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Air Methods Process Specification

AMPS 020-0292

UNITED ROTORCRAFT ENGINEERING INTERPRETIVE DOCUMENT

Revision: C	Date: 06/28/2022

Revision History

The latest revision of this document is indicated by the highest revision letter as listed below in the Revision History. All pages are revised when any page is changed so that all pages maintain the same revision level. A "List of Effective Pages" is therefore not included. Changes to the current revision will be indicated within the document by change bars in the right margin.

Revision	Date	Prepared By	Checked By	Design Check By	Approved By	Quality Check By
IR	09/23/2019	T. Muir	J. Whorton 9/27/19	T. Muir 9/25/19	Jared Moyer 9/27/19	Joseph Moyer 9/17/19
Description of Changes:		Initial release				
A	06/01/2020	T. Muir	T. Muir 6/22/20	T. Muir 6/22/20	J. Moyer 6/22/20	J. Moyer 6/22/20
B	05/23/2022	A. Miles	A. Miles 5/24/22	A. Miles 5/24/22	T. Biegler 5/24/22	M. Knight 5/24/22
C	06/28/2022	A. Miles				
Description of Changes:		Modified 5.1 to include Water Immersion testing as an alternate to Humidity Testing.				

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1 Introduction

United Rotorcraft holds the design authority for a variety of commercial and military aircraft, as well as ground vehicle systems and components.

The data and documents that apply to these systems and components have been produced over a number of years and under different technical leadership and varying requirements.

All data and documents have been approved and conformed under the applicable regulations and requirements at the time of initial release/manufacture.

As a result of the long production lives of designs, and as part of the natural refinement in data and build packages, discrepancies may arise when evaluating legacy products employing methods that have been refined over time.

This document clarifies Engineering's interpretation of the technical data where that data may be too vague to align with currently accepted methods.

2 Applicable Documents

- Ref I: MMPDS-01 Metallic Materials Properties Development and Standardization
- Ref II: AMTD 040-2016 Acceptable Alternate Forms of Aluminum Alloys

3 Engineering Interpretations

3.1 Materials-Related Interpretations

3.1.1 If a drawing specifies an aluminum alloy and temper but the temper does not contain the form suffix (i.e., AL 7075-T651 for plate), but does specify the form in nomenclature (i.e., "plate"), then this is an acceptable condition. See AMTD 040-2016: Acceptable Alternate Forms of Aluminum Alloys.

3.1.2 Many legacy drawings specify the finish material thickness in the materials block of the drawing. When the material block thickness is equal to the finish thickness of the part, the intent is to make the part from the next level thickness of material per the MMPDS-01.

3.1.3 If a data tag or shim specifies use of a material (i.e., aluminum), but does not specify alloy or temper, any alloy or temper of that material may be used.

3.1.4 If a material (typically Aluminum) used to make a part is thinner than the drawing specifies but the finished part cleans up completely, mill finish removed from surface, this is an acceptable condition as long as all other physical characteristics are met (i.e. material type and form).

3.2 Dimensional and Tolerance Interpretations

3.2.1 Threaded holes – Where thread depths are not defined to be minimum clear threads, and the depth of a threaded hole exceeds the dimension specified in the tolerance block, this is an acceptable condition unless the hole breaks thru where “no breakthru” is specified. Engineering considers the depth of threading requirement to be a minimum number of clear threads required.

3.2.2 Unless otherwise specified, all wire harness tolerances are to be -0.00” / +1.00”.

3.2.3 Unless otherwise specified, machined surface finishes are to be √125 or better. Surfaces that are not visible upon installation may be up to √250.

3.2.4 For drilled or otherwise machined holes with a 3-place callout, TABLE 1 will be referenced for tolerances and not the tolerance block on the drawing. If specification AND10387 is called out on the drawing, it is superseded by Table 1 of this document.

3.2.5 If a dimension on a composite or upholstered part is a function of the mold or template it is considered (Ref).

3.2.6 On pocket inside and bottom radii of machined parts the drawing intent is that they are to be measured with radius gauges in a manner that ensures that the correct cutting tool was used.

3.2.7 On placards which were designed to be made photographically on which datum targets are indicated, the placard is scaled relative to the targets. Therefore, its dimensions are approximate. The placard is subsequently trimmed to the outside of the placard border.

3.2.8 If a dimension on a part is consumed by a subsequent shop operation or dimension it is not necessary (or possible) to measure the consumed dimension.

3.3 Other Miscellaneous Interpretations

3.3.1 When finishes and/or silkscreen are called out IAW a recognized specification (i.e., a Mil Spec), the methods indicated in section 3 of AMPS 020-0135 shall be used with respect to masking, tolerances, finish in threaded features and minor cosmetic defects.

3.3.2 When a sheet metal or thermoplastic part is found to be out of tolerance but can be flexed to be in tolerance with moderate effort of up to 5 lbs., this is an acceptable condition.

3.3.3 If a rivet is called out on an Engineering document/drawing but the assembly stack up requires the length to vary from that which is called out, it is permissible to upsize or downsize the rivet length in accordance with $L_{Rivet} = (Dia._{Rivet} \times 1.5) + Grip$.

3.3.4 If a placard or label is covered by a protective clear coating or layer that is applied as part of the manufacturing process, this is an acceptable condition.

3.3.5 Current convention for “as required” items on drawings is to call out “1” as quantity and “AR” as unit of measure. Previous convention was to call out “0” and “AR”. The intent is to use the “1 AR” convention going forward. Use of the legacy “0” and “AR” is an acceptable condition.

3.3.6 When finishing is called for on an engineering drawing and masking of threaded features is called for, if there are no threaded features on the part itself, masking of threaded features can be omitted.

3.3.7 When the finishing requirements on the drawing calls for Type III anodize to be sealed with boiling deionized water it is permissible to use other sealing methods (except for sodium dichromate) as specified in MIL-A-8625 paragraph 3.8.2.

3.3.8 When drawings call for “Alodine 1201” or other Alodine Brand name products used for conversion coating, it is acceptable to use equivalent conversion coat products IAW MIL-DTL-81706 and listed on QPL-81706.

3.3.9 When drawings call for Conversion Coat IAW APS 020-0135 or MIL-DTL-5541, followed by anodize, and there are no threaded features or any other features identified to be masked, it is permissible to omit the conversion coat process.

3.3.10 When the title block of a drawing specifies weight of the item, it is considered (Ref).

3.3.11 It is permissible to use fasteners ±1 length from nominal length specified in assemblies and installations. A minimum of 1 complete thread is to be showing beyond the nut (ref AC 43.13). Care must be taken to ensure that the end of the fastener cannot damage adjacent components.

3.3.12 When a vendor/manufacturer/supplier is specified on a drawing, the intent is to supply the original manufacturer when known. Otherwise, it is acceptable to specify a vendor. Alternatively, when a distributor is called out but the same item is purchased from another distributor, it is acceptable to use – i.e., manufacturer and item are the same. Likewise, if the item is made to a standard or specification, it is acceptable to purchase from any certified vendor.

4 Tolerances

For holes drilled with a drilling machine or other device using suitable jigs and fixtures, the hole tolerances depend upon the diameter of the hole and increase as the hole diameter increases. The following are standard tolerances for general machine work and apply in all cases except where greater or lesser accuracy is required by the design:

TABLE 1: STANDARD DRILLED HOLE TOLERANCES

HOLE DIA	TOLERANCES
.0135 THRU .125	+ .004 - .005
.126 THRU .250	+ .005 - .005
.251 THRU .500	+ .006 - .005
.501 THRU .750	+ .008 - .005
.751 THRU 1.000	+ .010 - .005
1.001 THRU 2.000	+ .012 - .005

5 Metallic Material Post-Processing

Except for individual component dimensions, United Rotorcraft engineering drawings are end-item drawings. These drawings may include several material processing requirements without specifying the order of operations or required steps in between processing/treatments. The below sections are intended to provide additional information about common material processing and treatment callouts made on United Rotorcraft engineering drawings for metallic component parts.

5.1 Passivation

For the passivation of metallic parts, the typical United Rotorcraft drawing callout is:

"PASSIVATE IAW AMS 2700 METHOD **X**, TYPE **Y"**

This reference to AMS 2700 invokes only the passivation method and type but does not specify all information to be included on the purchase document. The list, and table below have been created to improve the communication of passivation requirements and is intended to mitigate the risk of component part corrosion susceptibility.

1. Treatments completed prior to passivation
   To ensure the removal of scale or foreign materials prior to passivation, all component parts are to be cleaned per AMS 2700 Paragraph 8.8. Specifically for heat treatment scaling and discoloration, parts are to be cleaned in accordance with ASTM A 380 Paragraph 5.2.1.

2. Material to be passivated
   The component material will be specified elsewhere on the component drawing. Typically in another drawing note, or in a material table in the drawing title block.

3. Acceptance Test/Verification Class (Class I, II, III or IV)
   Unless otherwise specified, it is to be assumed that all parts are Class IV.

4. Corrosion Resistance Properties & Testing Method
   Unless otherwise specified, all parts shall meet one of the following corrosion resistance conditions and the subsequent requirements of:
   a. AMS 2700, Paragraph 3.2.1.1 – Humidity
      Humidity testing to be performed per AMS 2700 A.3.2 Method 101 – High Humidity Test.
   b. AMS 2700, Paragraph 3.2.1.2 – Water Immersion
      Water immersion testing to be performed per AMS 2700 A.3.1 Method 100 – Water Immersion Test.

   In addition to meeting the above listed corrosion resistance requirements, all parts must meet the requirements of AMS 2700, Paragraph 3.2.2 – Surface Appearance.

5. Post Treatment Requirements
   When a post treatment is specified, parts shall be processed per AMS 2700 Paragraph 3.1.5. If no information is provided to determine the post treatment of parts, parts shall also be processed per AMS 2700 Paragraph 3.1.5.

6. Quantity of Parts
   The quantity of parts to be passivated shall be specified on the procurement documentation.

In the event component passivation per AMS 2700 is called out but does not specify the passivation type or method, Table 2 shall be used. If the material to be passivated is not specified in Table 2, a recommended passivation solution shall be used per AMS 2700 Table IV with the approval of a cognizant engineer at United Rotorcraft.

Table 2: United Rotorcraft Material Passivation Solution Requirements

	Alloy UNS (Material)	Method 1								Method 2
		Nitric Acid Type								
		1	2	3	4	5	6	7	8	
Austenitic										
Ferric										
Free Machining										
Martensitic										
Precipitation Hardening	S17400 (17-4)	X								