SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS7232

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Rivets, Solid and Tubular, Nickel Alloy Corrosion and Heat Resistant 74Ni - 15.5Cr - 8.0Fe Procurement Specification For

FSC 5320

RATIONALE

AS7232 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 Type:

This procurement specification covers aircraft quality solid rivets and tubular end rivets made from a corrosion and heat resistant nickel base alloy of the type identified under the Unified Numbering System as UNS N06600.

1.2 Application:

Primarily for fastener applications requiring corrosion resistance and heat and oxidation resistance up to 2000 °F, but with reduced strength at the elevated temperatures. Rivets shall not be hand peened during driving.

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.

2.1.1.1 Aerospace Material Specifications:

AMS 2269 Chemical Check Analysis Limits, Wrought Nickel Alloys and Cobalt Alloys
AMS 2750 Pyrometry

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AS7232

2.1.1.2 SAE Standards:

AS3230	Rivet, Tubular, Countersunk, AMS 7232
AS3231	Rivet, Tubular, Universal, AMS 7232

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

2.1.2.1 Military Standard:

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

2.1.2.2 Air Force-Navy Aeronautical Standards:

AN123301 thru AN123450	Rivet, Solid, Universal Head, AMS 7232
AN123601 thru AN123750	Rivet, Solid, 100° Flush Head, AMS 7232

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

ASTM E 92	Vickers Hardness Testing
ASTM E 354	Chemical Analysis of High-Temperature, Electrical, Magnetic and Other Similar Iron, Nickel, and Cobalt Alloys

2.2 Definitions:

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

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:

°F - degree, Fahrenheit
% - percent (1% = 1/100)
HV - hardness, Vickers

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 354 or by spectrochemical or other analytical methods acceptable to purchaser.

TABLE 1 - Material Composition

Element	% of Weight Min	% of Weight Max
Carbon	--	0.06
Manganese	--	1.00
Sillicon	--	0.50
Sulfur	--	0.015
Chromium	14.00	17.00
Nickel + Cobalt	72.00	--
Iron	6.00	10.00
Cobalt /1/	--	1.00
Columbium + Tantalum /1/	--	1.00
Titanium /1/	--	0.50
Aluminum /1/	--	0.35
Copper	--	0.50

/1/ Determination not required for routine acceptance.

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

3.1.2 Condition: Wire cold drawn from hot finished wire or rod which has been previously ground or has had surface preparation (other than by pickling) for removal of seams and other injurious surface imperfections.

3.2 Design and Dimensions:

Unless otherwise specified on the part drawing, rivets furnished to this specification shall conform to the design, dimensions, and other requirements specified on the applicable AS drawing as in 2.1.1.2 and the applicable AN standard drawing as in 2.1.2.2.

3.3 Fabrication:

Cold headed, unless purchaser permits machining, annealed, and descaled if necessary.

3.3.1 Annealing: Rivets shall be annealed by heating to 1950 °F ± 25, holding at heat for 5 to 20 minutes, and cooling as required. Furnaces may be any type ensuring uniform temperature throughout the parts being heated and shall be equipped with, and operated by, automatic temperature controllers and data recorders conforming to AMS 2750. The furnace atmosphere shall be such that it will not cause surface hardening.

3.4 Runout of Head:

The circular runout of rivet head relative to its 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 protruding head, or the conical surface near the top of the flush head, as the rivet is rotated with its 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	0.010	0.010
0.094	0.010	0.010
0.125	0.010	0.010
0.156	0.010	0.015
0.188	0.010	0.015
0.250	0.010	0.020
0.312	0.015	0.020
0.375	0.015	0.020

3.5 Properties:

Rivets shall conform to the following requirements:

3.5.1 Hardness: Shall be not higher than 151 HV, determined in accordance with ASTM E 92.

3.5.2 Formability: Solid-shank rivets shall withstand being driven cold to form a crack-free upset head. The cold driven, upset head shall have a diameter of 1.25 to 1.66 times the nominal shank diameter and a height within the range shown in Table 3. Using a rivet having a grip length of 1.5 times the nominal shank diameter, the cold driven rivet shall have an expansion of the shank 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 - Rivet Driven Head Height

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

3.5.3 Flarability: Hollow-end rivets as in 2.1.1.2 shall withstand being flared to a diameter of 1.5 times the nominal shank diameter without bending the shank and without cracking in the flared end.

3.7 Quality:

Rivets, as received by purchaser, shall be uniform in quality and condition, sound, smooth, and free from foreign materials and from imperfections detrimental to usage of the rivets.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The vendor of parts shall supply all samples for vendor's test and shall be responsible for performing all required tests. Purchaser reserves the right to sample and to perform any confirmatory testing 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 the 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.

4.3.1 Tests for all technical requirements are acceptance tests and shall be performed on each production inspection lot. A summary of acceptance tests is specified in Table 4.

4.4 Acceptance Tests Sampling:

4.4.1 Material Composition: One sample from each heat of alloy.

4.4.2 Nondestructive Tests - Visual and Dimensional: A random sample shall be selected from each production inspection lot in accordance with Table 5.

4.4.3 Hardness: A random sample consisting of five rivets shall be selected from each production inspection lot.

4.4.4 Formability or Flarability Tests: As agreed upon by purchaser and vendor.

4.4.5 Acceptance Quality: Of random samples tested, acceptance quality shall be based on zero defectives.

4.5 Reports:

The vendor of parts shall furnish with each shipment a report stating that the parts conform to the condition, chemical composition, and other technical requirements of this specification. This report shall include the purchase order number, lot number, AS7232, contractor or other direct supplier of material, part number, nominal size, and quantity.

TABLE 4 - Summary of Acceptance Tests

TABLE 4A - Nondestructive Tests

Characteristic	Req. Para.	Sample Size	Test Method
Packaging & identification	5.1	none	Visual examination
Dimensions	3.2	Table 5	Conventional measuring methods
Runout of Head	3.4	Table 5	Conventional measuring methods
Quality	3.7	Table 5	Visual examination

TABLE 4B - Destructive Tests

Characteristic	Req. Para.	Sample Size	Test Method
Material	3.1	4.4.1	Per ASTM E 354
Hardness	3.5.1	4.4.3	Per ASTM E 92
Formability	3.5.2	4.4.4	Conventional driving tool
Flarability	3.5.3	4.4.4	Conventional flaring tool

TABLE 5 - Sampling Data

Nondestructive Tests
Visual and Dimensional

Production Inspection Lot	Sample Size
2 to 5	2
16 to 50	3
51 to 150	5
151 to 500	8
501 to 3200	13
3201 to 35000	20
35001 to 500000	32
500001 and over	50

4.6 Rejected Lots:

If a production inspection lot is rejected, the vendor of parts may perform corrective action to screen out or rework the defective parts, and resubmit for acceptance tests inspection as in Table 4. Resubmitted lots shall be clearly identified as reinspected lots.