
AIPS
Airbus Process Specification

Installation of cold expanded modular retainers

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1 Scope

This Airbus Process Specification defines the Engineering requirements for installation of cold expanded modular retainers.

This specification does not give detailed instructions; these are given in the Process Instructions (PI) / Airbus Process Instruction (API) and the Work Instructions.

This specification shall not be used as an inspection document.

It shall be applied when mentioned in the relevant standard, material specification or Definition Dossier.

2 Normative references

Only normative references cited in the text are listed hereafter.

The latest issue of the publication referenced shall be used.

A1091	Airbus Requirements for the Management of Hazardous Substances
ABM3-2035	Aluminium alloy 7010 T76511 bars and extrusions
ABS2151	Retainer, modular, installation by cold expansion
ABS2165	Protective cap, for use on modular retainer
AIMS03-02-004	Aluminium alloy (2024) solution treated, controlled stretched and naturally aged (T351) plate 6,0 < a ≤ 55 mm close-tolerance flatness
AIMS03-02-008	Aluminium alloy (7175) solution treated, controlled stretched and artificially aged (T7351), Plate 6,0 mm < a ≤ 100,0 mm – Close tolerance flatness – Material Specification
AIMS03-04-009	Aluminium alloy (2024) Solution treated, controlled stretched and naturally aged (T351) Clad sheet 0,8 mm < a ≤ 6,0 mm Standard surface quality Chemical milling quality - Material Specification
AIMS03-04-010	Aluminium alloy (2024) solution treated and naturally aged (T42) clad sheet and strip 0,2 mm ≤ a ≤ 6,0 mm - Special surface quality - Material Specification
AIMS03-04-011	Aluminium alloy (2024) solution treated and naturally aged (T3) clad sheet 0,2 mm ≤ a ≤ 6,0 mm - Special surface quality - Material Specification
AIMS03-04-012	Aluminium alloy (2024) Solution treated and naturally aged (T24) Clad sheet and plate 0,2mm ≤ a ≤ 12,0mm - Special surface quality - Material Specification
AIMS03-04-013	Aluminium alloy (2024) Solution treated aged (T351) clad sheet and plate 0,8mm < a ≤ 12,0mm - Special surface quality - Chemical milling quality - Material Specification
AIMS03-04-014	Aluminium alloy (2024) Solution treated and naturally aged (T3) clad sheet and strip 0,2mm ≤ a ≤ 6,0mm - Standard surface quality - Material Specification
AIMS03-04-029	Aluminium alloy (7475), Solution treated controlled stretched and artificially aged (T761 or T7651), clad sheet and plate 0,8mm ≤ a ≤ 12,0mm - Special surface quality - Chemical milling quality - Material Specification
AIMS03-04-030	Aluminium alloy (7475), Solution treated and artificially aged (T762) Clad sheet, plate and strip 0,8mm < a ≤ 7,0mm - Special surface quality - Material Specification
AIMS03-04-053	Aluminium alloy (2198), solution treated, controlled stretched and artificially aged (T851) sheet, special surface quality, 3,2mm ≤ a ≤ 6,0mm - Material Specification
AIMS03-05-030	Aluminium alloy (7050) Solution treated, controlled stretched and artificially aged (T76511) Extruded section 1,2 ≤ a ≤ 12,0mm and 35,0 ≤ a ≤ 110,0mm with peripheral coarse grain control - Material Specification
AIMS03-05-032	Aluminium alloy Solution treated, controlled stretched and artificially aged (2099T83 / 2196T8511) Extruded section 1,2mm < a < 25,0mm with peripheral coarse grain control - Material Specification
AIMS03-18-001	Titanium alloy (Ti-6Al-4V), Annealed, Plate 6,0mm < a ≤ 100mm - Standard quality - Material Specification
AIMS03-18-004	Titanium alloy (Ti-6Al-4V), Annealed, Sheet 0,3mm ≤ a ≤ 6,0mm - Damage tolerant quality - Material Specification

AIMS03-18-007	TITANIUM alloy (Ti6Al-4V) β Annealed Plate 6,0 mm < a \leq 100 mm High damage tolerance - Material Specification
AIMS05-01-002	Carbon Fibre Reinforced Epoxy Prepreg Unidirectional Tape/180°C - curing class - Intermediate modulus fibre - Structural material - Material Specification
AIMS05-01-004	Carbon fibre reinforced prepreg 5HS fabric / 280g/m ² /180°C curing class Standard modulus fibre - Material Specification
AIMS05-01-006	Carbon Fibre Reinforced Epoxy Prepreg Twill 2x2 weave style / -180°C curing class - Standard modulus fibre - Structural material - Material Specification
AIMS05-01-007	Carbon Fibre Reinforced Epoxy Prepreg Unidirectional Tape/180°C- curing class High temperature - Standard modulus fibre - Structural material - Material Specification
AIMS05-02-002	Glass fibre reinforced epoxy prepreg 120 US-style Glass fabric/Epoxy resin - (105 g/m ² fibre area mass) – 180°C curing class – Material specification
AIMS05-04-009	Standard Modulus Carbon Fibre Fabric (with or without Binder) 5H Satin 370 g/m ² - Liquid epoxy resin 180°C curing – Material Specification
AIMS05-08-001	Glass fibre reinforced thermoplastic materials Glass/fabric/PPS resin - (300 g/m ² fabric area mass) - Material specification
AIMS05-09-002	Carbon Fabric, 285g/m ² fibre area mass with 43% PPS Resin or Equivalent Resin - Material Specification
AIMS05-27-002	Carbon Fibre Reinforced Epoxy Prepreg Unidirectional Tape / 180°C curing class / High performance resin Intermediate modulus fibre - Structural material - Material Specification
AIPS01-02-003	Preparation of Holes in Metallic Materials for Fastening
AIPS01-02-005	Preparation of Holes in Fibre Reinforced Plastics (FRP) and Mixed (FRP/Metal) Assemblies for Fastening
AIPS05-02-011	Rework of paints on metallic and non-metallic structural parts
AIPS05-05-001	Sealing of aircraft structures
EN9103	Aerospace series - Quality management systems - Variation management of key characteristics

3 Definition, applicability and limitations

3.1 Definition

Base structure	Component or structure the retainer is installed onto
Barrel	Metallic portion of the retainer that is fed into and expanded in the installation hole
Finish ID	Inner diameter of the barrel through hole after installation
Functional element	Element (e.g. nut) that can be clipped on the retainer after installation
ID	Inner diameter (thru hole) of the barrel
Installation hole	Hole in the base structure, the barrel portion of the retainer is fed into
Mandrel	Tool that is used to radially expand the barrel by pulling it through in order to achieve retention of the retainer in the base structure. The mandrel is segmented.
Nutcase	Thermoplastic or metallic cage that is attached to the barrel and that retains the functional elements
Retainer	Complete part as specified per ABS2151 consisting of nutcase and barrel
Retainer head side	Side of the retainer on which the flange and the nutcase is located
Ridges	Small protrusions that occur in the barrel thru hole after installation with a segmented mandrel
Thru hole	Hole in the barrel through which the mandrel is pulled

3.2 Applicability and limitations

The installation process described herein shall only be used for the installation of modular retainers per ABS2151 into composite, aluminium or titanium structures made from the materials as listed below:

Table 1: Compatible materials

Aluminium	Titanium	Composite
ABM3-2035	AIMS03-18-001 (Ti6Al4V)	AIMS05-01-002
AIMS03-02-004 (2024 T351)	AIMS03-18-004 (Ti6Al4V)	AIMS05-01-004
AIMS03-02-008 (7175 T7351)	AIMS03-18-007 (Ti6Al4V β annealed)*	AIMS05-01-006
AIMS03-04-009 (2024 T351)		AIMS05-01-007
AIMS03-04-010 (2024 T42)		AIMS05-02-002
AIMS03-04-011 (2024 T3)		AIMS05-04-009
AIMS03-04-012 (2024 T42)		AIMS05-08-001
AIMS03-04-013 (2024 T351)		AIMS05-09-002
AIMS03-04-014 (2024 T3)		AIMS05-27-002
AIMS03-04-029 (7475 T761/T7651)		
AIMS03-04-030 (7475 T762)		
AIMS03-04-053 (2198 T851)		
AIMS03-05-030 (7050 T76511)		
AIMS03-05-032 (2099/2196 T8511)		

* Special minimum grip requirements may apply: Refer to ABS2151 compatibility tables

4 Engineering requirements

Engineering requirements are minimum requirements specified by Responsible Engineering to ensure optimal performance of the manufacturing process.

All Engineering requirements have to be met and controlled in production.

4.1 Installation process specification

4.1.1 Installation hole requirements

Holes shall be drilled in accordance with AIPS01-02-003 for metals and AIPS01-02-005 for composites.

Hole diameters shall comply with the specifications of, annex A table A.1 for regular sizes and table A.2 for repair, respectively oversizes ("X"-suffix).

Installation holes in aluminium and titanium shall be free of any surface protection such as anodizing layer or paint.

4.1.2 Standard part requirements

Retainers with visible damages (e.g. separated barrels and nutcages) shall not be used.

It is not permitted to cut, shave or grind the retainers.

Retainers shall not be re-used, e.g. after removal or failed installation.

4.1.3 Retainer installation

Only validated tooling shall be used. Validation shall be provided through qualification testing as part of the approval of the concerned process instruction.

If the retainer shall be installed into aluminium material, an interfay (Class C) sealant fillet shall be applied around the nutcage bottom in accordance with Annex B, figure B.1. Application of sealant shall be in accordance with AIPS05-05-001. Sealant to be used shall comply with the corrosion area category of the component as indicated in the drawing.

The retainer shall be placed in the installation hole in such a way as to ensure that the barrel portion is perpendicular to the installation hole and that the nutcage bottom is in contact with the base structure. The nutcage shall not separate from the barrel during mandrel engagement.

The mandrel pull direction for radial expansion shall be from retainer head side towards open barrel end (bottom- or barrel-pull process).

After installation, the finish ID of nominal size retainers shall comply with requirements per, annex A table A.3. Measurement shall not be conducted between ridges locations.

4.1.4 Application of surface protection

Remaining metallic blank areas or areas covered by escaped sealant in the installation hole in metallic components (in particular on the bottom side) shall be re-treated per AIPS05-02-011 in accordance with the surface protection scheme as specified by the corrosion area categorisation indicated in the drawing (refer to Annex B, figure B.3).

Contamination of the barrel and barrel thru hole with paint is permissible. Contamination of the retainer head/bearing surface is not permissible.

4.1.5 Installation of a functional element

Functional element as specified by drawing shall be clipped into the nutcage by axial pressure until the legs of functional elements are completely inside the lugs of the nutcage.

No visible permanent deformation or breakage of the legs of the functional element is permitted. In case of damages, the element shall be scrapped and replaced.

No visible damage of the nutcage is permitted. In case of damages, the retainer shall be replaced as specified per chapter 4.2.2.

Functional element shall be installed such as to ensure that the element can move and is not jammed in the nutcage.

4.1.6 Installation of a protective cap per ABS2165

Protective caps per ABS2165 shall be installed on the retainer after installation of the functional element if indicated in the drawing.

Protective caps per ABS2165 shall be installed with interlay sealant (C-type) between cap and retainer nutcage. The sealant shall be applied such as to ensure that a closed seam is visible after the cap is clipped on the nutcage. No gaps between sealant and cap and sealant and structure are permissible.

Sealant shall be applied in a way that ensures that the bearing surface of the retainer head as well as the functional element does not become contaminated with sealant, penalising the movement capability.

Sealant to be used shall comply with the corrosion area category of the component as indicated in the drawing. Sealant shall be applied in accordance with AIPS05-05-001.

After the protective cap is correctly seated on the retainer, the cap bottom edges shall be sealed with an additional closed overcoat (Class A) sealant seam if indicated in the drawing.

Sealant to be used shall comply with the corrosion area category of the component as indicated in the drawing. Sealant shall be applied in accordance with AIPS05-05-001. Sealing shall be in accordance with the rationale of Annex B, figure B.2.

4.2 Repair process specification

4.2.1 Replacement of functional element

Functional element shall be removed using extraction tooling from the supplier of functional elements or retainers.

Re-installation of functional element shall be conducted in accordance with specifications of chapter 4.1.5.

For protective cap removal it is permissible to remove the sealant seam at the circumference to ease removal. It shall be ensured that the nutcage and base structure surface is not damaged or becomes rotated or axially moved during this operations.

4.2.2 Removal of retainer

Before removal the ID of the retainer barrel shall be enlarged by drilling per AIPS01-02-003 in case of composite structures. For metals, enlargement of inner barrel diameter may not be necessary.

It shall be ensured that the retainer does not rotate during drilling.

It shall be ensured that the drill does not penetrate through the barrel walls in order to avoid damages of the installation hole.

The retainer shall be removed by steady pushing after barrel thru hole was enlarged.

For removal, removal tooling supplied by the part manufacturer can be utilised to drill the thru hole. Other tooling might be applicable provided that above requirements are met.

An oversize ("X"-suffix) of the retainer with the same size and grip code as specified by the drawing set shall be installed in accordance with requirements of chapter 4.1.

Riveted anchor nuts shall only be used as repair solution if accepted by the concerned Design Office

4.3 Key Characteristic

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 2: Key Characteristic

Product Key Characteristic			Process Key Characteristic		
No.	Designation	Requirement/ Limit	Sub.- No.	Designation	Requirement/ Limit
1	Installation hole diameter	In accordance with Annex A			Shall be defined in relevant AIPI
2	Installation holes	For metals only: Free of anodising layer and paint			
3	Installation tooling	Only tooling from qualified part suppliers to be used			
4	Removal tooling	Appropriate tooling providing performance as indicated in section 4.2.2			
4	Standard part	Shall be free from defects; No grinding, shaving or cutting on retainer permitted			
5	Sealant application	Sealant shall be applied where required in accordance with section 4.1.3 and section 4.1.6			
6	Installation process	Only retainer head-side installation (bottom or barrel pull) permitted			
7	Finish ID	Shall be in accordance with Annex A after installation			
8	Surface protection	For metal base structure only: Shall be re-established per section 4.1.4			
8	Installation of functional element	No damages or permanent deformation on retainer or element permitted; Functionality of element shall be ensured (i.e. floating)			

5 Technical qualification

5.1 Process instruction (PI) qualification

The Technical Qualification shall be performed according to the relevant Airbus procedure. Tests shall be conducted in order to validate:

- Appropriate gauging methods and specifications
- Appropriate installation tooling specifications and tooling verification steps
- Appropriate functional element installation and removal procedure
- Appropriate sealant application procedure
- Appropriate paint re-treatment procedures
- Appropriate removal and repair procedures

Qualification testing shall be conducted for at least one ABS2151 retainer size and grip code for at least one coating type for aluminium and one coating type for composite/titanium.

6 First part qualification

Not applicable.

7 Series production inspection

The shop shall perform at least the following series production inspections under serial conditions.

- Inspection of pull mandrel wear
- Inspection of installation hole diameter
- Inspection of appropriate sealant application (where applicable)
- Inspection of finish ID of retainer
- Inspection for correct snap-in of functional element
- Inspection for nutcase damages
- Inspection for damages of legs of functional elements

8 Rework

Not applicable.

9 Environment, health and safety

The manufacturing process shall be in line with Airbus Health and Safety and ecoefficiency policies.

Compliance with A1091 shall be ensured for all materials, substances and/or articles implemented during process.

In particular, targeted substances according to A1091 shall not be used, if a safer alternative is available.

Uses made of all substances involved in the process shall be documented in Safety Data Sheet as required by REACH regulation (Registration Evaluation and Authorization of Chemicals).

Annex A

Table A.1 : Installation hole diameters for nominal sizes – (mm)

Material	Retainer size code							
	05		10		20		30	
	Min	Max	Min	Max	Min	Max	Min	Max
Composites	8,12	8,17	8,78	8,84	10,45	10,52	11,98	12,05
Metals	8,12	8,16	8,78	8,82	10,45	10,49	11,98	12,02

Table A.2 : Installation hole diameters for oversizes ("X"-code) – (mm)

Material	Retainer size code							
	05		10		20		30	
	Min	Max	Min	Max	Min	Max	Min	Max
Composites	8,42	8,47	9,08	9,14	10,75	10,82	12,28	12,35
Metals	8,42	8,46	9,08	9,12	10,75	10,79	12,28	12,32

Table A.3 : Finish ID of installed retainers – (mm)

Material	Retainer size code							
	05		10		20		30	
	Min	Max	Min	Max	Min	Max	Min	Max
Composites	5,17	5,26	6,28	6,37	7,79	7,88	9,40	9,49
Metals	5,20	5,31	6,31	6,42	7,82	7,93	9,43	9,54

Annex B

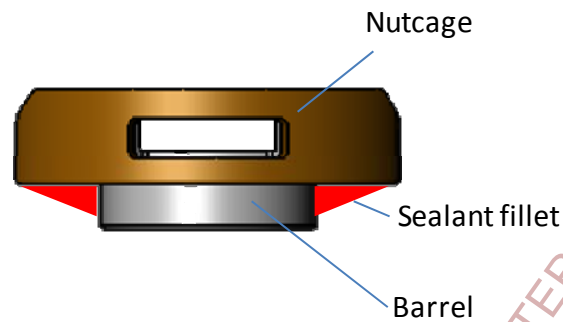


Figure B.1 : Sealant application on retainer

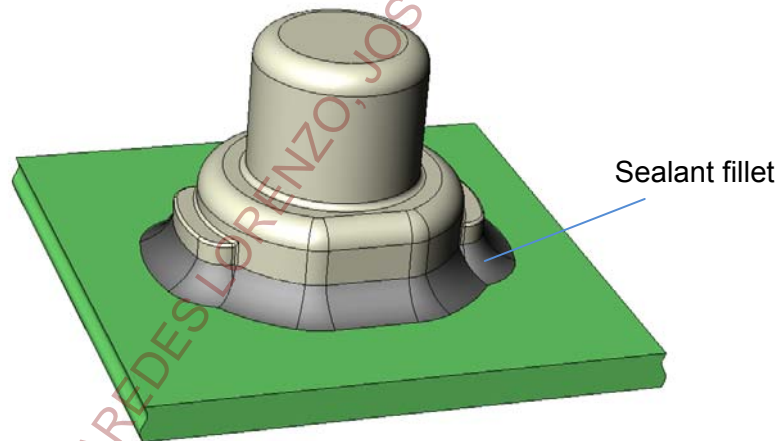
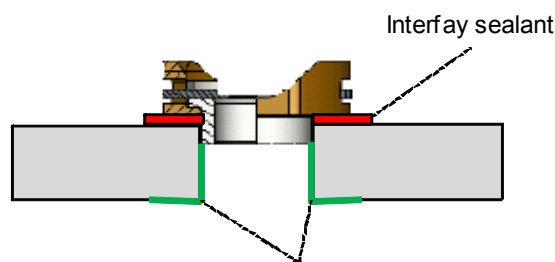


Figure B.2 : Sealant application for ABS2165 protective cap



Re-treated surface protection in accordance with
AIPS05-02-011 and drawing specifications

Figure B.3 : Surface protection scheme for metallic base structure materials

RECORD OF REVISIONS

Issue	Clause modified	Description of modification
1 04/11		New standard.
2 09/11	Section 2 Section 3.2 Section 4.1.4 Section 4.1.5 Section 4.1.6 Annex A	References added for additional parent materials Table 1 updated with additional validated parent materials Contamination limits added Jamming requirement added Sealant requirements refined; Contamination limits added Finish ID tables updated according to supplier data
3 09/12	Section 2 Section 3.2 Section 4.1.3 Figur B.3	References added for additional parent materials. Titles checked and corrected. Table 1 updated with additional validated parent materials Text added: The nutcage shall not separate from the barrel during mandrel engagement. "re-treated paint" replaced with "re-treated surface protection"