AIPS
Airbus Process Specification

Marking by Vibro-Engraving

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Contents

1 Scope

The purpose of this specification is to give Design and Quality requirements to manufacturers. Although the essential requirements of a process will be described in detail, the specification does not give complete in-house operation instructions, these shall be given in the manufacturers supporting work instructions.

This Airbus Process Specification establishes the requirements for the marking of metallic aircraft parts by vibro-engraving.

2 Normative references

AIPS 09-01-002:	Cleaning with solvents
AIPS 08-03-002:	Permanent marking with ink
EN 9103	Quality management systems – Variation management of key characteristics

Use the latest issue of the document.

3 Definition, applicability and limitations

- Vibro-engraving shall be used for the permanent marking of metallic parts when required by the Engineering drawing. However, it may also be used without a drawing requirement in areas to be removed after processing.
- This marking method is usually carried out at an early stage of processing, prior to the application of protective treatments (cadmium plating, anodising, …)
- This AIPS is not applicable for marking on the surface of parts whose thickness is lower than or equal to 0,8mm.
- The location of the marking shall be as indicated on the drawing. Locations where vibro-engraving should not be performed are:
    - bolts or screws, except on the surface of the heads;
    - on hardened surfaces;
    - in the direct area of fastener holes;
    - on or in the direct area of weld beads;
    - on faying surfaces, …

4 Requirements to be met by the process

4.1 Performance level and design requirements

- Markings shall be legible before and preferably after protective treatments (see para. 6.4), without affecting other requirements such as mechanical (static and fatigue) strength, dimensional tolerances, etc…
- Engraving depth shall not be over 0,07 mm, but sufficient to assure legibility, depending on base material, character size and thickness of protective coating.
- Dimensions of characters shall be from 2,5 mm to 4,0 mm in height.

4.2 Key characteristics

Key Characteristics acc. to EN9103 are defined by responsible engineering based on a risk analysis for parts manufactured by this process. Key characteristics shall be defined on product level and if necessary also on process level.
They shall be subject to variation control by production organization according to EN9103.
Key Characteristics do not relieve the production organization from meeting all engineering requirements defined in this document.

Table 1: Key Characteristic

Product Key Characteristic			Process Key Characteristic		
No.	**Designation**	Requirement / **Limit**	**Sub.-No.**	**Designation**	**Requirement / Limit**
1	Absence of influence in fatigue	Radius tip § 6.1	1.1	Correct Size tip	≥ 0.2 mm
2	Engraving depth	Engraving depth § 4.1	2.1	Controlling maximum depth	≤ 0.07 mm
3	Legible part mark	As per § 5.1.3	3.1	Controlling legible of mark	eye at the distance of 0.5m
4	Marking location	As per drawing and § 3	4.1	Controlling location of mark	As per drawing

4.3 Properties to be tested

- marking depth
- size of characters
- fatigue resistance shall be re-evaluated if the tip radius and/or marking depth are not in accordance with this specification.

4.4 Definition of test methods, test specimen and required results

Engraving depth shall be checked by one of the following methods. Destructive tests are primarily for use on test specimen; non-destructive tests are primarily for use on parts.

4.4.1 Destructive tests

Cut the sample through the marking and measure the profile through a binocular or optical microscope (magnification = 200)

4.4.2 Non destructive tests

- with a needle comparator (accuracy 0,01 mm)
- with an optical microscope by focussing on the non-engraved surface and in the deepest regions of the marking (accuracy 0,01 mm)

4.5 Mandatory process parameters

None

4.6 Operators approval

Not required

5 Process qualification

5.1 Specific qualification tests

The following engraving tests shall be performed under representative production conditions (workshop, equipment, air supply, personnel)

5.1.1 Definition of qualification specimen

- Typical dimensions: 80 mm x 125 mm, thickness above 2 mm
- Material Aluminium: 2024 T3 and 7075 T73
  Steel: low alloy steel of tensile strength < 1200 MPa and corrosion resistant steel
  Titanium: TiAl6V4
- Surface roughness: Ra < 1,6 µm
- Engrave the symbols “30914” in 5 locations on each test specimen (character height: 2,5 mm)

5.1.2 Inspection and qualification acceptance criteria

a) visual examination for legibility at a distance of 0,5 m (unaided eye)

b) micrographic cross section per § 4.4.1 (magnification = 200) for:
   - depth of mark (everywhere < 0,07 mm)
   - absence of cracks

6 Process work and quality control instruction

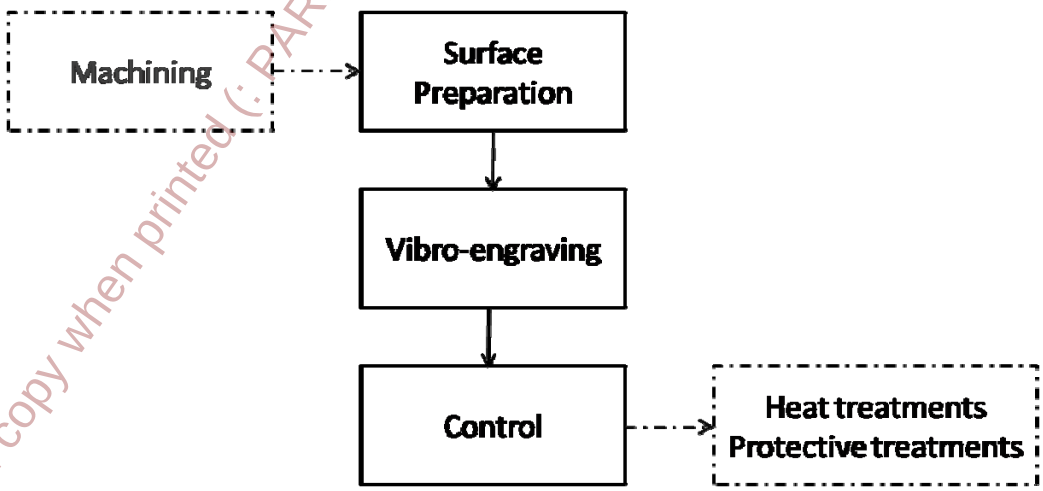
6.1 Equipment, materials

- Pneumatic or electric engraving tool, typical frequency 100 Hertz.
- Hard alloy, carbide, tantalum or diamond engraving tip, with radius higher or equal to 0,2 mm.
- Adequate solvcent (see AIPS 09-01-002, depending on base material).

6.2 Facilities requirements

Not applicable

6.3 Description of the process



- Surface preparation:
  A clean surface is recommended. Cleaning solvents shall be chosen according to the type of base material to be degreased, per AIPS 09-01-002.
- Vibro-engraving may be performed using a hand tool, held in the same way as a writing instrument (pencil) or mechnically if so required.
- Frequency and amplitude of the vibrating tool shall be adjusted on representative test samples to achieve an adequate engraving depth prior to marking parts.

6.4 Repair of parts or assy, damaged when still in production

- Parts on which the marking is too deep shall be subject to a non-conformance procedure and a decision made according to the part and marking position.
- Markings which are not legible before protective treatment shall be reworked with deeper marks or removed and replaced with larger characters as applicable.
- Parts on which the engraved marking is not legible after protective treatments shall be overmarked with ink per AIPS 08-03-002.

6.5 Quality control of the process

6.5.1 Control of process parameters

Check that requirements of chapter 6.3 have been met.

6.5.2 Control of equipment

The radius of the stylus tips for metallic parts shall be checked as often as its use dedicates but at least once a year.

6.5.3 Inspection of marked parts

Inspector shall verify that:
- the location and text of the marking conforms to the drawing.
- the marking is legible in accordance with paragraph 5.3.1
- the size and the depth of the marking meet this specification. Visual check per 4.4.2 shall be made for each material and batch, and depth measurements made in cases of doubt.

7 Health and safety

This specification does not necessarily detail all the precautions necessary to meet the requirements of health and safety.
It is the responsibility of the user of this specification to consult and establish appropriate health and safety precautions and the method should be operated by trained personnel.

RECORD OF REVISIONS

Issue	Clause modified	Description of modification
2 11/99		New standard.
3 04/10	4.2	Implementation of Key Characteristics