SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS7207

Issued 1992-10
Reaffirmed 2012-11

Spring Pins, Tubular, Slotted
Corrosion and Moderate Heat Resistant Steel
Procurement Specification for

FSC 5315

RATIONALE

AS7207 has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

1.1 Type:

This procurement specification covers tubular-shaped, slotted spring pins made of a corrosion and moderate heat resistant, martensitic iron base alloy of the type identified under the Unified Numbering System as UNS S42000 and heat treated to permit flexure when inserted into a hole.

1.2 Application:

Primarily to provide a spirng pin with sufficient flexure to remain tight against the surface of a recommended hole size into which the pin has been inserted.

1.3 Dimensions and Tolerances:

Unless otherwise specified herein, dimensions and tolerances are in inches.

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.

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/AS7207

2.1.1.1 Aerospace Material Specifications:

AMS 2371	Quality Assurance Sampling of Corrosion and Heat Resistant Steels and Alloys, Wrought Products and Forging Stock
AMS 5506	Steel Sheet, Strip, and Plate, Corrosion and Moderate Heat Resistant, 13Cr (0.30 - 0.40C) (SAE 51420)

2.1.1.2 SAE Standard:

J496	Spring Type Straight Pins

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 Federal Specification:

QQ-P-35	Passivation Treatments for Corrosion Resisting Steel

2.1.2.2 Military Standards:

MIL-STD-2073-1	DoD Materiel, Procedures for Development and Application of Packaging Requirements
MS171401 thru MS171900	Pin - Spring, Corrosion Resistant Steel

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

ASTM E 18	Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials

2.1.4 ANSI Publication: Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

ANSI/ASME B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)

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:

° - degree, angular
°F - degree, Fahrenheit
% - percent (1% = 1/100)
g - gram
cm^3 - cubic centimeter
lbf - pound-force
sp gr - specific gravity

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 Chemical Composition: Shall conform to AMS 5506 except the percentage by weight for carbon content may be as low as 0.22%.

3.1.2 Condition: Steel strip or flat wire, annealed.

3.2 Design:

Finished (completely manufactured) parts shall conform to the following requirements:

3.2.1 Design and Dimensions: Unless otherwise specified on the part drawing, spring pins furnished to this specification shall conform to the design, shape, dimensions, and other requirements specified on MS171401 through MS171900.

3.2.2 Surface Roughness: Surface roughness of finished parts shall conform to the requirements as specified on the part drawing, determined in accordance with ANSI/ASME B46.1.

3.2.3 Chamfer: Pins shall be chamfered at both ends as specified on the part drawing.

3.2.4 Average Diameter: Shall be as shown on the drawing, determined by averaging three diametral measurements made at the angular locations, with respect to the slot, shown on the drawing. Measurements shall be made at mid-length of pins 1 inch or less in length and at least 0.500 inch from the end of pins over 1 inch in length.

3.2.5 Maximum Diameter: Shall be not greater than that shown on the drawing, determined by means of a GO ring gage having length of hole not greater than 0.125 inch and a maximum diameter as shown on the drawing within a tolerance of -0.0001 inch.

3.2.6 Straightness: Shall be such that pins will pass freely through the appropriate ring gage constructed to meet the following requirements:

3.2.6.1 The maximum hole diameter of the gage shall be equal to the maximum pin diameter plus the pin straightness tolerance, within a tolerance of -0.0001 inch. The length of the gage hole and the straightness tolerance shall be as specified in Table 1 for the applicable pin length.

TABLE 1 - Pin Straightness Tolerance and Gage Length

Nominal Pin Length inches	Pin Straightness Tolerance inch	Length of Gage Hole inches
Up to 1, incl	0.007	0.995 - 1.005
Over 1 to 2, incl	0.010	1.995 - 2.005
Over 2	0.013	2.995 - 3.005

3.3 Fabrication:

Slotted pins shall be formed to meet design requirements as in 3.2 and heat treated to meet the properties as in 3.4.

3.3.1 Passivation: Finished pins after heat treatment shall be cleaned and passivated in accordance with QQ-P-35.

3.4 Properties:

3.4.1 Hardness: Shall be within the range specified in Table 2, determined in accordance with ASTM E 18 on a prepared flat surface 180° from the slot on the pin outside diameter.

TABLE 2 - Hardness

Wall Thickness inch	Hardness Range
Over 0.010 to 0.025	83 to 87 HR15N
Over 0.025 to 0.050	72 to 77 HRA
Over 0.050 to 0.094	43 to 52 HRC

3.4.2 Shear Strength: Shall be as specified in Table 3, determined in accordance with SAE J496.

TABLE 3 - Shear Strength

Nominal Pin Diameter inch	Double Shear Strength lbf, minimum
0.062	425
0.078	650
0.094	1000
0.109	1410
0.125	1840
0.141	2200
0.156	2880
0.188	4140
0.219	5640
0.250	7360
0.312	11500
0.375	16580
0.438	20000
0.500	25800

3.4.3 Microstructure: Shall be tempered martensite produced by hardening and tempering, and shall be free from grain boundary carbide network, determined by microscopic examination of a polished and etched specimen.

3.4.4 Ductility: Pins shall withstand, without cracking, squeezing in a vise until the gap closes. Pins which have been tested for shear strength shall show a ductile shear with no longitudinal cracks longer than 0.250 inch or one-third the total length of the pin, whichever is less.

3.4.5 Insertion: Pins shall withstand being inserted in the recommended minimum hole size shown in Table 4; nominal pin diameter sizes larger than 0.125 inch shall enter without the sides of the slot touching each other. Nominal pin diameter sizes 0.125 inch and smaller shall enter the minimum hole size shown in Table 4, but the slot may close. The hole in the gage used for this test shall have a basic diameter equal to the minimum hole size shown in Table 4 with a tolerance of ±0.0003 inch.

TABLE 4 - Hole Size for Pin Installation

Nominal Pin Diameter inch	Recommended Hole Diameter inch
0.062	0.062 to 0.065
0.078	0.078 to 0.081
0.094	0.094 to 0.097
0.109	0.109 to 0.112
0.125	0.125 to 0.129
0.141	0.141 to 0.145
0.156	0.156 to 0.160
0.188	0.187 to 0.192
0.219	0.219 to 0.224
0.250	0.250 to 0.256
0.312	0.312 to 0.318
0.375	0.375 to 0.382
0.438	0.437 to 0.445
0.500	0.500 to 0.510

3.4.6 Corrosion Resistance: Pins shall show not more than a slight haze of copper adhering to the surface after being subjected to the following test:

3.4.6.1 Scrub sample pins with soap and warm water, rinse in hot water, dip in 95% ethyl alcohol, and dry. Immerse the cleaned samples in a solution containing 4 g cupric sulfate, 10 g sulfuric acid (sp gr 1.84), and 90 cm^3 distilled water for 6 minutes at 65 °F ± 2 °F. Remove the samples and wash with a cloth saturated with clean water.

3.5 Quality:

Pins as received by purchaser, shall be sound, smooth, and free from foreign materials and from imperfections detrimental to usage of the pins.

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 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
b. Periodic tests

4.4.1 Acceptance Tests: Tests to determine conformance to requirements for material (3.1), design, dimensions and tolerances (3.2), shear strength (3.4.2), hardness (3.4.1), microstructure (3.4.3), and ductility (3.4.4) are classified as acceptance tests and shall be performed on each production inspection lot. A summary of acceptance tests is specified in Table 5.

4.4.2 Periodic Tests: Tests to determine conformance to requirements for insertion (3.4.5) and corrosion resistance (3.4.6) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by the purchaser.

TABLE 5 - Summary of Acceptance Tests

TABLE 5A - Nondestructive Tests

Characteristic	Req. Para.	Sample Size	Test Method
Material	3.1	AMS 2371	Per 3.1.1
Design & dimensions	3.2.1	Tables 6 & 7	Conventional measuring methods
Surface roughness	3.2.2	Tables 6 & 7	Per ANSI/ASME B46.1
Chamfer	3.2.3	Tables 6 & 7	Conventional measuring methods
Average diameter	3.2.4	Tables 6 & 7	Conventional measuring methods
Maximum diameter	3.2.5	Tables 6 & 7	GO ring gage
Straightness	3.2.6	Tables 6 & 7	Ring gage

TABLE 5B - Destructive Tests

Characteristic	Req. Para.	Sample Size	Test Method
Shear Strength	3.4.2	Table 8	Per SAE J496
Hardness	3.4.1	Table 8	Per ASTM E 18
Microstructure	3.4.3	Table 8	Microscopic examination
Ductility	3.4.4	Table 8	Per 3.4.4

4.5 Sampling, Acceptance Tests:

4.5.1 Material: In accordance with AMS 2371.

4.5.2 Nondestructive Tests - Visual and Dimensional: A random sample of parts shall be taken from each production inspection lot, the size of the sample to be as specified in Table 6. The classification of dimensional characteristics shall be as specified in Table 7. All dimensional characteristics are considered defective when out of tolerance.

4.5.3 Destructive Tests: A random sample of parts shall be selected from each production inspection lot, the size of the sample shall be as specified in Table 8. The sample pins may be selected from those that have been subjected to and passed the nondestructive tests.

TABLE 6 - Sampling Data

Nondestructive Tests
Visual and Dimensional Characteristics
For Classes Major and Minor

Production Inspection Lot	Major Sample Size	Minor Sample Size
25 & under	5	3
26 to 50	8	5
51 to 90	13	8
91 to 150	20	13
151 to 280	32	20
281 to 500	50	32
501 to 1200	80	50
1201 to 3200	125	80
3201 to 10000	200	125
10001 to 35000	315	200
35001 to 150000	500	315
150001 to 500000	800	500
500001 and over	1250	800