INTERNATIONAL STANDARD

ISO 12289

Second edition
2016-03-15

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

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

Reference number
ISO 12289:2016(E)

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 4, *Aerospace fastener systems*.

This second edition cancels and replaces the first edition (ISO 12289:2003), of which it constitutes a minor revision.

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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 7870–1, *Control charts — Part 1: General guidelines*

ISO 7870–2, *Control charts — Part 2: Shewhart control charts*

ISO 7870–3, *Control charts — Part 3: Acceptance control charts*

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

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 products, manufactured using the same processes, from a single material cast (single heat of alloy) having the same *definition document* (3.4) number, diameter and length code, heat treated together to the same specified condition and produced as one continuous run

3.2
rivet wire sample
length of wire, sampled at one end of the coil used for the manufacture of rivets of the *batch* (3.1)

Note 1 to entry: The rivet wire samples should undergo the same heat treatments as the rivets of the batch, at the same time.

3.3
rivet sample
rivet sampled at random from the *batch* (3.1)

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

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

Note 1 to entry: The definition document may 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 is a departure from established specifications 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
maximum percent defective (or the maximum number of defects per hundred units) that, for purposes of sampling inspection, can be considered satisfactory as a process average

Note 1 to entry: Variant: quality level, which in a *sampling plan* (3.14), 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, and 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 7870-1, ISO 7870-2, and ISO 7870-3);

— 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 υ 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
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	Visual examination with or without magnification. The magnification shall be limited to ×6.	Table 2
		Localized, non-continuous seams, laps, cold shuts, tool marks and pits having a maximum depth of 0,07 mm are permissible.	Defect depth shall be measured perpendicular to a line tangent with the surface.	
5.3.3	**Surface treatment**	Treatment in accordance with the product standard or definition document	See applicable surface treatment standard.	
5.4	**Mechanical properties**			
5.4.1	**Double shear strength**	See Table 3.	ISO 17057	Table 4
5.5	**Metallurgical properties**			

Table 1 *(continued)*

Number	Characteristic	Requirement	Inspection and test method	Classification of defects and sampling
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
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, and — 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
2,0	1,92	1 911	3 185
2,5	2,42	3 036	5 060
3,0	2,92	4 420	7 366
3,5	3,395	5 975	9 958
4,0	3,895	7 864	13 107
5,0	4,895	12 421	20 701
6,0	5,895	18 014	30 023
8,0	7,87	32 106	53 510
10,0	9,87	50 497	84 162

[a] For other diameters, use the formula given below.

[b] Values calculated using the following formula: $\left(D_{1\,\min}\right)^2 \times \frac{\pi}{4} \times 2 \times \left(\text{min. shear stress}\right)$

Table 4 — Sampling plans for the inspection of double shear strength

Batch size	Sample size	Sampling plan[a,b]				AQL
		Inspection level	Sampling number	Acceptance	Rejection	%
≤ 500	2	S-1	First	0	2	15
			Second	1		
501 to 35 000	3		First	0		10
			Second	1		
≥ 35 001	5		First	0		6,5
			Second	1		

[a] In accordance with ISO 2859-1, double sampling, normal inspection.

[b] Other sampling plans of ISO 2859-1 may be used, provided that they ensure an equivalent quality level.

Table 5 — Sampling plans for visual inspection and inspection of dimensional characteristics

Batch size	Sample size	Sampling plan[a,b]				AQL
		Inspection level	Sampling number	Acceptance	Rejection	%
91 to 150	5	I	First	0	3	10
			Second	3	4	
151 to 280	8		First	0	3	6,5
			Second	3	4	
281 to 500	13		First	1	4	
			Second	4	5	
501 to 1 200			First	0	3	4
			Second	3	4	
1 201 to 10 000	20	S-4	First	2	5	6,5
			Second	6	7	
10 001 to 35 000			First	1	3	4
			Second	4	5	
35 001 to 500 000	50		First	3	6	
			Second	9	10	
≥ 500 001	80		First	3	6	2,5
			Second	9	10	

[a] In accordance with ISO 2859-1, double sampling, normal inspection.

[b] Other sampling plans of ISO 2859-1 may be used, provided that they ensure an equivalent quality level.