



AEROSPACE MATERIAL SPECIFICATION

AMS2304™

REV. C

Issued	1991-01
Reaffirmed	2015-05
Revised	2020-05

Superseding AMS2304B

Steel Cleanliness, Special Aircraft-Quality
Magnetic Particle Inspection Procedure

RATIONALE

AMS2304C results from a Five-Year Review and update of this document, allows periodic testing by adding 4.2.3, 4.2.3.1, 4.2.3.2, 4.2.3.3, and 8.8 that cover the process qualification, testing frequency, historical data and melting-casting process controls.

1. SCOPE

1.1 Purpose

This specification covers steel cleanliness requirements in inch/pound units for special aircraft-quality ferromagnetic steels, including hardenable corrosion resistant steels, by magnetic particle inspection methods. This specification contains sampling, sample preparation, inspection procedures and cleanliness rating criteria (see 8.2).

1.1.1 The metric version, MAM2304, has been cancelled. The SI units have been included in this specification, but the inch/pound units are primary (see 8.7).

1.2 Application

This procedure has been used typically for the cleanliness evaluation of blooms, billets, tube rounds, stock for forging or flash welded rings, slabs, bars, sheet, plate, tubing, and extrusions used in fabricating highly stressed parts where very strict magnetic particle inspection standards are used in final inspection of such parts, but may be used for qualification of a heat, melt or lot of steel.

1.2.1 Product qualified to this specification is not recommended for use in parts where the high transverse properties of vacuum-arc-remelted or electroslag remelted steel are required (see 8.4).

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

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2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP1917 Clarification of Terms Used in Aerospace Metals Specifications

2.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E10 Brinell Hardness of Metallic Materials

ASTM E1444 Magnetic Particle Testing

2.3 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ANSI B46.1 Surface Texture

3. TECHNICAL REQUIREMENTS

3.1 Specimen Preparation

3.1.1 Heat Qualification

Sampling shall be in accordance with 4.3.1. Samples shall be converted into test specimens in accordance with 3.1.3.

3.1.2 Product Qualification

Product from a heat not qualified based on sampling as in 4.3.1 shall be sampled in accordance with 4.3.2. Samples shall be converted into test specimens in accordance with 3.1.3.

3.1.3 Working and Rough Machining

3.1.3.1 Solid Product 12 Inches (305 mm) and Over in Nominal Diameter or Distance Between Parallel Sides

A quarter section shall be cut from the sample sufficiently oversize that the center of the original sample will be approximately on the surface of the specimen after generating to test size. The quartered section shall then be forged to a 3 to 6 inch (76 to 152 mm) round or square, maintaining the axis of the forging approximately parallel to the original direction of rolling. As an alternate method, the full section may be rolled or forged to a 6-inch (152-mm) round or square and an oversize quarter obtained as in 3.1.3.3. Specimens shall be rough machined to a "one-step" straight cylinder nominally 5 inches (127 mm) long. Minimum stock removal shall be consistent with the machining allowance specified in 3.1.4.1.

3.1.3.2 Solid Product Over 6 to 12 Inches (152 to 305 mm), Exclusive, in Nominal Diameter or Distance Between Parallel Sides Except Slabs and Plates

A quarter section shall be cut from each sample sufficiently oversize that the center of the original sample will be approximately on the surface of the specimen after generating to test size. The quarter section shall be converted into a test specimen by machining, or forging and machining, to a 3 to 6 inch (76 to 152 mm) round or square. Specimens shall be rough machined to a "one-step" straight cylinder nominally 5 inches (127 mm) long. Minimum stock removal shall be consistent with the machining allowance specified in 3.1.4.1.

3.1.3.3 Solid Product 6 Inches (152 mm) and Under in Nominal Diameter or Distance or Distance Between Parallel Sides Except Flat Bars, Slabs, and Plates

A quarter section shall be cut from each sample sufficiently oversize that the center of the original sample will be approximately on the surface of the specimen after generating to test size. The quarter section shall be converted into a test specimen by machining to a "one-step" straight cylinder nominally 5 inches (127 mm) long. Minimum stock removal shall be consistent with the machining allowance specified in 3.1.4.1.

3.1.3.3.1 As an alternate method, a stepdown specimen may be generated from the full cross-section in equal length circumferential steps as shown in Table 1.

Table 1A - Stepdown specimens - cylindrical (inch/pound units)

Nominal Diameter or Distance Between Parallel Sides Inches	Step Length Inches	Step 1 Diameter	Step 2 Diameter	Step 3 Diameter	Step 4 Diameter	Step 5 Diameter
0.250 to 0.500, incl	5.000	D	--	--	--	--
Over 0.500 to 0.750, incl	2.500	D	2/3D	--	--	--
Over 0.750 to 1.000, incl	1.665	D	3/4D	1/2D	--	--
Over 1.000 to 1.500, incl	1.250	D	4/5D	3/5D	2/5D	--
Over 1.500	1.000	D	4/5D	3/5D	2/5D	1/5D

D = Original diameter or distance between parallel sides minus machining stock removed.

Table 1B - Stepdown specimens - cylindrical (SI units)

Nominal Diameter or Distance Between Parallel Sides Millimeters	Step Length Millimeters	Step 1 Diameter	Step 2 Diameter	Step 3 Diameter	Step 4 Diameter	Step 5 Diameter
6.35 to 12.70, incl	127.0	D	--	--	--	--
Over 12.70 to 19.05, incl	63.50	D	2/3D	--	--	--
Over 19.05 to 25.40, incl	42.29	D	3/4D	1/2D	--	--
Over 25.40 to 38.10, incl	31.75	D	4/5D	3/5D	2/5D	--
Over 38.10	25.40	D	4/5D	3/5D	2/5D	1/5D

D = Original diameter or distance between parallel sides minus machining stock removed.

3.1.3.4 Flat Bars

Specimens nominally 5 inches (127 mm) long shall be rough machined to equal-length steps across the width of the specimen, in accordance with Table 2, allowing 20% of the thickness or 0.100 inch (2.54 mm), whichever is less, for minimum stock removal. Allowance of 0.010 inch (0.25 mm) shall be made for finish machining.