

AIPS
Airbus Process Specification
Installation of raceways in wings

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1 Scope

This Airbus Process Specification defines the Engineering requirements for installation of raceways in wings.

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.

AIPS01-02-008	Airbus Process Specification - Torque tightening of screws, bolts and nuts
AIPS07-01-001	Airbus Process Specification - Manufacturing and installation of cable harnesses
AIPS07-01-003	Airbus Process Specification - Cables tying
AIPS07-01-006	Airbus Process Specification - Electrical bonding
AIPS07-01-009	Airbus Process Specification - Installation of backshells
AIPS07-06-002	Airbus Process Specification - Identification and marking of electrical installations
AIPS07-07-002	Airbus Process Specification - Installation of flexible textile sleeve ABS0125, ABS0596, ABS0890, ABS1552, ABS2413, ABS2418, ASNE0559 and EN6049-003 to EN6049-009 for external protection of electrical cables
EN9103	Aerospace series - Quality management systems - Variation management of key characteristics
A1091	Airbus Requirements for the Management of Hazardous Substances

3 Definition, applicability and limitations

3.1 Definition

3.1.1 Terms

Break-out	Each change from raceway-protection to protection with EMI-sleeve has to be considered as a break-out. E.g. change of protection at break-out bracket within the raceway line, change of protection at break-out bracket at Raceway ends or at raceway-line interruption.
Break-out device	Device to perform a break-out from raceway-protection to EMI-sleeve protection. E.g. assembly of bulkhead, strain relief support and bracket support.
Electrical Protection	Device qualified: <ul style="list-style-type: none">- to provide electrical insulation- to contain or to protect from the destructive thermal effect of electrical malfunctions, such as short circuits, arcing, flashover or arc-tracking.- to limit the destructive effect of external mechanical impacts (e.g: chaffing, in-service or maintenance activities) (refer also to mechanical protection).
EMI protection	A device or method qualified to protect electrical signals (e.g. as existing in wires, cables or electrical equipment) from Electro Magnetic Interferences (EMI).
Fire Protection	Device to protect electrical equipment or electrical wiring. There are two levels of protection: <ul style="list-style-type: none">- Fire proof: With respect to materials, components and equipment, means the capability to withstand the application of heat by a standard flame, for a period of 15 minutes without any failure that would create a hazard to the aircraft.- Fire resistant: With respect to materials, components and equipment, means the capability to withstand the application of heat by a standard flame, for a period of 5 minutes without any failure that would create a hazard to the aircraft.
MBN	The MBN is a network of metallic parts, electrically bonded together. It is used for electrical bonding purposes, such as failure current return, lightning protection and electrostatic discharge. It is not used as Current Return path for power supplies or signals.
Mechanical protection	Device qualified to limit the destructive effect of external mechanical impacts (e.g. chaffing, in-service or maintenance activities).
Splint	A splint is a retainer device used to maintain wires inside wing raceways over a longer distance. It is used in areas with difficult acces (no access to place retainers with sufficient spacing).
Unprotected Length	Part of bundle which is not EMH protected. It means that the bundle is not protected by raceway, nor bracket, nor break-out, nor sleeve The length shall be mesured at last and first protected point of the unprotected bundle portion (filling ratio of raceway or bonding point).

3.1.2 Abbreviation

A/C	Aircraft
e.g.	For example
EMH	Electro-Magnetic Hazard
EMI	Electro-Magnetic Interference
MBN	Metallic Bonding Network
TE	Trailing edge
LE	Leading edge
GTR	Ground Test Requirements

3.2 Applicability and limitations

This Airbus specification is applicable when called up by the drawing directly or through another document for the purpose given in the scope. When processing to AIPS07-01-024 is required, it shall be called up on the drawing by the words "AIPS07-01-024 Installation of raceways in wings".

Only practises defined in this document are authorized.

This document is applicable for the installation of wing raceways, its components and the harnesses in the raceways, during the life time of the aircraft.

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 fulfilled and controlled in production.

For installation of raceways in wings :

- on A350 program, refer to §4.2.
- on A330/A340 programs, refer to §4.3.
- on A320 family, refer to §4.4.

Table 1: Raceway line components

Component	Description	Subclauses per Program		
		A350	A330/A340	A320
1	Bracket	§4.2.1.1	§4.3.1.1	§4.4.1.1
2	Wing raceway	§4.2.1.1	§4.3.1.1	§4.4.1.1
3	Break-out device	§4.2.1.2	§4.3.1.2	§4.4.1.2
4	Cable retaining system (retainer + hook tie)	§4.2.1.3	§4.3.1.3	§4.4.1.3

4.1 Performance requirements

During all activities (storage, transport, installation, etc...) all components shall not be subjected to any type of stress, contamination or damage.

All the characteristic of parts composing the wing raceway line (raceway profiles, cable retaining systems, brackets etc.) can be found in the corresponding standard specification.

Position and distribution of route installed inside wing raceway is given in Definition Dossier and AIPS07-06-002.

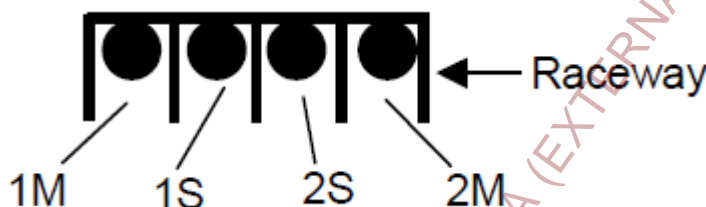


Figure 1: General principle of wing segregation in raceways

Besides supporting routes installed in the wing environment, the raceway-line contributes to:

- Electrical protection,
- Mechanical protection,
- EMI protection,
- Fire protection (depending of the zone).

Individual technical specifications of wing raceway line parts shall not be adversely affected by the applied installation and manufacturing processes. Each detail specification of the processed part shall be met, taking into account the installed cables. Refer to the individual product norm and its associated technical specification for further information.

4.2 Installation of raceways in wings for A350 program

Each raceway line is composed of several parts. A schematic description of raceway parts and components to install bundles inside the raceways is shown in Figure 2.

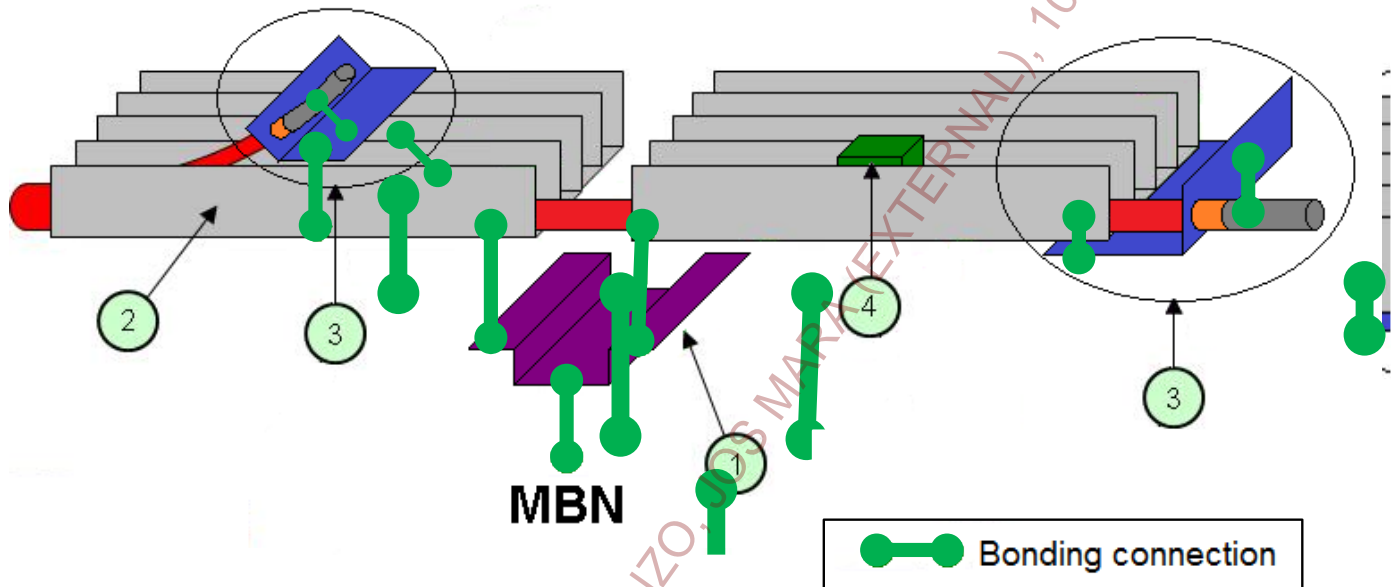


Figure 2: Raceway line components

4.2.1 Raceway line installation

For the following components installation:

- The installation shall be in accordance with the Definition Dossier.
- The fixation material shall be in accordance with Definition Dossier.
- Electrical bonding resistance after installation shall respect RG20 codes as defined in Definition Dossier.

4.2.1.1 Raceway installation

Special attention shall be taken not to damage the protective finish and insulation coating of the bracket and the raceway.

No drilling shall be performed on the wing raceways.

Torque values for bracket connection with raceways shall be in accordance with AIPS01-02-008.

Gap between two consecutive raceway sections is given in the Definition Dossier.

In order to prevent chaffing of wires with the edges of raceways, adjacent raceways shall be aligned in accordance with the Definition Dossier.

Two consecutive raceway sections should be aligned with a maximum alignment of $\pm 1,0$ mm in a cylindrical section (see Figure 3).

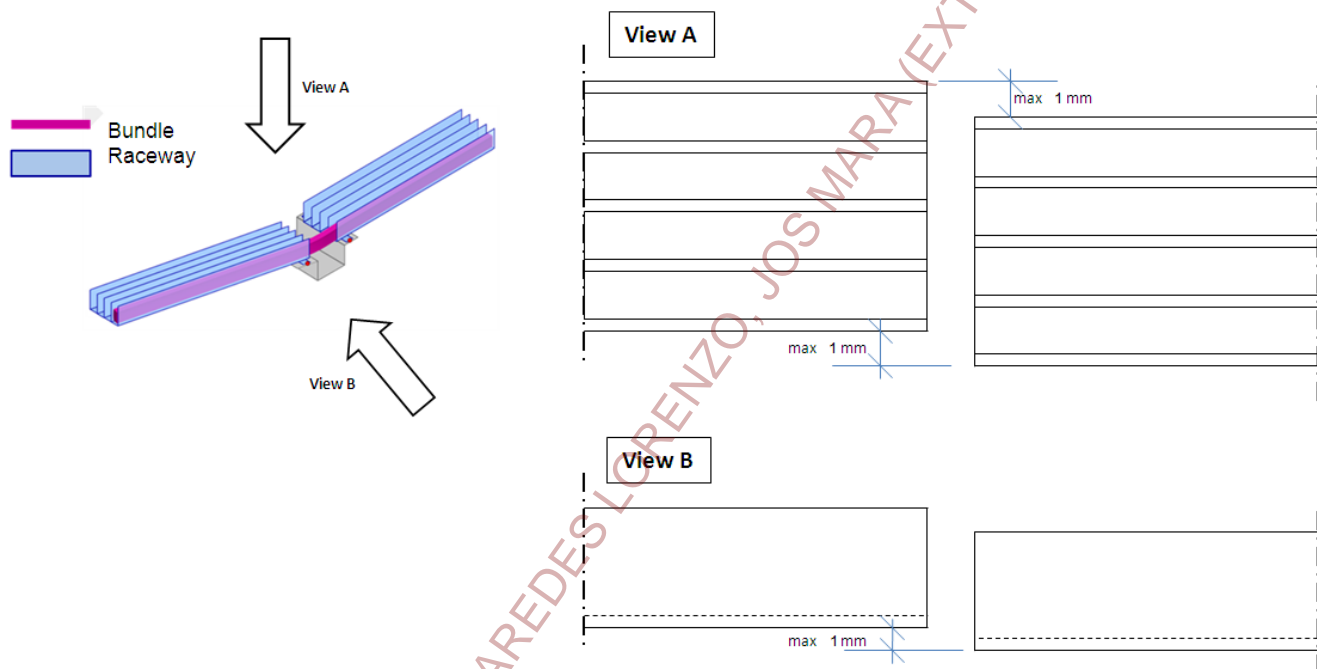


Figure 3: Raceway sections alignment

4.2.1.2 Break-outs

The installation of break-out (position and orientation) shall be done in accordance with the Definition Dossier and with AIPS07-01-006 for bonding.

Each break-out shall be supported using a dedicated attachment device.

Installation and use of bulkhead adaptor for break-out shall be in accordance with AIPS07-01-009.

For bundles exiting a raceway, the following principles shall be observed:

- The EMI unprotected length shall not exceed 100 mm.
- This EMI unprotected length shall be located at 50 mm maximum from the top of the raceway wall, as illustrated in Figure 4.
- Bundles shall be protected by mechanical protection at the level of the raceway wall edges.

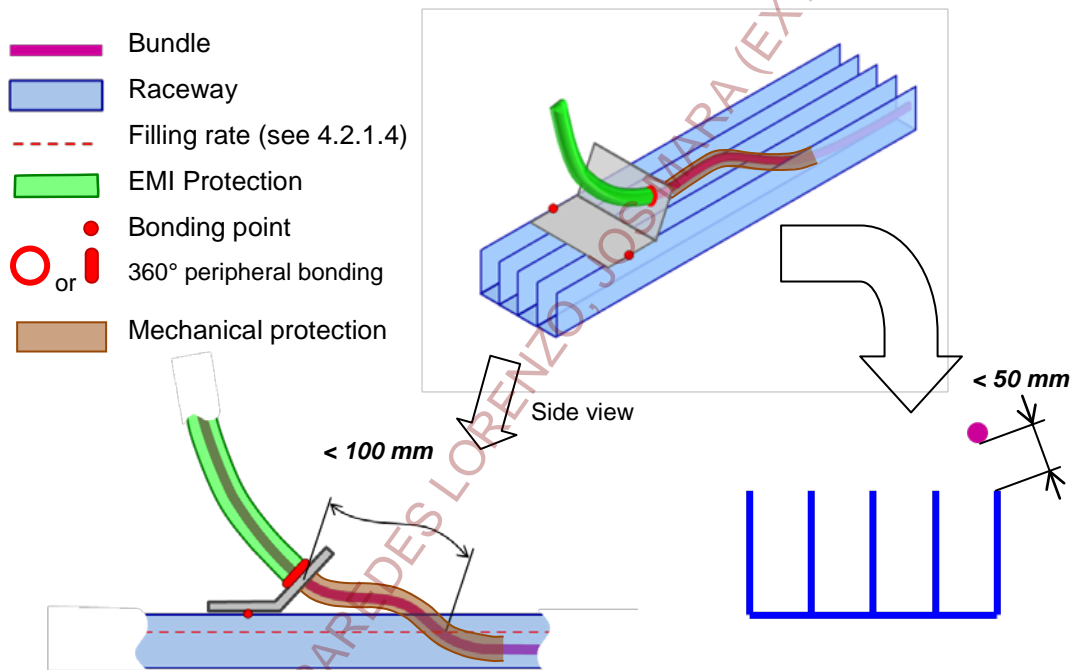


Figure 4: Unprotected length at breakouts

4.2.1.3 Cable retaining systems installation

Inside raceways, cable retaining system shall be used to maintain bundles in the raceway channel.

The position of cable retaining system shall be in accordance with the Definition Dossier.

Hook ties shall be clipped securely through the holes in the bottom of the raceway and on the edge of the raceway walls

If due to space constraints a sufficient attachment pitch can not be provided, a splint or a cover can be used. This shall be defined in the Definition Dossier.

When closing the retaining system, special attention shall be taken to

- avoid tangled and crossing wires under the pressure pads.
- not have any wires trapped between pressure pad and the raceway channel wall.

Cables crossing, swelling, sagging or protruding outside of the bundle or raceway channel are not acceptable.

Only non-metallic dedicated tool should be used to fix and remove the cable retaining system.

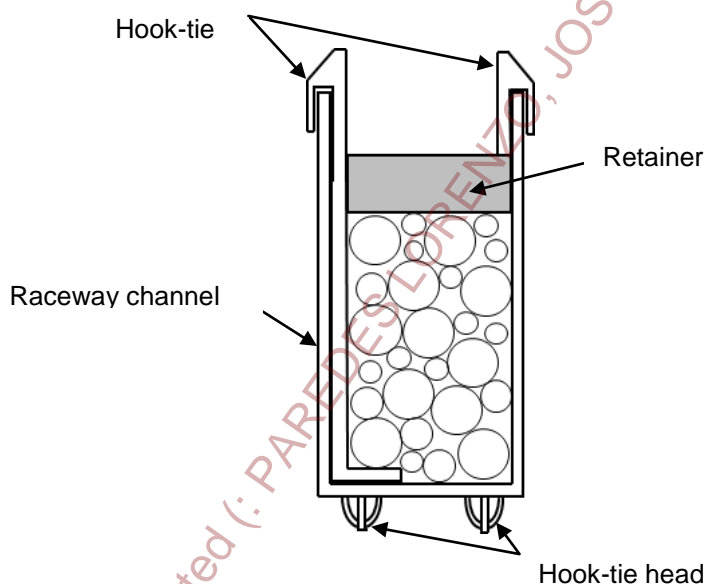


Figure 5: Cable retaining system installation

4.2.1.4 Harness installation inside raceways

Generic harness installation shall be in accordance with AIPS07-01-001 but, for specific cases, refer to following subclause.

Except where protected harness routes with unprotected harness, bundle tying inside wing raceway is not necessary and shall be conform to AIPS07-01-003.

For tying of sleeve refer to AIPS07-07-002.

Walls of raceway channels shall not be permanently deformed more than 1,0 mm on each side. (see Figure 6)

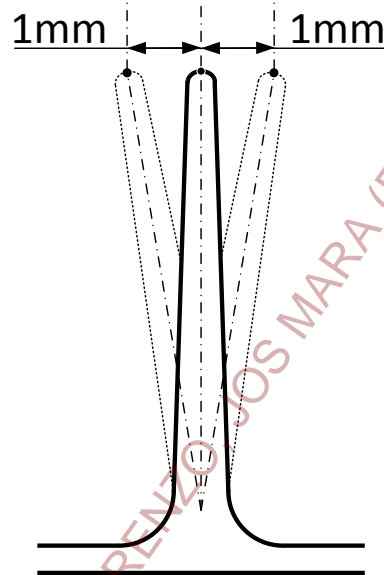


Figure 6: Wall deformation

The bundle shall be positioned in such a way that hard contacts with raceway termination edges are minimized (see Figure 7).

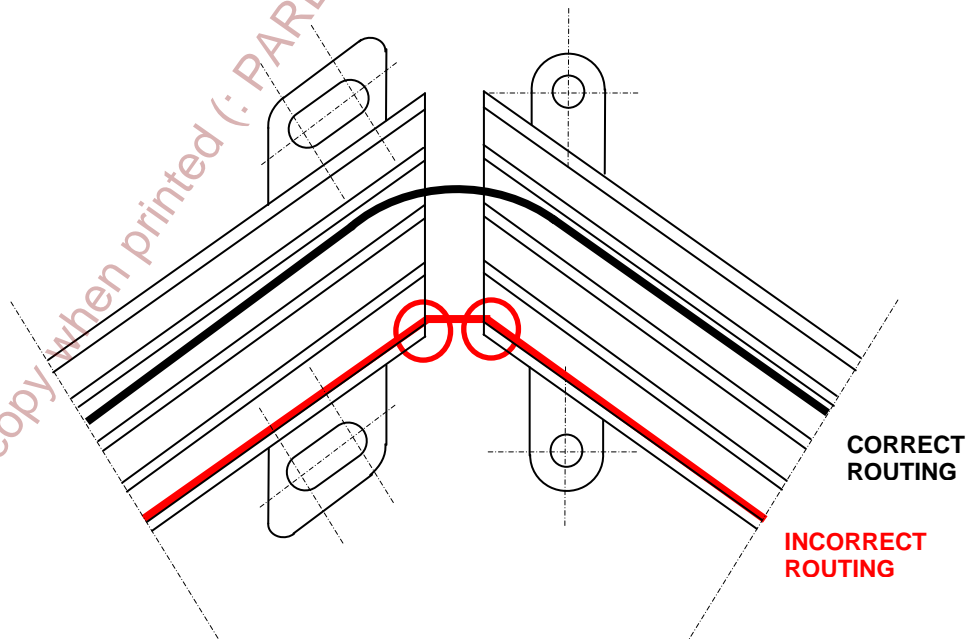


Figure 7: Bundles alignment in raceways

Bundle in raceway shall not be tensioned or twisted.

In case one or a few number of cables are included into bundle protected by protection sleeve, relative movement of the unprotected cables shall be avoided by tying.

No over-length shall be stowed inside the raceway (e.g.: loop).

Bundles shall be protected when:

- The gap between two consecutive raceway sections is > 3 mm in accordance with the Definition Dossier,
or
- There is an angle between two raceway sections,
or
- Misalignment of raceway section is > 1 mm.

At gap level, mechanical/electrical protection shall be installed overlapping both sides of the gap by 25,0 mm minimum. Length and width of the protection mean shall be defined in the Definition Dossier.

NOTE: If sliding of the protection device along the bundle occurs an overlap of 10,0 mm can be accepted.

Damage, kink and fold of protection mean are not allowed.

Protection mean shall be properly secured.

Wing raceways shall be filled at :

- no more than 80% of their height on the wing Leading Edge.
- and 65% of their height on the wing Trailing Edge.
- In the 2D Fire zone only the 1S raceway channel could be filled at 75%.

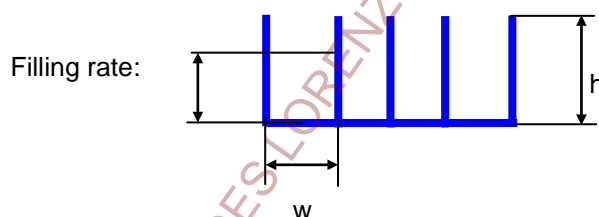


Figure 8: Filling rate raceways in wing

4.2.2 Installation in 2D Fire Zone

All requirements listed in §4.1 to 4.2.2 are applicable to the 2D fire zone but are superseded by requirement from §4.2.2 if contradiction exists.

4.2.2.1 Harness installation in raceways in 2D Fire Zone

A specific bundle sequence shall be applied to ensure fire protection in 2D fire areas in accordance with Definition Dossier :

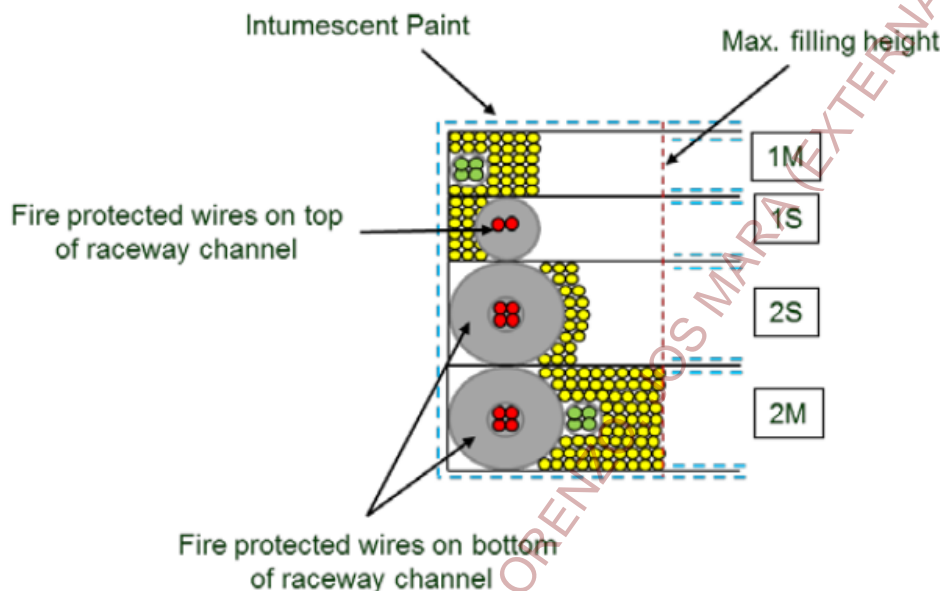


Figure 9: Fire protection in raceways in wing

Cables in contact with intumescent paint and/or raceway wall edge shall be mechanically protected.

4.2.2.1.1 2M and 2S routes in 2D Fire Zone

Unprotected wires in 2M and 2S routes shall be installed on top of the digit "W" fire protected routes in a flat configuration (see Figure 9). Fire unprotected routes shall be tied to fire protected routes by fire resistant tying device with a pitch of 100 mm.

Unprotected wires shall not be tied. For ECFS cables tying and protection refer to AIPS07-01-001.

Fire protection sleeve in 2M and 2S routes shall be tied as per AIPS 07-07-002

4.2.2.1.2 1S route in 2D Fire Zone

Unprotected wires in 1S routes shall be installed on the bottom of the raceway channel, under the digit "W" fire protected routes (see Figure 9). Fire unprotected routes shall be tied to fire protected routes by fire resistant tying device with a pitch of 500 mm.

For 1S route, in order to fit in channel's shape:

- Fire protection sleeve shall not be tied.

and

- Fire protection sleeve shall not be twisted. The longitudinal edge of the fire protection sleeve shall face to the loose wires, avoiding the sleeve opening.

Unprotected wires shall not be tied. For ECFS cables tying and protection refer to AIPS07-01-001.

4.3 Installation of raceways in wings for A330/340 programs

4.3.1 Raceway line installation

For the following components installation:

- The installation shall be in accordance with the Definition Dossier.
- The fixation material shall be in accordance with Definition Dossier.
- Electrical bonding resistance after installation shall be in accordance with GTR. Only the raceway foot shall be checked during the bonding check.
-

4.3.1.1 Raceway installation

Special attention shall be taken not to damage the protective finish and insulation coating of the bracket and the raceway.

No drilling shall be performed on the raceways.

Torque values for bracket connection with raceways shall be in accordance with AIPS01-02-008.

In general way:

- Two consecutive raceway sections should be aligned with a maximum alignment of $\pm 0,5$ mm in a cylindrical area (see Figure 9).
- and
- Maximum gap between two consecutive raceway sections should be less than 8 mm (in accordance with the Definition Dossier)..

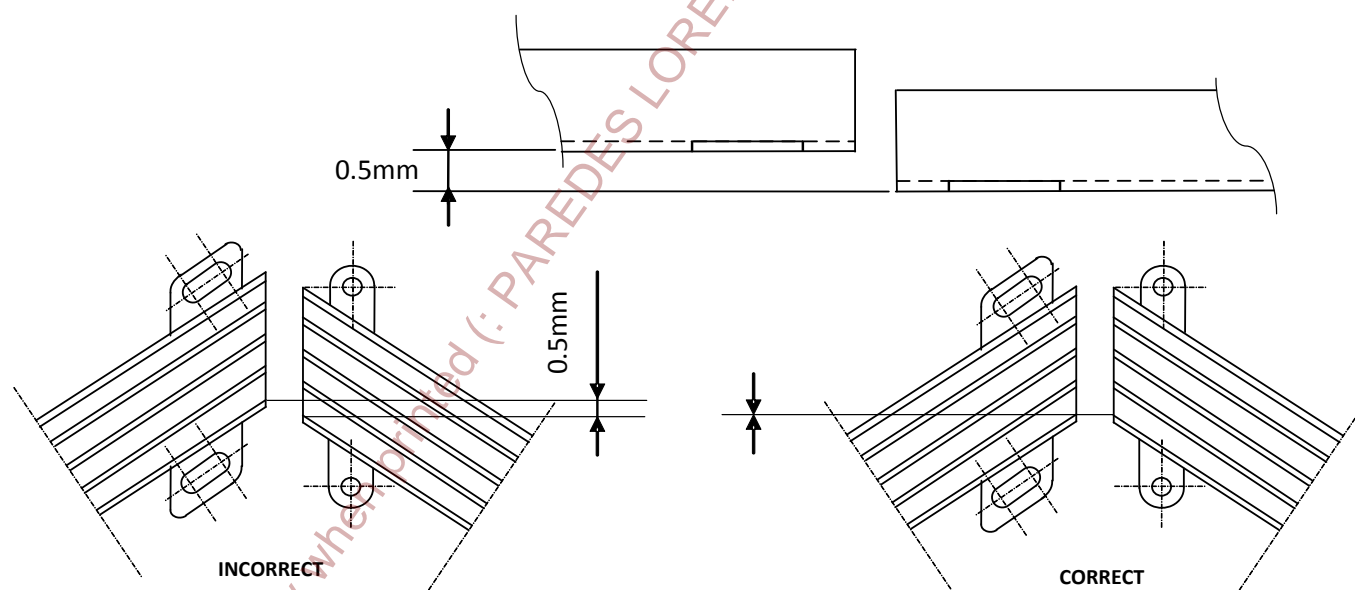


Figure 10: Raceway alignment

4.3.1.2 Break-outs

The installation of break-out (position and orientation) shall be done in accordance with the Definition Dossier. For bundles derivations out of the raceways, the bundles shall not be routed across the wall edges. Each break-out shall be supported using a dedicated attachment device in accordance with Definition Dossier. Installation and use of bulkhead adaptor for break-out shall be in accordance with AIPS07-01-009.

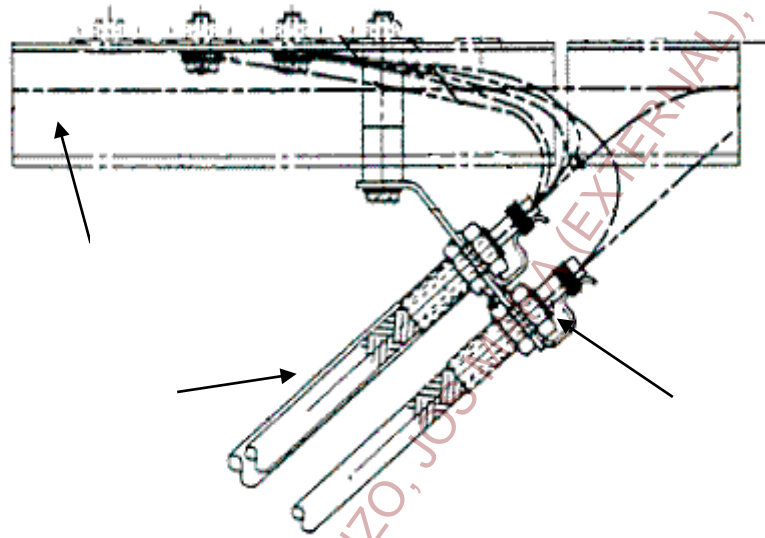


Figure 11: Bundle derivation in raceway

4.3.1.3 Cable retaining system installation

Inside raceways, cable retaining system shall be used to maintain bundles in the raceway channel. When closing the retaining system, special attention shall be taken to avoid tangled and crossing wires under the pressure pads. Cables crossing, swelling, sagging or protruding outside of the bundle or raceway channel are not acceptable. When closing the retaining system, special attention shall be taken not to have any wires trapped between pressure pad and the raceway channel wall. If bridges or pressure pads have to be removed, this shall be done by hand or with a suitable non-metallic tool. Retaining system shall be installed in the correct orientation (nose upwards) as describe in Figure 12. If retaining systems have to be removed, they shall not be re-installed. New parts shall be used. A little distance between the pressure pads and cables is allowed.

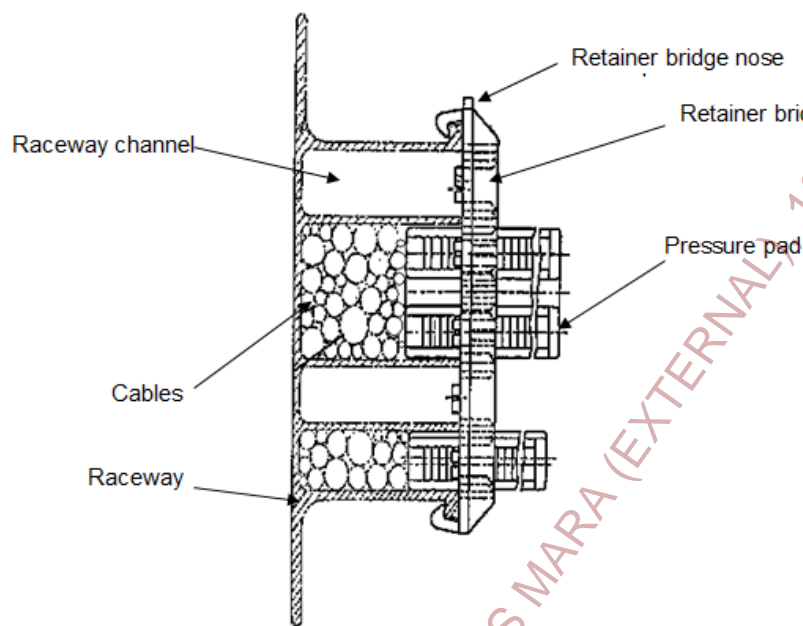


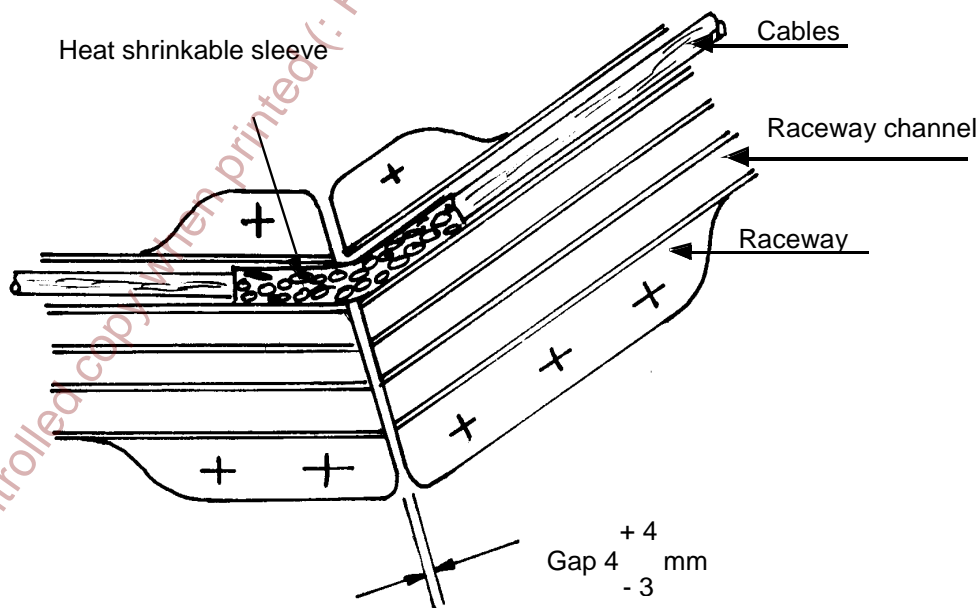
Figure 12: Cables installation inside raceways

4.3.2 Harness installation inside raceway

Generic harness installation shall be in accordance with AIPS07-01-001.
Raceway walls shall not be permanently deformed due to harness installation.
Bundle in raceway shall not be tensioned or twisted.

Bundles shall be mechanically protected when :

- It is not possible to align the raceway sections,
or
- The gap between two consecutive raceway sections is greater than 6,0 mm.



The protection shall not slide along the bundle.

Figure 13: Additional protection inside raceway

No over-length shall be stowed inside the raceway (e.g. loop).

Bundle tying inside wing raceway is not necessary, if tying is requested it shall be conform to AIPS07-01-003.

Wings raceways shall be filled at no more than 65% of their height.

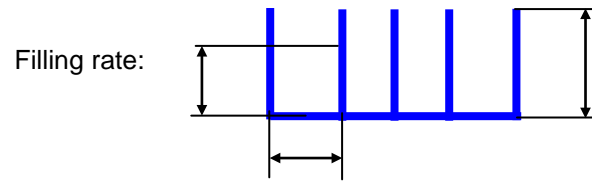


Figure 14: Filling rate raceways in wing

Bundle protection shall be in accordance with Definition Dossier.

4.4 Installation of raceways in wings for A320 programs

4.4.1 Raceway line installation

For the following components installation:

- The installation shall be in accordance with the Definition Dossier.
- The fixation material shall be in accordance with Definition Dossier.
- Electrical bonding resistance after installation shall be in accordance with GTR. Only the raceway foot shall be checked during the bonding check.

4.4.1.1 Raceway installation

Special attention shall be taken not to damage the protective finish and insulation coating of the bracket and the raceway.

No drilling shall be performed on the raceways.

Torque values for bracket connection with raceways shall be in accordance with AIPS01-02-008.

In general way two consecutive raceway sections should be aligned with a maximum alignment of $\pm 0,5$ mm in a cylindrical area (see Figure 15) in accordance with the Definition Dossier.

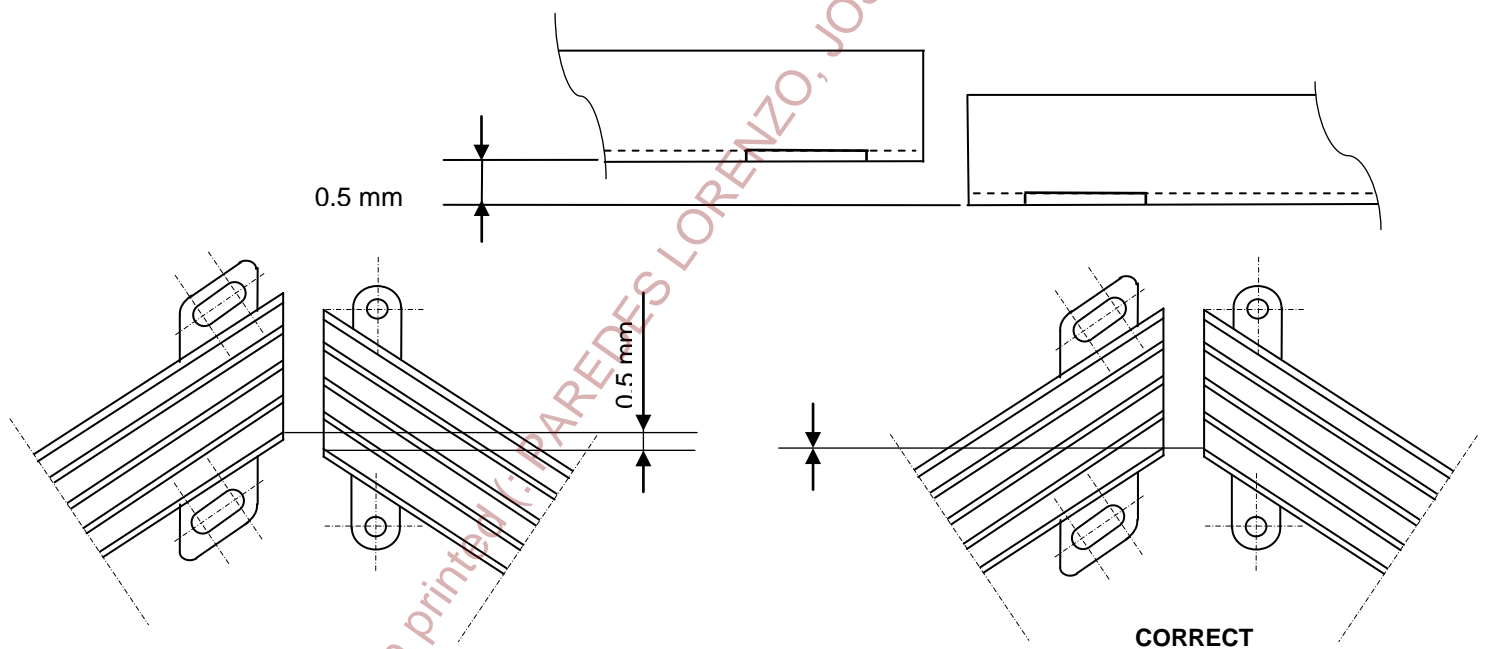


Figure 15: Raceway alignment

4.4.1.2 Break-outs

The installation of break-out (position and orientation) shall be done in accordance with the Definition Dossier.
Installation and use of mounting bracket shall be in accordance with Definition Dossier.

End cap shall be installed at convoluted conduit end.

Conduit shall be installed so that end cap is adjacent to the retainer.

Each derivative bundle shall be attached on mounting bracket by a cable tie located at end cap level.(see Figure 16).

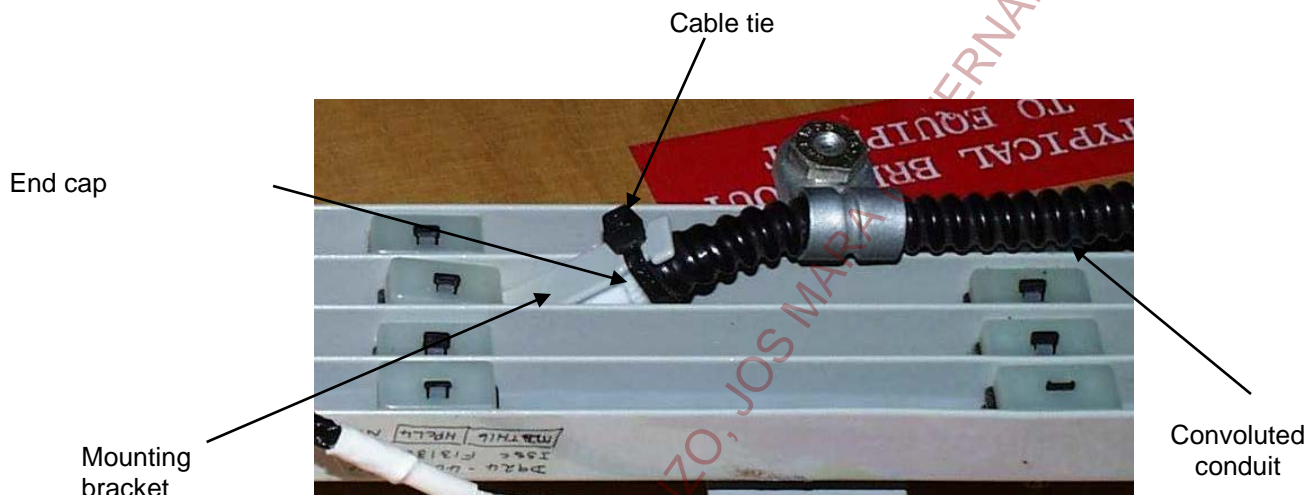


Figure 16: Bundle derivation in raceway

4.4.1.3 Cable retaining systems installation

Inside raceways, cable retaining system shall be used to maintain bundles in the raceway channel.

When closing the retaining system, special attention shall be taken to avoid tangled and crossing wires under the pressure pads.

Cables crossing, swelling, sagging or protruding outside of the bundle or raceway channel are not acceptable.

When closing the retaining system, special attention shall be taken not to have any wires trapped between pressure pad and the raceway channel wall.

If bridges or pressure pads have to be removed, this shall be done by hand or with a suitable non-metallic tool.

Harpoon tie shall be clipped securely inside the raceways.

Cables shall be installed inside the raceway and distributed on either side of the harpoon ties (see Figure 17).

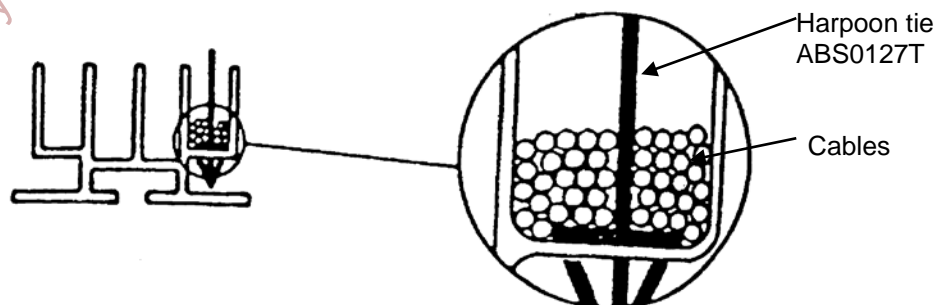


Figure 17: Cables installation inside raceway

The position of cable fairleads and retainers shall be done in accordance with the Definition Dossier.

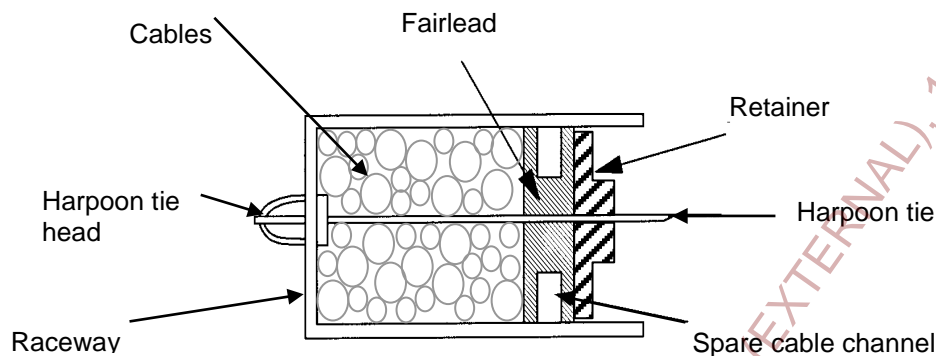


Figure 18: Cables attachment inside raceway

4.4.2 Harness installation inside raceway

Generic harness installation shall be in accordance with AIPS07-01-001.
Raceway walls shall not be permanently deformed due to harness installation.
Bundle in raceway shall not be tensioned or twisted.
No over-length shall be stowed inside the raceway (e.g. : loop).
Bundle tying inside wing raceway is not necessary, if tying is requested it shall be conform to AIPS07-01-003.

Wing raceways shall be filled at :

- no more than 80% of their height on the wing leading edge.
- and 65% of their height on the wing trailing edge.

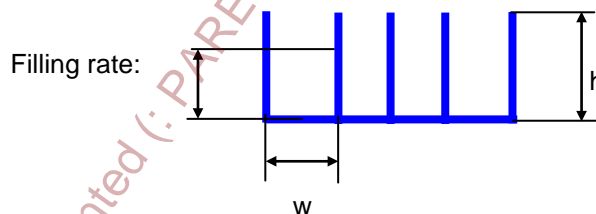


Figure 19: Filling rate raceways in wing

Bundle protection shall be in accordance with Definition Dossier.

4.5 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 2: Key Characteristics for A350

Product Key Characteristic			Process Key Characteristic		
No.	Designation	Requirement/ Limit	Sub.- No.	Designation	Requirement/ Limit
1	Secure raceway line attachment to structure / substructure	Refer to: 4.2.1.1 and 4.1.2.2 and 4.2.1.3	1.1	Ensure torque value properly applied on each raceway line fixation	Shall be defined in AIPS01-02-008
			1.2	Ensure RW alignment	± 1,0 mm in a cylindrical section
2	Secure harness installation	Refer to 4.2.1.4	2.1	No relative movement of harness	Shall be defined in relevant AIPI
			2.2	Harness attachment pitch	
			2.3	Gap protection	Gap > 3mm
			2.4	Respect filling rate	80% for LE 65% for TE 75% in 2D fire zone for 1S channel
3	Respect unprotected length for break-out	Below 100 mm per break-out refer to 4.2.1.2	Shall be defined in relevant AIPI		
4	Respect distance between unprotected length and raceway	Below 50 mm refer to 4.2.1.2	Shall be defined in relevant AIPI		

Table 3: Key Characteristics for A330/A340

Product Key Characteristic			Process Key Characteristic		
No.	Designation	Requirement/ Limit	Sub.- No.	Designation	Requirement/ Limit
1	Secure raceway line attachment to structure / substructure	Refer to: 4.3.1.1 and 4.3.1.2 and 4.3.1.3	6.1	Ensure torque value properly applied on each raceway line fixation	Shall be defined in AIPS01-02-008
			6.2	Ensure RW alignment	± 0,5 mm in a cylindrical section
2	Secure harness installation	Refer to 4.3.2	7.1	No relative movement of harness	Shall be defined in relevant AIPI
			7.2	Gap protection	Gap > 6 mm
			7.3	Respect filling rate	65%

Table 4: Key Characteristics for A320 family

Product Key Characteristic			Process Key Characteristic		
No.	Designation	Requirement/ Limit	Sub.- No.	Designation	Requirement/ Limit
1	Secure raceway line attachment to structure / substructure	Refer to: 4.4.1.1 and 4.4.1.2 and 4.4.1.3	6.1	Ensure torque value properly applied on each raceway line fixation	Shall be defined in AIPS01-02-008
			6.2	Ensure RW alignment	± 0,5 mm in a cylindrical section
2	Secure harness installation	Refer to 4.4.2	7.1	No relative movement of harness	Shall be defined in relevant AIPI
			7.2	Respect filling rate	80% for LE 65% for TE

5 Technical qualification

The Technical Qualification shall be performed, according to the relevant Airbus procedure.

6 First Part qualification

Not applicable.

7 Series production inspection

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

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).

RECORD OF REVISIONS

Issue	Clause modified	Description of modification
1 10/15	All	New standard.
2 07/16	All	Organization of subclauses reviewed and subclauses 4 updated
	2	ABS0932, AIPS05-02-012, AIPS05-05-001, AIPS05-07-001, AIPS07-01-004 and AIPS07-08-007 deleted. AIPS07-07-002 added..
	4.1	Position and distribution of route and Figure 1 added.
	4.2	Figure 2 updated.
	4.2.1.2	Figure 4 updated with mechanical/electrical protection.
	4.2.2.1	Harness installation in 2D fire zone.
	4.2.1.4	Protection at gap level and wall deformation added..