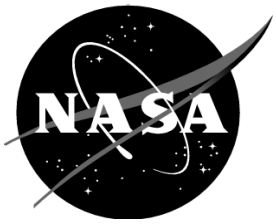
Process Specification for the Chemical Conversion Coating of Aluminum Alloys

Engineering Directorate

Structural Engineering Division

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REVISIONS		
VERSION	**CHANGES**	**DATE**
--	Original version	5/15/96
A	Reviewed and update for accuracy; Author changed	7/21/99
B	Limited the brush application for conversion coating in section 9.0	8/25/05
C	Reviewed and updated for accuracy. Deleted an obsolete “Prepared by:” signature block and updated the MIL specification number.	12/31/07
D	Major reorganization of document. Added chemical conversion coating types, manual and touch-up descriptions, and bonding to Section 3.0. Updates to section 6.0.	7/2020
E	Minor wording changes for clarity. Elaboration of temp limitations and removal of oxide in Section 6.	6/2026

1.0 SCOPE

This process specification establishes technical requirements for the manual application of chemical conversion coatings on aluminum and aluminum alloys.

2.0 APPLICABILITY

This process specification covers the requirements for two classes of chemical conversion coatings formed by the reaction of chemical conversion materials and the surfaces of aluminum and aluminum alloys. Conversion coatings covered by this specification are intended to provide increased corrosion resistance and/or a surface having better paint adhesion than uncoated aluminum. They are not intended to be used for decorative applications.

3.0 USAGE

This process specification shall be called out on the engineering drawing by using a drawing note that identifies the process specification, type, and class of the conversion coating to be used. For example:

CHEMICAL CONVERSION COAT PER PRC-5005, TYPE I, CLASS 1A

The two types of chemical conversion coatings are:

Type I Compositions containing hexavalent chromium

Type II Compositions containing no hexavalent chromium

If type is not specified on the drawing, then Type I shall be used.

Due to environmental effects of hexavalent chromium, there have been great efforts made to use Type II chemical conversion coatings; however, Type I coatings consistently outperform Type II coatings in corrosion tests, especially with filiform or deep scratch type tests. Hexavalent chromium migrates to the deep scratch locations providing extra corrosion protection. Therefore, Type I is recommended for most flight hardware applications.

The two classes of chemical conversion coatings are:

Class 1A For maximum protection against corrosion, for surfaces to be painted or left unpainted

Class 3 For protection against corrosion where lower electrical resistance is required

CHEMICAL CONVERSION COAT REMACHINED AREAS USING THE MANUAL PROCESS PER NASA/JSC PRC-5005.

Chemical conversion coating provides a good base for paint primers but only a fair base coat for bonding. Chemical conversion coating is usually applied to bond surfaces to protect them from oxidation and corrosion before adhesive bonding occurs. The standard method for painting is to leave the chemical conversion coating in place to simplify surface preparation. The standard method for adhesive bonding is to remove the chemical conversion coating during surface preparation to improve bond strength. If the design requires the opposite of either standard method to occur, it shall be specified on the drawing. For example:

CHEMICAL CONVERSION COATING (*in area identified*) SHALL BE REMOVED BEFORE APPLYING (*primer*) TO BARE METAL.

DO NOT REMOVE CHEMICAL CONVERSION COATING (*in area identified*).

For any primer or bonding to have adequate adhesion, it is important that the primer or adhesive be applied in less than 48 hours after the conversion coating process is performed; refer to the adhesive bonding specification for time limits.

3.1 WORK INSTRUCTIONS

Work instructions shall be generated for implementing this process specification. The work instructions shall contain sufficient detail to ensure that the manufacturing process produces consistent, repeatable products that comply with this specification.

For work performed at JSC facilities, these work procedures shall consist of Detailed Process Instructions (DPI's).

For contracted work, the contractor shall be responsible for preparing and maintaining, and certifying written work procedures that meet the requirements of this specification.

4.0 REFERENCES

The following references were used to develop this process specification. All documents listed are assumed to be the current revision unless a specific revision is listed:

SOP-001.2 Preparation and Revision of Process Specifications

JPR 8500.4	Engineering Drawing System Requirements
MIL-DTL-5541	Detail Specification, Chemical Conversion Coatings on Aluminum and Aluminum Alloys

5.0 MATERIALS REQUIREMENTS

Material requirements shall be as specified in MIL-DTL-5541.

If no type is specified on the drawing, then Type 1 shall be used.

6.0 PROCESS REQUIREMENTS

All chemical conversion coating of aluminum alloys shall be conducted in accordance with MIL-DTL-5541. Manual (brush) conversion coatings are only allowed if specifically called out on the engineering drawing.

Touch-up repairs using manual (brush) conversion coatings shall be performed only when approved by a Materials Review Board (MRB).

Surfaces shall have any oxidation removed via a mechanical or chemical method to achieve a water break-free surface before the chemical conversion coating is applied. Iron-based abrasives such as steel wool or iron oxide shall be avoided for the surface preparation processes.

The chemical conversion coating must be rinsed after application to ensure that the acids and salts in the process solution are removed before the coating dries.

Chemical conversion coating shall be removed when preparing for adhesive bonding unless otherwise specified by the engineering drawing. The time between application of chemical conversion coatings and painting or adhesive bonding shall be as specified to prevent problems with adhesion. Refer to the adhesive bonding specification for the time limit. When the conversion coating will be removed during the bonding or painting preparation process, there is no time limit.

Temperature Limitations: Conversion coatings may be degraded by exposure to moderate temperatures that are sometimes encountered during processing or in service. Aluminum alloys in the 2000 and 7000 series shall not be exposed to temperatures above 130°F in an uncoated condition. All other alloy series shall be limited to 140°F when uncoated. Higher temperatures are permitted for bonded and painted surfaces during curing and service. If a higher temperature exposure for a short time is needed, for example, exposure of an uncoated surface during curing of a different area, the integrity of the conversion coating shall be verified by the corrosion test found in MIL-DTL-5541, section 4.4.1 to show no degradation as compared to unheated coatings.

7.0 PROCESS QUALIFICATION

Qualification of conversion coating processes shall be as specified in MIL-DTL-5541.

8.0 PROCESS VERIFICATION

Process verifications shall be as specified in MIL-DTL-5541.

9.0 PERSONNEL TRAINING AND CERTIFICATION

All chemical conversion coating of aluminum alloys shall be performed by personnel qualified to conduct the process through training or experience. If these processes are to be performed by an outside vendor, the development of an appropriate training program shall be the responsibility of the vendor.

10.0 DEFINITIONS

Hexavalent Chromium	Also known as Chromium (VI), Cr (VI), and chromium 6. It is the chromium element in any chemical compound found in the +6 oxidation state, the hexavalent state.