

Aerospace series — Nickel alloy rivets — Technical specification

ICS 49.030.60

National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Spécification technique

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Foreword

This document (EN 2941:2008) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

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1 Scope

This standard specifies the performance and test requirements for solid rivets in the nickel alloys quoted below, intended for aerospace applications. It applies wherever it is specified in the document defining the rivet.

Its use, after agreement between the customer and the supplier, for solid rivets made from other materials, requires determination, case by case, of the minimum tensile and double shear loads.

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*.

EN 2002-001, *Aerospace series — Metallic materials — Test methods — Part 001: Tensile testing at ambient temperature*.

EN 2002-7, *Aerospace series — Metallic materials — Test methods — Part 7: Hardness test*. ¹⁾

EN 2305 ²⁾, *Nickel base alloy NI-P11 — $540 \text{ MPa} \leq R_m \leq 620 \text{ MPa}$ — Bars and wires for rivets — Aerospace series*. ³⁾

EN 3238, *Aerospace series — Metallic materials — Test method — Shear test for wires and rivets*. ⁴⁾

EN 4371, *Aerospace series — Heat resisting alloy NI-PD9001 (NiCu31) — Non heat treated — Bar for rivets — $D \leq 10 \text{ mm}$* . ¹⁾

EN 4372, *Aerospace series — Heat resisting nickel alloy with copper NI-PD9001 (NiCu31) — Wire for solid rivets — $D \leq 10 \text{ mm}$* . ¹⁾

3 Terms and definitions

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

3.1

batch

for all tests, inspections and supplies, a batch of rivets is defined as follows: finished rivets of the same form, diameter and length, manufactured by the same process, made from one material, batch from the same heat treatment furnace with the same surface treatment, and deriving from the same wire coil and the same place of manufacture

The maximum mass of each batch is limited to 25 kg.

1) Published as ASD Prestandard at the date of publication of this standard.

2) Inactive for new designation, see EN 4371 and EN 4372.

3) Published as ASD Standard at the date of publication of this standard.

4) In preparation at the date of publication of this standard.

3.2**rivet wire samples**

for the test, each rivet batch shall be accompanied by rivet wire samples taken from each end of the coil used to manufacture the batch. The samples shall be submitted to the same heat treatment as the rivets of that batch

3.3**rivet samples**

rivet samples intended for tests shall be chosen at random from each batch

4 Required characteristics

The rivets shall conform with the requirements of the document defining the rivet and those prescribed in Table 1. Inspections and tests are to be carried out by the rivet manufacturer.

Table 1 — Technical requirements and test methods

Subclause	Characteristics	Technical requirements	Inspection and test methods	Number of samples
4.1	Materials	Shall conform with the requirements of the material standard quoted in the document defining the rivet.	See material specification.	—
4.2	Dimensions	Shall conform with the requirements of the document defining the rivet.	Methods are at manufacturer's option. In case of dispute the projection method will be used as the reference method, using $\times 25$ magnification for diameters up to 6 mm and $\times 10$ for greater diameters. This inspection shall be carried out at three equidistant points around the rivet.	Table 2
4.3	Heat treatment	Shall conform with the condition of use defined in the material standard.	See 4.5.	—
4.4	Surface treatment	Shall be in conformity with the defining document	Methods are at manufacturer's option.	—
4.5	Mechanical properties	Shall be checked either by a double shear test or by a tensile test combined with a hardness test.	—	—
4.5.1	Double shear	Non-assembled rivets (i.e. without post-formed head) shall conform with the values specified in Table 4.	See EN 3238. If the rivets are not long enough for the double shear test, it shall be carried out on the wire samples.	Table 3
4.5.2	Tension	Rivet wire samples shall conform with the values specified in Table 5.	See EN 2002-001.	Table 3

continued

Table 1 — Technical requirements and test methods (continued)

Subclause	Characteristics	Technical requirements	Inspection and test methods	Number of samples
4.5.3	Hardness	Hardness values for rivet wire samples shall conform with the requirements of the corresponding material standard. Hardness values for rivets shall correspond with the rivet hardness values within a tolerance of $\pm 5\%$.	Refer to EN 2002-7.	Table 3
4.5.4	Upset test	After upset the head of the rivets shall be free from cracks or folds when viewed at a magnification of $\times 10$.	Rivets shall be placed in a test fixture substantially conforming to Figure 1a). The free end of the rivet shall be upset using a flat tool to obtain a head conforming to the requirements of Figure 1b).	Table 3 This test to be performed only at the request of the purchaser
4.6	Surface condition, appearance	Rivets shall be free from seams, burrs, laps, crevices, incrustations clefts, tooling marks, scores, cracks and other defect prejudicial to the use of the rivet.	Rivets shall be examined visually with or without magnification. Magnification is limited to $\times 6$.	Table 2
4.7	Identification and marking	Each rivet shall be marked in conformity with the defining document, except for particular indications requested by the customer. No sharp edges or other defect detrimental to the correct setting of the rivet shall be present.	Visual examination.	—
4.8	Packaging	<p>Rivets shall be delivered in strong and durable packages, capable of protecting them from physical and corrosive deterioration.</p> <p>Any particular or additional packaging requirements shall be specified in the order.</p> <p>If the rivets delivered come from different batches, each batch shall be packed and identified separately.</p> <p>Unless particularly specified in the order, the number of rivets in the same package is left to the manufacturer's discretion. However, maximum mass is 25 kg.</p> <p>A copy of the manufacturer's delivery note relating to the rivet batch shall be included in the package but may, on the other hand, be sent separately on request.</p>	—	—

continued

Table 1 — Technical requirements and test methods *(concluded)*

Subclause	Characteristics	Technical requirements	Inspection and test methods	Number of samples
4.9	Labelling	<p>Durable external labels on the package shall contain the following information:</p> <ul style="list-style-type: none"> – Identity block of the standard rivet; – Quantity (mass or number of rivets); – Customer's order number; – Manufacturer's identification, name and address; – Number of manufacturer's delivery note; – Manufacturer's batch number; – Manufacturer's inspection stamp. <p>Labels attached to a secondary package shall include the following information as a minimum:</p> <ul style="list-style-type: none"> – Identity block of the rivet; – Quantity; – Batch number; – Inspection stamp. 	—	—

Table 2 — Sampling plan and acceptance level ⁵⁾
non-destructive tests

Number of rivets in the batch	Number of rivets to be taken for the sampling batch	Maximum number of defective rivets in the sampling batch which permit acceptance of the batch ^a
151 to 280	32	3
281 to 500	50	5
501 to 1 200	80	7
1 201 to 3 200	125	10
3 201 to 10 000	200	14
10 001 to 35 000	315	21
35 001 to 150 000	500	21
^a Defective rivets shall not be returned to the batch.		

5) Sampling plan for normal inspection to ISO 2859-1 (AQL = 4 %).

**Table 3 — Sampling plan and rejection levels
destructive tests**

Number of rivets in the batch	Number of rivets to be taken for the sampling batch	Number of defective rivets which lead to rejection of the batch ^a
151 to 280	5	1
281 to 500	5	1
501 to 1 200	5	1
1 201 to 3 200	8	1
3 201 to 10 000	8	1
10 001 to 35 000	8	1
35 001 to 150 000	13	1

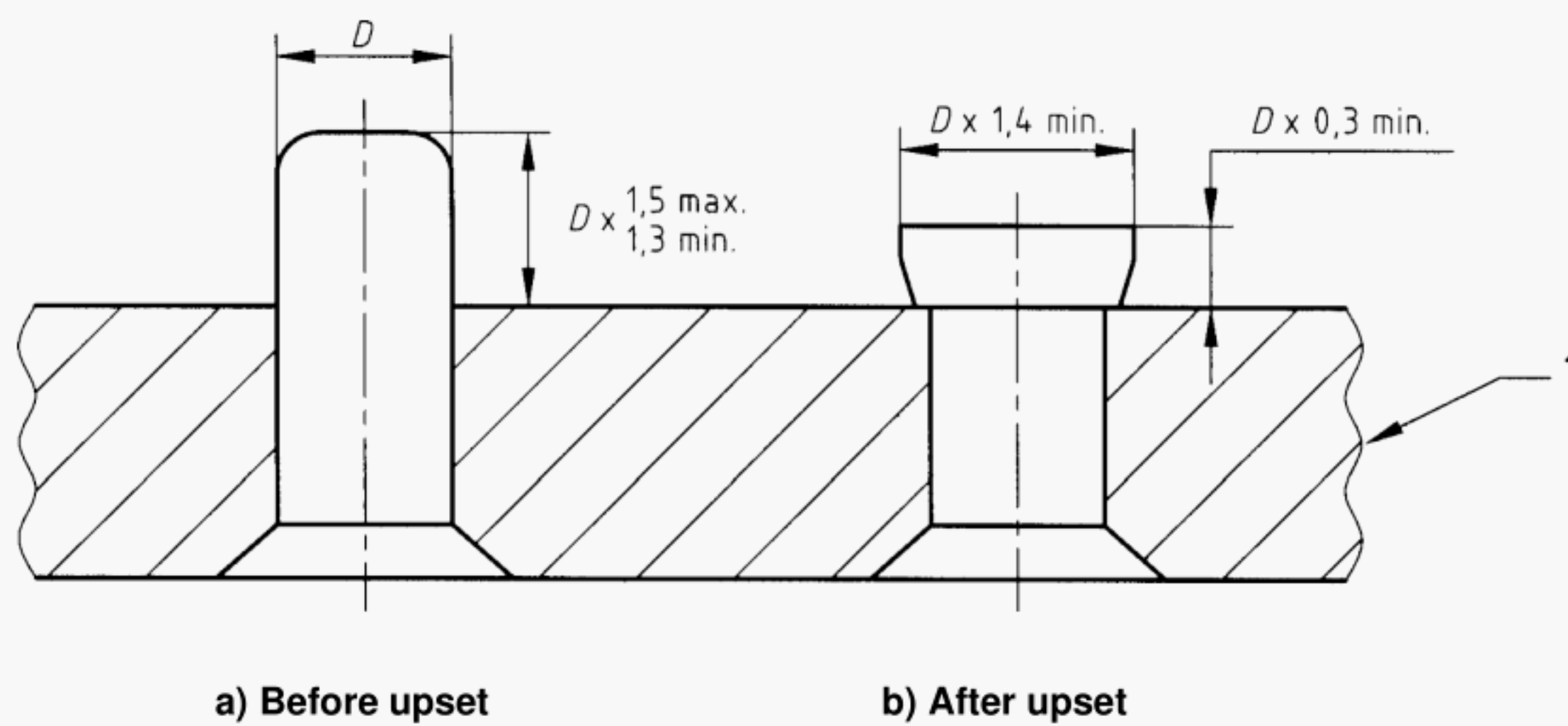
^a If the reason for rejection results from the method of operating the test apparatus or from faulty heat treatment which can be rectified in a satisfactory manner, the tests may be repeated after elimination of the cause. A note to this effect shall be added to the corresponding inspection documents.

Table 4 — Shear strength

Nominal rivet diameter mm	Minimum breaking load in double shear N
	EN 2305 R _c 340 MPa
1,6	1 280
2,4	2 950
3,2	5 300
4,0	6 290
4,8	11 950
5,6	16 330
6,4	21 400
8,0	33 330
9,6	48 200

Table 5 — Tensile strength

Nominal rivet diameter mm	Minimum tensile breaking load N
	EN 2305 R_c 540 MPa
1,6	1 020
2,4	2 340
3,2	4 200
4,0	6 580
4,8	9 490
5,6	12 970
6,4	16 990
8,0	26 470
9,6	38 275

**Key**

1 Test material hardness HRC 50-55

Figure 1 — Upset test

5 Filing of documents

For each batch, the manufacturer shall keep documentation stating at least:

- relationship between the rivet wire material batch and the rivet batch;
- a copy of the documents concerning the rivet wire material batch and the test references;
- heat treatment documents for the rivet batch;
- documents concerning the rivet batch inspections and tests;
- the final inspection certificate.

These documents and all associated references shall be kept on file for at least three years, and available for despatch to the customer at his request, within that period.

6 Certificate of conformity

The rivet manufacturer shall supply to the customer, no later than the delivery of the product, a final inspection certificate to confirm that the product conforms with all the requirements of this specification.

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