



AEROSPACE STANDARD

AS7233™**REV. A**

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Superseding AS7233

Rivets, Solid, UNS N04400, Corrosion Resistant
67Ni - 31Cu
Procurement Specification for

FSC 5320

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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1. SCOPE:

1.1 Type:

This procurement specification covers aircraft-quality solid rivets made from a corrosion resistant nickel-copper alloy of the type identified under the Unified Numbering System as UNS N04400 and of 46 ksi minimum shear strength.

1.2 Application:

Primarily for use as a fastening device where corrosion resistance up to approximately 800 °F is required and where ease of forming full heads are essential during riveting operation. The riveting operation shall be done by squeezing, using steadily applied pneumatic or hydraulic pressure; hand peening is not permitted.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other documents shall be the issue in effect on the date of the purchase order.

2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 2269 Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys

2.1.2 U.S. Government Publications: Available from Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-STD-1312 Fasteners, Test Methods

MIL-STD-2073-1 DoD Materiel, Procedures for Development and Application of Packaging Requirements

2.1.3 ASTM Publications: Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM E 76 Chemical Analysis of Nickel-Copper Alloys

2.2 Definitions:

DEFECTIVE: A defective is a unit of product which contains one or more defects.

PRODUCTION INSPECTION LOT: A production inspection lot shall be all finished parts of the same part number, made from a single heat of alloy, heat treated at the same time to the same specified condition, produced as one continuous run, and submitted for vendor's inspection at the same time.

2.3 Unit Symbols:

- ° degree, angle
- °F degree, Fahrenheit
- ksi kips (1000 pounds) per square inch
- lb pound, weight (mass)
- % percent (1% = 1/100)

3. TECHNICAL REQUIREMENTS:

3.1 Material:

The rivets shall be made from material conforming to the following:

3.1.1 Composition: Shall conform to the percentages by weight specified in Table 1, determined by wet chemical methods in accordance with ASTM E 76, spectrochemical methods, or by other analytical methods acceptable to the purchaser.

3.1.1.1 Check Analysis: Composition variations shall meet the requirements of AMS 2269.

3.1.2 Condition: Cold drawn wire for heading.

3.2 Design:

Rivet design shall be as specified on the applicable drawing.

TABLE 1 - Material Composition

Element	% By Weight min	% By Weight max
Nickel + Cobalt	63.0	---
Copper	28.0	34.0
Iron	---	2.5
Manganese	---	2.0
Cobalt /1/	---	1.0
Silicon	---	0.50
Carbon	---	0.16
Sulfur	---	0.024
Phosphorus /1/	---	0.02
Zinc /1/	---	0.02
Lead /1/	---	0.006
Tin /1/	---	0.006

/1/ Determination not required for routine acceptance.

3.3 Fabrication:

Preformed heads shall be cold headed, unless purchaser permits machining. Unless otherwise specified on the part drawing, rivets, after forming, shall be annealed and shall be descaled if necessary.

3.4 Runout of Head:

The circular runout of rivet head relative to the shank shall be within the full indicator movement (FIM) specified in Table 2, unless otherwise specified on the part drawing. The measurement shall be taken with the indicator stylus touching the periphery of the head as the rivet is rotated with the shank as an axis.

TABLE 2 - Circular Runout Tolerance

Rivet Shank Nominal Diameter inch	Rivet Head Runout Tolerance FIM, inch Flush Head	Rivet Head Runout Tolerance FIM, inch Protruding Head
0.062, 0.094, 0.125	0.010	0.010
0.156, 0.188	0.010	0.015
0.250	0.010	0.020
0.312, 0.375	0.015	0.020

3.5 Properties:

Rivets shall conform to the following requirements:

- 3.5.1 Formability: Solid-shank rivets shall withstand being squeeze driven cold to form a crack-free upset head having a diameter of 1.25 to 1.5 times the nominal shank diameter and a height within the range specified in Table 3 and expansion of the shank, for a length not less than one-half the grip length as measured from the squeezed rivet head, to the full diameter of the hole in which it is installed, provided that the hole diameter is not more than 0.006 inch greater than the nominal shank diameter.

TABLE 3 - Upset Head Height Proportion

Rivet Shank Nominal Diameter inch	Upset Head Height Proportion of Nominal Shank Diameter D
0.062, 0.094	0.5 to 1.0
0.125, 0.156	0.5 to 0.8
0.188, 0.250	0.5 to 0.8
0.312, 0.375	0.5 to 0.7

- 3.5.2 Flarability: Hollow-end rivets shall withstand being squeeze flared to a diameter of 1.5 times the nominal shank diameter without bending the shank and without cracking in the flared end when flared with a 90° included angle conical flaring tool.
- 3.5.3 Shear Strength: The shank of an undriven rivet shall have shear strength of 46 to 59 ksi, determined in accordance with MIL-STD-1312-13 for double shear test, or MIL-STD-1312-20 for single shear test if shank length is less than 2.5 times the nominal shank diameter.

3.6 Quality:

Parts shall be uniform in quality and condition, clean, sound, smooth, and free from burrs and foreign materials and imperfections detrimental to usage of the parts.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of parts shall supply all samples and shall be responsible for performing all required tests. Purchaser reserves the right to sample and perform such confirmatory testing as deemed necessary to ensure that the parts conform to the requirements of this specification.

4.2 Responsibility for Compliance:

The manufacturer's system for parts production shall be based on preventing product defects, rather than detecting the defects at final inspection and then requiring corrective action to be invoked. An effective manufacturing in-process control system shall be established, subject to the approval of the purchaser, and used during production of parts.

4.3 Production Acceptance Tests:

The purpose of production acceptance tests is to check, as simply as possible, using a method which is inexpensive and representative of the part usage, with the uncertainty inherent in random sampling, that the parts comprising a production inspection lot satisfy the requirements of this specification.

4.4 Classification of Tests:

The inspection and testing of parts are classified as follows:

- a. Acceptance tests which are performed on each production inspection lot. A summary of acceptance tests is shown in Table 4.
- b. Periodic tests which are to be performed periodically on production lots at a frequency selected by the vendor unless frequency of testing is specified by the purchaser. Requirements for formability as in 3.5.1 and flarability as in 3.5.2 are classified as periodic tests and shall be performed when requested by the purchaser.

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TABLE 4 - Summary of Acceptance Tests

TABLE 4A - Nondestructive Tests

Characteristic	Req. Para.	Sample Size	Test Methods
Packaging and identification	5.1	None	Visual examination
Quality	3.6	Table 5	Visual examination
Dimensions	3.2	Table 6	Conventional measuring methods
Runout of head	3.4	Table 6	Conventional measuring methods

TABLE 4B - Destructive Tests

Characteristic	Req. Para.	Sample Size	Test Methods
Material	3.1	4.5.1	ASTM E 76
Shear strength	3.5.3	4.5.3	MIL-STD-1312-13 or MIL-STD-1312-20

4.5 Sampling, Acceptance Tests:

4.5.1 Material: One sample from each heat of alloy.

4.5.2 Nondestructive Tests:

- 4.5.2.1 Visual Examination: A random sample shall be selected from each production inspection lot in accordance with Table 5.

TABLE 5 - Sampling Data for Visual Examination

Production Inspection Lot	Sample Size
25 & under	All
26 to 50	8
51 to 90	13
91 to 150	20
151 to 280	32
281 to 500	50
501 to 1200	80
1201 to 3200	125
3201 to 10000	200
1000 to 35000	315
35001 to 150000	500
150001 to 500000	800
500001 & over	1250

- 4.5.2.2 Dimensions and Tolerances: Lot size shall be defined in terms of pounds and sample size shall be defined in terms of number of rivets. For lots of 1200 lb and less, a random sample shall be selected in accordance with Table 6. For lots over 1200 lb, 10 rivets shall be selected at random from each production inspection lot.

TABLE 6 - Sampling Data for Dimensions and Tolerances

Production Inspection Lot, lb	Sample Size Parts
2 to 25	2
26 to 150	3
151 to 1200	5
1201 & over	10

- 4.5.3 Destructive Test, Shear Strength: A random sample consisting of five rivets shall be selected from each production inspection lot.