 Federal..................................................................Error! Bookmarks reference unavailable.
3.2 Bombardier Aerospace.................................................5
3.3 Learjet..............................................................5

4.0 REQUIREMENTS.........................................................5
4.1 General..................................................................5
4.2 Cleaning..................................................................6
4.3 Plating...................................................................6
4.4 Thickness................................................................6
4.5 Supplementary Treatment............................................7
4.6 Embrittlement Control................................................7
4.7 Adhesion..................................................................7
4.8 Corrosion Resistance..................................................7
4.9 Stripping..................................................................7

5.0 QUALITY CONTROL REQUIREMENTS.........................................8
1.0 PURPOSE

This specification established the requirements applicable to cadmium plating of copper alloys and steels heat treated to a tensile strength not greater than 220,000 psi.

2.0 SCOPE AND CLASSIFICATION

2.1 This Specification shall govern cadmium plating for Learjet when specified directly or indirectly on the Engineering Drawing. This Specification covers the cadmium plating of copper alloys and steel heat treated to a tensile strength not greater than 220,000 psi.

EXCEPTION: Springs shall be plated per this Specification regardless of heat treat. Embrittlement control of springs shall be in accordance with ¶ 4.6.

Processes meeting the requirements of specification QQ-P-416 or BAPS 160-008 may be used as equivalent by sub-contractors provided the requirements of ¶ 4.0 of this Specification are complied with.

2.2 Cadmium plating covered by this Specification shall be the following types:

2.2.1 Type I - Without any supplementary treatment.
2.2.2 Type II - With supplementary chromate treatment.
2.2.3 Type III - With supplementary phosphate treatment.
2.2.4 If Type I, II or III is not specified on the Engineering Drawing, Type II shall be applied.

3.0 REFERENCES

Except where a specific revision is indicated, the current revision of the following references shall be considered a part of this specification to the extent indicated herein.

3.1 Federal

3.1.1 AMS-QQ-P-416 Plating, Cadmium (Electro Deposited).
3.1.2 AMS 2750 Pyrometry.
3.2 Bombardier Aerospace

3.2.1 BAPS 160-008 Cadmium Plating of Steels Heat Treated to Less Than 220 KSI and Copper Alloys

3.2.2 BAPS 168-006 Baking of Steel for Relief of Hydrogen Embrittlement

3.2.3 BAERD GEN-007 Engineering Requirements for Heat Treating Equipment and Hot Forming Equipments

3.3 Learjet

3.3.1 LES 1006 Magnetic Particle Inspection

3.3.2 LES 1007 Non-Destructive Inspection Specification

3.3.4 LES 1043 Chemical Cleaning of Metals

3.3.5 S-100 Learjet Finish Code

4.0 REQUIREMENTS

4.1 General

4.1.1 Unless otherwise specified, plating shall be applied after all machining, brazing, welding, and forming of the part have been completed. Cadmium shall be deposited directly on the basis metal without a preliminary plating of other metal, except that a preliminary nickel strike may be applied to corrosion resistant steel parts.

4.1.2 Unless otherwise specified, all dimensions shown on the Engineering Drawing are "after-plating" dimensions.

4.1.3 Those areas not requiring plating shall be masked off. Masking may optionally be done prior to cleaning.

4.1.4 All parts that are to be replated, shall be stripped per ¶ 4.9 prior to replating.

4.1.5 Holes up to 1/4 inch in diameter may be drilled in cadmium plated parts up to 0.250 inch in thickness after plating. It should be noted, however, drilling operations should be performed before cadmium plating whenever practical.
4.2 **Cleaning**

Cleaning of parts prior to plating shall be performed according to the requirements of QQ-P-416 or BAPS 160-008, with the following additional requirements:

4.2.1 Steel parts not to be machined all over shall be descaled (mechanically cleaned) to avoid excessive chemical cleaning. This mechanical cleaning should be done prior to any finish machining to avoid changes in dimension or finish of machined surfaces by descaling operations.

4.2.2 Parts shall be vapor degreased or solvent cleaned prior to plating. Steel parts must be thoroughly cleaned and derusted, preferably by anodic cleaning, so that only brief pickling will be required. Do not use cathodic (direct) electro-cleaning on steel parts heat treated over 180,000 psi (Rc40).

4.3 **Plating**

Parts shall be cadmium plated in accordance with QQ-P-416 or BAPS 160-008.

4.4 **Thickness**

Unless otherwise specified on the Engineering Drawing, plating thickness requirements shall be as follows:

4.4.1 Externally threaded parts shall be plated to 0.0002 to 0.0003 inch plating thickness. (Learjet Finish Code F-9)

4.4.2 Holes, recesses, internal threads, surfaces which cannot be touched by a ball 0.75 inch in diameter, and other areas where a controlled deposit cannot normally be obtained shall not be subject to a thickness requirement.

4.4.3 All other surfaces shall be plated to 0.0003 to 0.0005 inch plating thickness. (Learjet Finish Code F-8)

4.4.4 The minimum allowable and maximum desirable plating thickness shall be as specified to ¶ 4.4.1 and ¶ 4.4.3. Parts shall not be rejected for exceeding the maximum plating thickness unless the excess plate interferes with the functioning of the part.
4.5 Supplementary Treatment

4.5.1 The chromate treatment for conversion to Type II shall produce a continuous, smooth, distinct protective film, distinctly colored iridescent bronze to brown.

4.5.2 The phosphate treatment for conversion to Type III shall produce a continuous evenly deposited film of uniform texture and dark grey to black color.

4.5.3 Cadmium plated surfaces over which organic finishes are to be applied shall be given a supplementary chromate treatment for conversion to Type II, or a supplementary phosphate treatment for conversion to Type III.

4.6 Embrittlement Control

The processing of externally threaded steel parts heat treated to over 160,000 psi (Rc36) shall conform to the requirements of BAPS 168-006. The processing of all other steel parts heat treated to over 180,000 psi (Rc40) shall conform to the requirements of BAPS 168-006 specifically applicable to such parts.

NOTE: AMS-QQ-P-416 or BAPS 168-006 may be used as equivalents for embrittlement control.

4.7 Adhesion

The adhesion of the plating shall conform to the requirements of QQ-P-416.

4.8 Corrosion Resistance

Type II plating shall show no white corrosion products of cadmium in accordance with the requirements of QQ-P-416.

4.9 Stripping

Parts having defects or incorrect processing shall be stripped and replated, except that parts subjected to embrittling processes in violation of the procedural requirements of this Specification shall be rejected. Steel parts heat treated over 180,000 psi (Rc40) shall be stripped only in ammonium nitrate solution per LES 1043.
5.0 QUALITY CONTROL REQUIREMENTS

5.1 Records of solution control, oven control, and testing shall be kept complete and available. The records shall contain all data necessary to show compliance with the requirements of this specification.

5.2 Parts shall be magnetic particle inspected if specified on the Engineering Drawing, or if required per LES 1007. Magnetic particle inspection shall be done in accordance with LES 1006. This inspection shall be performed after heat treating, machining, and forming but prior to all finishing operations such as plating or painting.

5.3 Ovens used for hydrogen embrittlement baking shall conform to the requirements of BAERD GEN-007 or AMS 2750.