

AEROSPACE STANDARD

SAE AS9102
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REV.
A

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(R) Aerospace First Article Inspection Requirement

FOREWORD

In December 1998, the Aerospace Industry had established the International Aerospace Quality Group (IAQG) with the purpose of achieving significant improvements in quality and reductions in cost throughout the value stream.

This organization, with representation from Aerospace companies in Americas, Asia and Europe and sponsored by SAE, SJAC, and AECMA has agreed to take responsibility for the technical contents of this standard.

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1. INTRODUCTION:

1.1 Scope:

This SAE Aerospace Standard (AS) establishes requirements for performing and documenting the First Article Inspection (FAI).

1.2 Purpose:

The purpose of the First Article Inspection is to give objective evidence that all engineering, design and specification requirements are correctly understood, accounted for, verified, and recorded. The purpose of this standard is to provide a consistent documentation requirement for aerospace components FAI.

1.3 Convention:

The following convention is used in this Standard.

- The words “shall” and “must” indicate mandatory requirements.
- The word “should” indicates mandatory requirements with some flexibility allowed in compliance methodology. An Organization is permitted to show that its approach meets the intent of the requirement and this standard.
- Words “typical”, “example” or “e.g.” show suggestions given for guidance only.
- “Notes” are used for additional clarification.

2. REFERENCES:

1. International Aerospace Standard 9100 “Quality Systems - Aerospace - Model for Quality Assurance in Design, Development, Production, Installation and Servicing”.
2. International Aerospace Standard 9103 “Variation Management in Key Characteristics”.
3. International Aerospace Standard 9131 “Quality Systems - Nonconformance Documentation”.

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3. DEFINITIONS:

ATTRIBUTE DATA: A result from a characteristic or property that is appraised only as to whether it does or does not conform to a given requirement (for example, go/no-go, accept/reject, pass/fail, etc.).

DELIVERABLE SOFTWARE: Embedded or loadable airborne, space borne or ground support software components that are part of an aircraft Type Design, weapon system, missile or spacecraft.

DESIGN CHARACTERISTICS: Those dimensional, visual, functional, mechanical, and material features or properties, which describe and constitute the design of the article as specified by Drawing Requirements. These characteristics can be measured, inspected, tested, or verified to determine conformance to the design requirements. Dimensional features include in-process locating features such as target-machined (or forged/cast) dimensions on forgings and castings, and, weld/braze joint preparation necessary for acceptance of finished joint. Material features or properties may include processing variables and sequences, which are specified by the drawing (e.g., heat treat temperature, fluorescent penetrant class, ultrasonic scans, sequence of welding and heat treat). These provide assurance of intended characteristics that could not be otherwise defined.

DRAWING REQUIREMENTS: Requirements of the drawing (including Parts Lists), specification, or purchasing document to which the article is to be made. These include any notes, specifications, and lower-level drawings invoked.

FIRST ARTICLE INSPECTION (FAI): A complete, independent, and documented physical and functional inspection process to verify that prescribed production methods have produced an acceptable item as specified by engineering drawings, planning, purchase order, engineering specifications, and/or other applicable design documents.

FIRST ARTICLE INSPECTION REPORT (FAIR): The forms and package of documentation for a part number or assembly, including FAI results, as per this Standard.

FIRST PRODUCTION RUN PARTS: The first group of one or more parts that are the result of a planned process designed to be used for future production of these same parts. Prototype parts, or parts built using methods different from those intended for the normal production process, shall not be considered as part of the first production run.

MULTIPLE CHARACTERISTICS: Identical characteristics that occur at more than one location (e.g., "4 Places") but are established by a single set of drawing requirements (e.g., rivet hole size, dovetail slots, corner radii, chemical milling pocket thickness).

PRODUCT: The result of a process, which in the context of this Standard includes finished detailed parts and assemblies. It also includes forgings and castings.

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3. (Continued):

REFERENCE CHARACTERISTICS: The characteristics that are used for “information only” or to show relationship. These are dimensions without tolerances and refer to other dimensions on the drawing.

STANDARD CATALOG HARDWARE: A part or material that conforms to an established industry or national authority published specification, having all characteristics identified by text description, National/Military Standard Drawing, or catalog item.

VARIABLES DATA: Quantitative measurements taken on a continuous scale. For example, the diameter of a cylinder or the gap between mating parts.

4. APPLICABILITY:

This Aerospace Standard applies to assemblies sub-assemblies, and detail parts including castings and forgings. This Standard applies to organizations that are responsible for producing the design characteristics of the product. The Organization shall flow down the requirements of this Standard to Suppliers who produce Design Characteristics.

This Standard does not apply to procured Standard Catalog Hardware or Deliverable Software.

5. REQUIREMENTS:

5.1 Part Requirements:

The Organization shall perform FAI on new Product representative of the First Production Run.

NOTE: For assemblies, the assembly level FAI shall be performed on those characteristics specified on the assembly drawing.

NOTE: The Organization shall not use prototype parts, or parts manufactured using methods different from those intended for the normal production process, for the FAI. This Standard may be used to verify conformance of a prototype part to design requirements.

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5.2 Evaluation Activities:

The Organization should conduct the following activities in support of FAI.

1. Review documentation for the manufacturing process (e.g., routing sheets, manufacturing/quality plans, manufacturing work instructions, etc.) to make sure all operations are complete as planned.
2. Review referenced exhibits supporting the FAI (e.g., inspection data, test data, Acceptance Test Procedures, etc.) for completeness.
3. Review nonconformance documentation (if any), for completeness.

NOTE: International Aerospace Standard 9131 may be used as a guidance.

4. Review material certifications for compliance, as applicable.
5. Verify that approved Special Process sources are used (as applicable), and that the manufacturing planning/routing document calls out the correct specification.
6. Verify that Key Characteristic requirements have been met, as applicable (see International Aerospace Standard 9103 for guidance).
7. Verify part specific gages and/or tooling are qualified and traceable, as applicable.
8. Verify that every design characteristic requirement is accounted for, uniquely identified and has inspection results traceable to each unique identifier.

5.3 Partial or Re-accomplishment of First Article Inspection:

The FAI requirement, once invoked, shall continue to apply even after initial compliance.

The FAI requirements may be satisfied by a partial FAI that addresses differences between the current configuration and prior approved configurations. When a partial FAI is performed, the Organization shall complete only the affected fields in the FAI forms. FAI requirements may also be satisfied by previously approved FAI performed on identical characteristics of similar parts produced by identical means. When FAI requirements (partial or complete) are satisfied in this manner, identify the approved configuration in the index of part numbers on Form 1.

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5.3 (Continued):

The Organization shall perform a full FAI, or a partial FAI for affected characteristics, when any of the following events occurs:

1. A change in the design affecting fit, form or function of the part.
2. A change in manufacturing source(s), process(es), inspection method(s), location of manufacture, tooling or materials, that can potentially affect fit, form or function.
3. A change in numerical control program or translation to another media that can potentially affect fit, form or function.
4. A natural or man-made event, which may adversely affect the manufacturing process.
5. A lapse in production for two years or as specified by the Customer.

5.4 Nonconformance Handling:

The FAI is not complete until the Organization closes all non-conformances affecting the part and implements corrective actions. The Organization shall re-do an FAI for those affected characteristics and shall record the results.

5.5 Documentation:

5.5.1 Forms: The Appendix of this Standard contains forms that comply with the documentation requirements of this Standard. Each field in the forms is designated with a unique reference number. Each field is also identified as:

- (R) Required: This is mandatory information.
- (CR) Conditionally Required: This field must be completed when applicable (i.e., when there exists a Customer requirement, then this field must be filled in).
- (O) Optional: This field is provided for convenience.

Forms contained in the Appendix should be used to document the results of the FAI.

NOTE: The fields in the forms are color-coded for convenience. Use of black-and-white forms is acceptable.

Forms other than those contained in the Appendix may be used, however they must contain all "Required" and "Conditionally Required" information and have the same field reference numbers.

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5.5.1 (Continued):

All forms shall be completed either electronically or in permanent ink.

All forms shall be completed in English or in a language specified by the Customer.

NOTE: Continuation sheets using the same form are acceptable or insert additional rows if completing electronically.

5.5.2 Characteristic Accountability: The Organization shall verify every Design Characteristic during FAI and record the results. Every Design Characteristic shall have its own unique characteristic number.

NOTE: Reference characteristics may be omitted from the FAI.

NOTE: Use more than one line if needed for any characteristic.

NOTE: Characteristics not measurable in the final product shall be verified during the manufacturing process (as long as they are not affected by subsequent operations) or by destructive means. Characteristics verified at the detail level may be referenced in the assembly-level FAIR.

5.5.3 Record of Results: Results from inspection of design characteristics shall be expressed in quantitative terms (Variables Data) when a Design Characteristic is expressed by numerical limits.

The Organization shall record the results in the units specified on the drawing or specification, unless otherwise approved by the Customer.

Attribute Data (e.g., go/no-go) may be used if no inspection technique resulting in Variables Data is feasible. Attribute Data is permitted when the Design Characteristic does not specify numerical limits (e.g., break all sharp edges). It is also permitted where qualified tooling is consistently used as a check feature and a go/no-go feature has been established for the specific characteristic.

5.6 Control of Records:

All FAI documentation required by this Standard shall be considered as a quality record and the Organization shall retain it according to Customer or regulatory requirements.

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6. NOTES:

- 6.1 The change bar (|) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document.

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PREPARED UNDER THE JURISDICTION OF
SAE COMMITTEE G-14, AMERICAS AEROSPACE QUALITY GROUP (AAQG)

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APPENDIX A FORMS AND GUIDELINES TO COMPLETE THE FORMS

This Appendix provides the guidelines to complete the forms. Each input field is identified as:

- **(R) Required:** This is mandatory information. This field is shown in **Bold** font.
- **(CR) Conditionally Required:** This field must be completed when applicable. This field is shown in ***Bold Italic*** font.
- **(O) Optional:** This field is provided for convenience. It is shown in Regular font.

The fields are also color coded for visual convenience: (R) as yellow and (CR) as blue. Use of black-and-white forms is acceptable.

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Instructions to Complete Form 1: Part Number Accountability

This form is used to identify the part that is being first-article inspected (FAI part) and associated subassemblies or detail parts.

NOTE: Fields 1-4 are repeated on all forms for convenience and traceability.

- 1) (R) **Part Number:** Number of the part (FAI part).
- 2) (R) **Part Name:** Name of the part as shown on the drawing.
- 3) (CR) **Serial number:** Serial number of the part.
- 4) (O) **FAI Report Number:** Reference number that identifies the FAI. This may be an internal report number.
- 5) (CR) **Part Revision Level:** Latest part revision that affects the part being first article inspected. If there is no revision, indicate as such. Note: The latest drawing revision (Field 7) does not always affect all parts contained on a drawing.
- 6) (CR) **Drawing Number:** Drawing number associated with the FAI part.
- 7) (CR) **Drawing Revision Level:** The revision level of the engineering drawing. If there is no revision, indicate as such.
- 8) (CR) **Additional Changes:** Provide reference number(s) of any changes that are incorporated in the product but not reflected in referenced drawing/part revision level (e.g., change in design, engineering changes, manufacturing changes, deviation or exclusion from certain drawing requirement, etc.).
- 9) (R) **Manufacturing Process Reference:** A reference number that provides traceability to the manufacturing record of the FAI part (e.g., router number, manufacturing plan number, etc.)
- 10) (R) **Organization Name:** Name of the Organization performing this FAI.
- 11) (O) **Supplier Code:** Supplier Code is a unique number given by Customer to the Organization. It is sometimes referred to as Vendor Code, Vendor Identification Number, Supplier Number, etc.
- 12) (O) **P.O. Number:** Enter Customer Purchase Order number, if applicable or required.
- 13) (R) **Detail part or an Assembly FAI:** Check as appropriate .
- 14) (R) **Full FAI or Partial FAI:** Check as appropriate. For a partial FAI, provide the baseline part number (including revision level) to which this partial FAI is performed and the reason for it. For example, changes in design, process, manufacturing location, etc.

15, 16, 17 and 18: This section is required only if the part number in Field 1 is an assembly requiring lower level parts to be installed into the assembly.

- 15) (CR) **Part Number:** Detail or next level sub-assembly part number to be included in the assembly.
- 16) (CR) **Part Name ,** as shown on the drawing.
- 17) (CR) **Part Serial Number** of the part that is installed in the assembly, when applicable.
- 18) (O) **FAI Report Number** for detail part.

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- 19) (R) **Signature:** Name and signature of the person who prepared FAI Form 1. Also check appropriate box if this FAI is complete per 5.4.
Note: The signature on this form certifies the following two things:
1) that all characteristics are accounted for; meet drawing requirements or are properly documented for disposition.
2) if this FAI is complete per 5.4. Check as appropriate.
- 20) (R) **Date** when this FAI Form 1 was prepared.
- 21) (O) Name of the person from the Organization who approved FAI report
- 22) (O) Date when the FAI report is approved.
- 23) (O) Customer Approval. This field is used by Customer to record approval, if required.
- 24) (O) Date Customer approved this FAI form.

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Instructions to Complete Form 2: Product Accountability – Raw Material, Specifications and Special process(s), Functional Testing

This form is used if any material, special processes or functional testing are defined as a Design Requirement.

NOTE: Fields 1-4 are repeated on all forms for convenience and traceability.

- 1) (R) **Part Number:** Number of the part (FAI part).
- 2) (R) **Part Name:** Name of the part as shown on the drawing.
- 3) (CR) **Part serial number:** Serial number of the part.
- 4) (O) **FAI Report Number:** Reference number that identifies the FAI. This may be an internal report number

- 5) (CR) **Material or Process:** Enter the name of material or process.
- 6) (CR) **Specification:** Enter material or process specifications number (include permitted alternates, if used), class, and material form (e.g., sheet, bar, etc.). Include all "Make From" materials that are incorporated into the FAI part. For raw materials, include all materials that are incorporated into the FAI part, (e.g., weld/braze filler materials, balls for ball brazing, etc.), and Standard Catalog hardware (e.g., AN, MS fasteners); but do not include processing materials such as acid etchants.
- 7) (O) **Code:** Enter any required code from the Customer for material or process listing, when required.
- 8) (CR) **Special Process Supplier Code:** Customer given Supplier code of the organization performing special process(es) or supplying material, as applicable. Also add, Special process supplier name and address.
- 9) (CR) **Customer Approval Verification:** Indicate if the special process or material source is approved by the Customer. Write NA if Customer approval is not required.
- 10) (CR) **Certificate of Conformance number:** Number of the certificate (e.g., special process completion certification, raw material test report number, Standard Catalog hardware compliance report number, traceability number).
- 11) (CR) **Functional Test Procedure Number:** Functional Test Procedure called out as Design Requirement.
- 12) (CR) **Acceptance Report Number:** The functional test certification indicating that test requirements have been met.
- 13) (O) **Comments:** As applicable.
- 14) (R) **Prepared By:** Name of the person who prepared this form.
- 15) (R) **Date:** Date when this form was completed.

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Instructions to Complete Form 3: Characteristic Accountability, Verification and Compatibility Evaluation

NOTE: Fields 1-4 are repeated on all forms for convenience and traceability.

- 1) (R) **Part Number:** Number of the part (FAI part).
- 2) (R) **Part Name:** Name of the part as shown on the drawing.
- 3) (CR) **Part serial number:** Serial number of part.
- 4) (O) **FAI Report Number:** Reference number that identifies the FAI. This may be an internal report number.

- 5) (R) **Characteristic Number:** Unique assigned number for each Design Characteristic.
- 6) (CR) **Reference Location:** Location of the Design Characteristic (e.g., drawing zone (page number and section), specification, etc.)
- 7) (CR) **Characteristic Designator:** If applicable, record characteristic type (e.g., key, flight safety, critical, major, etc.).
- 8) (R) **Requirement:** Specified requirement for the Design Characteristic (e.g., drawing dimensional characteristics with nominal and tolerances included, drawing notes, specification requirements, etc.).

- 9) (R) **Results:** List measurement(s) obtained for the Design Characteristics.
 - For Multiple Characteristics list each characteristic as individual values or list once with the minimum and maximum of measured values attained. If a characteristic is found to be non-conforming then that characteristic must be listed separately with the measured value noted.
 - If a Design Requirement requires verification testing, then the actual results will be recorded on the form. If a laboratory report or certificate of test is included in the FAIR, then these results need not be written on the form, record the reference number in this field. The laboratory report or certificate of test must show specific values for requirements and actual results.
 - For metallurgical characteristics with visual verification requirement that are rated against standard photographs, list the photo number of the closest comparison. A statement of conformance is acceptable (record the reference number in this field).
 - For processes that require verification per Design Characteristic, include statement of compliance (e.g., certification of compliance, verification indicator such as "accept", etc.).
 - For part marking, ensure that marking is legible, correct in content and size and properly located, per applicable specification.