INTERNATIONAL STANDARD

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Aerospace — Rivets, solid, in corrosion-resisting steel — Procurement specification

Aéronautique et espace — Rivets ordinaires, en acier résistant à la corrosion — Spécification d'approvisionnement

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 12289 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 4, *Aerospace fasterner systems*.

Aerospace — Rivets, solid, in corrosion-resisting steel — Procurement specification

1 Scope

This International Standard specifies the characteristics and quality assurance requirements for solid rivets made in corrosion-resisting steel for aerospace construction.

It is applicable whenever it is referenced in a definition document.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 7870, *Control charts — General guide and introduction*

ISO 7966, *Acceptance control charts*

ISO 8258, *Shewhart control charts*

ISO 17057, *Aerospace — Rivets, solid — Test method*

ISO/TR 13425, *Guide for the selection of statistical methods in standardization and specification*

ASTM E112[1)], *Standard test methods for determining average grain size*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
batch
quantity of finished rivets, using the same process, from a single material cast (single heat of alloy), having the same number of definition document, diameter and length code, heat treated together to the same specified condition and produced as one continuous run

1) Published by: American Society for Testing and Materials (ASTM), 1916, Race street, Philadelphia, PA 19103, USA.

3.2
rivet wire sample
length of wire, sampled at one end of the coil used for the manufacture of rivets of the batch

3.3
rivet sample
rivet sampled at random from the batch

3.4
definition document
document specifying directly or indirectly all the requirements for rivets

NOTE The definition document can be an International Standard, an in-house standard or a drawing.

3.5
crack
rupture in the material, which can extend in any direction and which can be intercrystalline or transcrystalline in character

3.6
seam
longitudinal open surface defect

3.7
lap
surface defect caused by folding over metal fins or sharp corners and then forming them into the surface

3.8
cold shut
doubling over of metal which can occur during the cold-heading operation

3.9
blistering
defect in the metal on or near the surface, resulting from expansion of gas in a sub-surface zone

3.10
pit
small sharp cavity in a metal surface caused by non-uniform electrodeposition or by corrosion

3.11
critical defect
defect that, according to judgement and experience, is likely to result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the considered product, or that is likely to prevent performance of the function of a major end item

3.12
major defect
defect, other than critical, that is likely to result in a failure or to reduce materially the usability of the considered product for its intended purpose

3.13
minor defect
defect that is not likely to reduce materially the usability of the considered product for its intended purpose, or that represents a departure from established specification having little bearing on the effective use or operation of this product

3.14
sampling plan
plan according to which one or more samples are taken in order to obtain information and to reach a decision, if possible

3.15
acceptable quality limit
AQL
⟨sampling inspection⟩ maximum percent defective (or the maximum number of defects per hundred units) that can be considered satisfactory as a process average

3.16
acceptable quality limit
AQL
⟨sampling plan⟩ level of quality that corresponds to a specified, but relatively high, probability of acceptance

4 Quality assurance

4.1 General

The manufacturer shall be capable of continuous production of solid rivets complying with the quality requirements specified in this International Standard. It is recommended that the manufacturer be certified to a recognized quality management system. The certification authority may be the prime contractor.

The purpose of acceptance inspection and tests of a solid rivet is to check, as simply as possible, using a method which is inexpensive but the most representative of the actual conditions of use, with the uncertainty inherent in statistical sampling, that the solid rivets satisfy the requirements of this International Standard.

Acceptance inspections and tests shall be carried out by the manufacturer, or under his responsibility.

4.2 Acceptance inspection and test conditions

Acceptance inspections and tests (requirements, methods, numbers of solid rivets) are specified in Table 1. They shall be carried out on each batch. Solid rivets shall be selected from the batch to be tested by simple random sampling.

Each solid rivet may be submitted to several inspections or tests, provided that none of characteristics to be verified has been previously altered during any of these inspections or tests.

The solid rivets to be subjected to destructive inspections or tests may be those on which non-destructive inspections or tests have been carried out.

A batch declared unacceptable after the acceptance inspection shall be resubmitted for acceptance only after all the defective units have been removed and/or defects have been corrected.

In this case, the attribute(s) which caused the rejection shall be verified using a sample of twice the normal size with the same acceptable limit.

If the reason for rejection results from the method, the test apparatus or from faulty heat treatment which can be rectified in a satisfactory manner, the tests may be repeated after elimination of the cause, provided that any surface treatment be removed prior to heat treatment, without being detrimental to rivet final use. A note to this effect shall be added to the corresponding inspection documents.

Unless otherwise specified, the test temperature shall be the ambient temperature.

4.3 Use of statistical process control (SPC)

When a characteristic is obtained by a controlled statistical process, the manufacturer has the possibility, in order to declare conformity of the characteristic, of refraining from making the final systematic sampling provided for in this International Standard, if he is capable of **formally justifying** this choice by using ISO/TR 13425 and the standards quoted in it as a basis.

This justification will include the following phases:

— analysis of the product's key characteristics;

— analysis of the risks for each implemented process;

— determination of the parameters and/or characteristics to be respected under SPC;

— determination of the capabilities of each process;

— drawing up an inspection plan and integration in the manufacturing process;

— drawing up of routes and control charts (ISO 7966, ISO 7870, ISO 8258);

— use of control charts for data consolidation;

— determination of the audits to be run and the control to be carried out to ensure reliability of the device.

To be usable in production, this process shall be or should be validated beforehand by the qualifying body, either during the qualification phase, or *a posteriori* according to the case, by analysing the justificatory file and the results of the qualification inspections such as provided for in Clause 5.

5 Requirements and test methods

See Table 1.

Table 1 — Requirements and test methods

Number	Characteristic	Requirement	Inspection and test method	Classification of defects and sampling
5.1	**Material**	In accordance with the product standard or definition document	See material standard.	
5.2	**Dimensions**	In accordance with the product standard or definition document	Usual instruments In case of dispute, the projection method at a magnification of × 25 for diameters ⩽ 6 mm and × 10 for diameters > 6 mm, shall be used as the reference method. Checks shall be made at three equidistant points around the rivet.	Table 2

Table 1 (*continued*)

Number	Characteristic	Requirement	Inspection and test method	Classification of defects and sampling
5.3	**Manufacturing**			
5.3.1	**Heat treatment**	Rivet wire samples shall undergo the same heat treatments as the rivets of the batch, at the same time. As specified in the material standard or definition document.		
5.3.2	**Workmanship**	No cracks, blistering or burrs Localized, non-continuous seams, laps, cold shuts, tool marks and pits having a maximum depth of 0,07 mm are permissible.	Visual examination with or without magnification. The magnification shall be limited to × 6. Defect depth shall be measured perpendicular to a line tangent with the surface.	Table 2
5.3.3	**Surface treatment**	Treatment in accordance with the product standard or definition document	See applicable surface treatment standard.	Table
5.4	**Mechanical properties**			
5.4.1	**Double shear strength**	See Table 3.	ISO 17057	Table 4
5.5	**Metallurgical properties**			
5.5.1	**Grain size**	Grain size shall be equal to or finer than four in accordance with ASTM E112.	Longitudinal cutting through the shank, polishing and etching using the appropriate reagents and then macroscopic examination	One test per heat of material per diameter
5.6	**Product identification marking**	In accordance with the product standard or definition document	Visual examination	Table 2

Table 1 (*continued*)

Number	Characteristic	Requirement	Inspection and test method	Classification of defects and sampling
5.7	**Delivery**			
5.7.1	**Packaging**	The packaging shall: — prevent any damage or corrosion occurring during handling, transport and storage; — only contain rivets from the same batch, the number of which is left to the manufacturer's discretion; however, the maximum mass is 25 kg; — contain a copy of the manufacturer's delivery note relating to the batch. Furthermore, this note may be sent separately upon request. Any particular or additional packaging requirements shall be specified with the order.	Visual examination	
5.7.2	**Labelling**	Durable labels, secured to the packaging, bearing the following information: — designation; — quantity (mass or number); — manufacturer's name; — batch number.	Visual examination	

Table 2 — Classification of defects

Category of defects	Acceptable quality limit (AQL)	Characteristics
Major	See Table 5.	Head diameter Head angle Head protrusion Product identification marking [a] Shank diameter Length Cracks Blistering
Minor	See Table 6.	All other dimensions, appearance items and miscellaneous defects

[a] Including legibility.

Table 3 — Double shear strength

Rivet diameter [a] D_1 mm		Minimum double shear strength [b] N	
		Steel designation (minimum shear stress)	
nom.	min.	Fe18Cr12Ni AISI 304 L (330 MPa)	Fe25Ni15Cr A286 (550 MPa)
1,6	1,52	1 198	1 996
2	1,92	1 911	3 185
2,5	2,42	3 036	5 060
3	2,92	4 420	7 366
3,5	3,395	5 975	9 958
4	3,895	7 864	13 107
5	4,895	12 421	20 701
6	5,895	18 014	30 023
8	7,87	32 106	53 510
10	9,87	50 497	84 162

[a] For other diameters, use the formula given in note b.

[b] Values calculated using the following formula:

$$(D_{1\,\min})^2 \times \frac{\pi}{4} \times 2 \times (\text{min. shear stress})$$