SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
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AEROSPACE STANDARD

SAE AS50141

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Tube, Pneumatic Tire, Aircraft

1. SCOPE:

This SAE Aerospace Standard (AS) establishes requirements for manufacturing, testing, identification, packaging, and quality of tubes for application in commercial and military aircraft wheel assemblies.

2. REFERENCES:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 Tire and Rim Association (TRA) Publication: Available from ???

Aircraft Yearbook

2.1.2 American Society for Testing and Materials (ASTM) Publications: Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM D 412	Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D 746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
ASTM D 5118	Standard Practice for Fabrication of Fiberboard Shipping Boxes

2.1.3 American Society for Quality Control Publication: Available from ???

ANSI/ASQC Z1.4	Sampling Procedures and Tables for Inspection by Attributes

TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX: (724) 776-0790 SAE WEB ADDRESS: http://www.sae.org

2.1.4 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

TSO-C62	Tires
MIL-PRF-5041	Performance Specification, Tires, Ribbed Tread, Pneumatic, Aircraft, General Specification For

2.2 Definitions:

2.2.1 LOT: Unless otherwise specified, a lot shall include all tubes of the same size manufactured during one continuous production run.

2.2.2 TUBE: A tube is defined as the internal component of a pneumatic tire used primarily as an air-retaining chamber. A conventional pneumatic tire consists of an assembly of the casing and tube.

2.2.3 FABRIC BASE: To prevent wheel chafing, some tubes are manufactured with a fabric base. The fabric reinforces the inside diameter (base) of the tube.

3. REQUIREMENTS:

3.1 Qualification:

The tubes furnished under this specification shall be products that are authorized by the procuring activity. Changes in plants, construction, materials or processes that affect performance of the tube shall require requalification per this specification. Qualification testing of a specific tube size need not be reaccomplished if the contractor has been granted qualification approval and the materials and process for that tube size have not changed.

3.2 Materials:

The materials shall meet the performance requirements specified both herein and by the pertinent reference documents.

3.2.1 Physical Properties of Tube Material: The physical properties of the material used in the tube body shall comply with Table 1 requirements.

TABLE 1 - Physical Properties

Property	Before Aging	After Aging
Minimum Tensile Strength (psi)	2,100	- - -
Minimum Elongation (percent)	550	- - -
Maximum Set Stretch (percent)	- - -	25
Tensile Strength of Splice[1]	- - -	- - -
Average (psi)	1,500	- - -
Minimum (psi)	1,200	- - -

[1]Based on cross-sectional area of the rubber adjacent to the splice.

3.2.2 Operating Temperature Range: The selected materials shall maintain their intended properties within a temperature range of -50 to 52 °C (-58 to 125 °F). The tube and valve core materials shall satisfactorily pass the low temperature test specified in Section 4.

3.3 Physical Characteristics:

Tube gauge, weight, static unbalance, and valve configuration/components shall comply with Table 2 requirements. All military tubes shall be provided with TR VC-5 caps.

3.3.1 Vent Ridges: Vent ridges shall be provided to prevent air entrapment between the tire casing and tube. The ridge groups shall be spaced at approximately 6-in intervals. Mold dimensions for the ridges shall be at least 0.015 in deep and 0.030 in wide.

3.3.2 Balance: Each fabric base tube, with the valve installed, shall be checked for balance and shall conform to the requirement specified in Table 2. Hot or cold patches, if used, shall have beveled or step-off edges, shall be neatly applied, and shall be clearly marked to indicate that they are balance patches. All-rubber tubes do not require an individual balance check (except as noted in Section 4), but shall be manufactured such that the balance requirements specified in Table 2 are met.

3.3.3 Thickness: Each tube shall conform to the minimum gauge thickness as specified in Table 2. Tubes having localized thin spots in the crown area of not less than 65% of the specified minimum thickness or in the base area of not less that 80% of the specified minimum thickness are acceptable.

3.4 Valve Attachment Strength:

Fabric base tubes with a TR-60, TR-67, TR-168, or TR-176A valve shall meet the applicable valve attachment strength requirement as specified in Table 3.

3.5 Leakage:

All tubes shall be airtight. Any indication of bubbling shall be cause for rejection.

TABLE 2 - Physical Characteristics

Size	Minimum Thickness (inches)		Minimum Fabric Insert Half Width (inches)(1)	Maximum Weight (pounds)	Maximum Static Unbalance (inch-ounces)	*Valve TR No.
	Crown	Base				
8.00	.060	------	----------	0.53	(3)	12
10.00	.060	------	----------	0.80	(3)	12
14.50	.060	------	----------	1.6	(3)	20
27	.060	.080	----------	5.3	6	25
33	.070	.100	----------	9.0	11	14M, 94-B
36	.070	.100	----------	11.2	16	227-A
44	.080	.115	----------	17.2	25	99-C, 176A
44FB(2)(11)	.095	.110	7.25	18.1	25	227-A
47	.080	.115	----------	23.4	28	227-A
56(2)(11)	.120	.160	8.50	39.3	40	93-E
5.00-4	.070	.075	----------	1.35	5	AC21, 60, 67-A
5.00-5	.060	.060	----------	1.4	(3)	67-A, 88
6.00-6	.060	.060	----------	2.12	8	20, 67
6.50-8	.060	.060	----------	3.0	8	15
6.50-10	.060	.090	----------	4.24	8	25
7.00-6	.060	.060	----------	2.75	8	20
7.00-8	.060	.085	----------	3.25	7	15, 67
7.50-10	.060	.100	----------	4.8	8	14M, 25(7), 193
7.50-14	.070	.100	----------	5.0	8	176A-E
8.00-4	.090	.090	----------	2.1	(3)	12
8.00-6	.060	.060	----------	3.25	8	20
8.50-6	.060	.060	----------	4.0	8	20
8.50-10	.060	.100	----------	5.1	8	25
8.90-12.50	.080	.090	----------	8.0	12	15
9.00-6(4)	.060	.060	----------	4.0	8	69-Straight
9.00-6(5)	------	------	----------	4.0	8	69-A
9.50-16	.070	.100	----------	8.5	10	176A-E
10.00-7	------	------	----------	6.35	9	350
11.00-12(4)	.090	.090	----------	8.0	12	13
11.00-12(5)	.090	.090	----------	8.0	12	150CW
12.50-16	.070	.110	----------	14.0	18	101-C
15.00-16	.090	.140	----------	18.6	22	92-A
15.50-20	.090	.140	----------	21.2	26	92-C
17.00-16	.090	.140	----------	21.2	26	91-G
17.00-20(2)(11)	.100	.150	5.50	27.6	40	92-C
19.00-23(2)(11)	.100	.150	7.75	36.0	41	98-B
20.00-20	.100	.110	----------	34.0	45(6)	193-Bent
20.00-20(2)(11)	.100	.150	6.25	34.0	45(6)	193-Bent
25.00-28(2)(11)	.150	.180	8.75	76.0	200	193-Bent
12.50x4.5	.120	.120	----------	1.8	(3)	89-Bent
16x4.4	.085	.085	----------	2.8	4	60, 60-B
16 x 4.4(2)(11)	.090	.150	1.25	2.8	4	60-B

TABLE 2 - Physical Characteristics (Continued)

Size	Minimum Thickness (inches)		Minimum Fabric Insert Half Width (inches)(1)	Maximum Weight (pounds)	Maximum Static Unbalance (inch-ounces)	*Valve TR No.
	Crown	Base				
18x4.4	.090	.100	- - - - - - - - - -	3.25	5	67-C
18 x 4.4(2)(11)	.090	.150	1.25	3.25	5	67-C
18x5.5	.080	.100	- - - - - - - - - -	3.5	4	15, 67-C
18 x 5.5(2)(11)	.090	.150	1.62	3.5	4	67-C
20 x 4.4(2)(11)	.090	.150	1.25	3.5	5	67-B
22 x 5.5(2)(11)	.090	.150	1.62	4.25	7	67-B
24 x 5.5(2)(11)	.090	.150	1.62	4.5	8	67-B
24x7.7	.090	.100	- - - - - - - - - -	6.0	8	14M
24 x 7.7(2)(11)	.090	.150	2.50	6.0	8	14M
25x6.0	.090	.100	- - - - - - - - - -	4.5	15	68-C
25 x 6.0(2)(11)	.090	.150	1.38	4.5	15	68-C
26 x 6	.080	.120	- - - - - - - - - -	4.8	8	176A-G
26x6.6	.090	.100	- - - - - - - - - -	6.0	17	176A-G
26 x 6.6(2)(11)	.090	.150	2.00	6.0	17	176A-G
29 x 7.7(2)(11)	.090	.150	2.00	7.25	20	102-D
30 x 6.6(2)(11)	.090	.150	1.62	7.0	10	168-R
30 x 7.7(2)(11)	.090	.150	2.62	7.5	19	176A-D
30 x 8.8(2)(11)	.090	.150	2.38	8.1	21	102-D
32 x 8	.080	.120	- - - - - - - - - -	7.15	10	14M
32x8.8	.090	.100	- - - - - - - - - -	8.5	21	176A-D
32 x 8.8(2)(9)(11)	.090	.150	3.12(8)	8.5	21	96-C, 176A-D
34x9.9	.090	.125	- - - - - - - - - -	10.0	27	150CW, 176A
34 x 9.9(2)(11)	.090	.150	3.50	10.0	27	150CW
36 x 11(2)(11)	.095	.160	3.75	12.5	16	92-C, 93-D
40 x 12(2)(11)	.105	.160	4.25	17.0	40	91-C
44 x 13(2)(11)	.115	.160	4.75	22.5	25	193-Bent
46 x 9(2)(11)	.095	.160	2.25	13.5	52	99-B
49 x 17(2)(11)	.120	.160	5.88	28.5	40	193-Bent
56 x 16(2)(11)	.120	.160	5.00	30.0	90	193-Bent
15x6.0-5	.060	.060	- - - - - - - - - -	1.4	(3)	67-A
15x6.0-6	.060	.060	- - - - - - - - - -	2.12	8	20(10), 67-A
19.5x6.75-8	.060	.060	- - - - - - - - - -	3.0	8	15
22x7.25-11.50	.065	.090	- - - - - - - - - -	3.75	6	150CW
22x8.0-8	.060	.085	- - - - - - - - - -	3.25	7	15
29x6.25-16	.090	.095	- - - - - - - - - -	7.0	20	76-A
29x11.0-10	.070	.095	- - - - - - - - - -	5.9	20	193-Bent
29x13-5	.060	.100	- - - - - - - - - -	6.9	10	262-Bent
380x150-5	.060	.060	- - - - - - - - - -	1.4	(3)	67-A

TABLE 2 - Physical Characteristics (Continued)

(1) Measured from centerline of tube base to edge of fabric.
(2) Shall be provided with fabric base.
(3) Balance not required.
(4) These tubes shall be marked “Drop Center.”
(5) These tubes shall be marked “Flat Base.”
(6) Must not exceed 45 in-oz with valve extension and must not exceed 20 in-oz without valve extension.
(7) For OV-10 nose wheel, use valve TR 193-Bent.
(8) For dual brake applications, use fabric width of 2.38.
(9) The use of fabric base with the best heat resistant tube is mandatory.
(10) For H-60 tail wheel tube, use valve TR 67-A.
(11) Not recommended for new design and not likely to be procurable.
* Reference TRA Aircraft Yearbook.

TABLE 3 - Valve Attachment Strength Requirements

*Valve TR No.	Minimum Ultimate Load (lb)
60	450
67	500
168	500
176A	800

*Reference TRA Aircraft Yearbook

3.6 Age:

Tubes shall be not more than 36 months old from the date of manufacture to the initial date of delivery.

3.7 Identification:

3.7.1 Tubes: Each tube shall be legibly and permanently marked with the following information:

a. Size
b. Specification (AS50141)
c. Name or trademark of qualified manufacturer
d. Date of manufacture (month and year) located within 6 in of valve stem

3.7.2 Valves: Each valve shall be legibly and permanently marked with the appropriate TR number on an external surface least affected by service life abrasion. Marking shall be molded in raised letters on rubber sections or stamped in depressed letters on metal sections.

3.8 Workmanship:

The tube shall be free from defects that affect proper functioning in service. The tube shall have a smooth finish and be free of tool marks, dirt, and foreign material which affect appearance.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Inspection and Testing Responsibility:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection and testing requirements as specified herein. The supplier may utilize his own or any other facilities suitable for the performance of the requirements specified herein unless disapproved by the procuring activity. The procuring activity reserves the right to perform any of the inspections or tests set forth in this specification if deemed necessary to ensure conformance to prescribed requirements.

4.2 Classification of Tests:

The inspection and testing of tubes shall be classified as follows:

a. Qualification tests (4.3)
b. Acceptance tests (4.4)

4.3 Qualification Tests:

The qualification test samples shall consist of three tubes of each size on which approval is desired. Samples shall be identified as required and forwarded to an appropriate testing laboratory. Qualification testing shall consist of all the tests of this specification. After completion of the qualification tests, the testing laboratory shall furnish two copies of each qualification test report to the responsible procuring activity if requested.

4.4 Acceptance Tests:

The acceptance tests shall consist of:

a. Individual tests (4.4.1)
b. Sample tests (4.4.2)

4.4.1 Individual Tests: Each tube shall be subjected to the product examination test (4.5.1).

4.4.2 Sample Tests: Unless otherwise specified, samples shall be selected from each lot in accordance with ANSI/ASQC Z1.4 (Inspection Level I, Acceptance Number Zero) and subjected to the following tests:

a. Physical properties/characteristics (4.5.2)
b. Strength of splice (4.5.3)
c. Valve attachment strength (4.5.4)
d. Balance (4.5.5)
e. Leakage (4.5.6)

4.5 Test Methods:

4.5.1 Product Examination Test: Each tube shall be visually examined for conformance to all the requirements of this specification not covered by tests.

4.5.2 Physical Properties/Characteristics Test: All tests of tensile strength, elongation, and set shall be conducted in accordance with ASTM D 412. The methods used for verifying gauge thickness, valve dimensions, and weight shall be satisfactory to the inspector.

4.5.2.1 Set Test Conditions: Test samples per ASTM D 412, Die B shall be used. Sample thickness shall be 0.080 in ± 0.008 in. The sample(s) shall be centered and clamped with the inner edges of the clamps 4.5 in ± 0.1 in apart. The sample(s) shall be stretched to achieve 50% elongation of the gage length and then air-heated for a minimum of 5 h at 107 °C ± 3 °C (225 °F ± 5 °F). Elongation shall not be adjusted during the test.

4.5.2.2 Determination of Set: Following aging, the sample(s) shall be allowed to cool under tension for a minimum of 2 h. The tension shall then be released and the permanent set in the gage length shall be measured after a 23 h ± 1 h dwell period.

4.5.3 Strength of Splice Test: The average strength of a splice shall be determined by averaging the strength of samples taken from the crown, base, and two sides of the tube in accordance with ASTM D 412. For fabric base tubes, only three samples shall be taken (one from the crown and one from each sidewall above point where gum strip ends).

4.5.4 Valve Attachment Strength Test: A section of the tube with valve stem assembly shall be centrally positioned in a valve attachment strength test apparatus similar to that shown in Figure 1. The apparatus shall then be securely clamped in the jaws of a testing machine of such capacity that the tension during test shall not exceed 85% nor be less than 15% of the machine's rated capacity. The stroke speed shall be set at a rate of 0.5 in/min. The ultimate load required to pull out the valve stem shall be recorded as the valve attachment strength.

4.5.5 Balance Test: Each fabric base tube shall be balanced by determining the weight required to produce static balance and attaching an appropriate weight patch to bring the tube within required balance limits. All-rubber tubes shall be sampled for compliance with balance requirements in accordance with the sampling plan.

4.5.6 Leakage Test: Tubes shall be checked for leakage by inflating with air and immersing in water.

4.5.7 Low Temperature Test: A sample of the material shall satisfactorily pass testing in accordance with ASTM D 746 at -50 °C (-58 °F). In addition to the standard test requirement, there shall be no evidence of pending failure of the test samples at a temperature higher than -50 °C (-58 °F). Alternate test methods may be employed provided data is submitted substantiating the equivalence of test methods.

5. PREPARATION FOR DELIVERY:

5.1 Surface Treatment:

Each tube shall be partially inflated and folded in a manner that will eliminate sharp creases. The tubes shall be protected from injury by the metal valve stem, or components thereof, by means of a suitable non-corrosive material. Each tube shall be treated with powdered soapstone, talc, or a suitable substitute to prevent rubber-to-rubber adhesion when packaged.