



Designation: B708 – 12

# Standard Specification for Tantalum and Tantalum Alloy Plate, Sheet, and Strip<sup>1</sup>

This standard is issued under the fixed designation B708; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers unalloyed and alloyed tantalum plate, sheet, and strip as follows.

1.1.1 R05200, unalloyed tantalum, electron-beam furnace or vacuum-arc melt, or both,

1.1.2 R05400, unalloyed tantalum, powder-metallurgy consolidation,

1.1.3 R05255, tantalum alloy, 90 % tantalum, 10 % tungsten, electron-beam furnace or vacuum-arc melt, or both,

1.1.4 R05252, tantalum alloy, 97.5 % tantalum, 2.5 % tungsten, electron-beam furnace or vacuum-arc melt, or both, and

1.1.5 R05240, tantalum alloy, 60 % tantalum, 40 % niobium, electron-beam furnace or vacuum-arc melt.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety and/or health problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

E8 Test Methods for Tension Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E112 Test Methods for Determining Average Grain Size

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee B10 on Reactive and Refractory Metals and Alloys and is the direct responsibility of Subcommittee B10.03 on Niobium and Tantalum.

Current edition approved Dec. 1, 2012. Published January 2013. Originally approved in 1982. Last previous edition approved in 2005 as B708 – 05. DOI: 10.1520/B0708-12.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.1 *annealed material, n*—plate, sheet, or strip that has been annealed.

3.1.2 *annealing (annealed), n*—the act of heat treating to soften plate, sheet, or strip.

3.1.3 *lot, n*—all material produced from the same ingot or a single powder blend at one time with the same cross section, and with the same nominal metallurgical parameters.

3.1.4 *plate, n*—a flat product more than 0.1853 in. (4.7 mm) in thickness.

3.1.5 *sheet, n*—a flat product 6 in. (152.4 mm) or more in width and from 0.005 in. (0.13 mm) to 0.1875 in. (4.76 mm) in thickness.

3.1.6 *strip, n*—a flat product, may be supplied in coil, less than 6 in. (152.4 mm) in width and from 0.005 in. (0.13 mm) to 0.1875 in. (4.76 mm) in thickness.

## 4. Classifications

4.1 The strip, sheet or plate is to be furnished in the following grades:

4.1.1 R05200, unalloyed tantalum, electron-beam furnace or vacuum-arc melted, or both,

4.1.2 R05400, unalloyed tantalum, powder-metallurgy consolidation,

4.1.3 R05255, tantalum alloy, 90 % tantalum, 10 % tungsten, electron-beam furnace or vacuum-arc melted, or both,

4.1.4 R05252, tantalum alloy, 97.5 % tantalum, 2.5 % tungsten, electron-beam furnace or vacuum-arc melted, or both,

4.1.5 R05240, tantalum alloy, 60 % tantalum, 40 % niobium, electron-beam furnace or vacuum-arc melted, or both.

4.1.6 For sputtering application see supplemental requirements to grades R05200 and R05400.

## 5. Ordering Information

5.1 Orders for material under this specification shall include the following information as applicable:

5.1.1 Quantity (weight, number of pieces or other suitable measure of quantity),

5.1.2 Name of material (tantalum plate, sheet, or strip),

5.1.3 Grade (alloy and method of manufacture) (see 4.1.1 – 4.1.6),

5.1.4 ASTM Standard (Specification B708) and year of issue, and

5.1.5 Additions to the specification and supplementary requirements if required.

## 6. Materials and Manufacture

6.1 Material covered by this specification shall be made from vacuum-arc melted or electron-beam melted ingots or powder metallurgy consolidated unalloyed tantalum.

6.2 The various tantalum mill products covered by this specification are formed with the conventional extrusion, forging, and rolling equipment normally available in metal working plants.

6.3 All material shall be supplied in the annealed condition unless otherwise specified by the purchaser.

6.3.1 If specified on the purchase order, the material can be supplied in the “fully recrystallized” condition. In this case the plate, sheet, strip, or foil shall be 90 % minimum recrystallized as measured in accordance with 16.3. The terms “fully annealed,” “completely,” and other similar terms shall be considered the same as “fully recrystallized.”

## 7. Chemical Composition

7.1 The tantalum and tantalum alloy ingots and the tantalum powder metallurgy consolidated ingots for conversion to finished products covered by this specification shall conform to the requirements for chemical composition as prescribed in Table 1.

7.1.1 Analysis for elements not listed in Table 1 and not normally expected in tantalum shall not be required unless specified at time of purchase.

7.2 The manufacturer’s ingot (or powder metallurgy consolidated bar) analysis may be considered the chemical analysis for products supplied under this specification. Alternately, an analysis of a representative sample of in-process material (or the final product) from the same ingot may be substituted.

7.3 When requested by the purchaser at the time of purchase, the seller shall furnish a report certifying the values of carbon, oxygen, nitrogen, and hydrogen of the finished

product as specified in Table 2 for each lot of material supplied. The performance of this special provision shall be negotiated.

## 8. Mechanical Properties

8.1 Annealed materials supplied under this specification shall conform to the requirements for mechanical properties as specified in Table 3. No mechanical property requirements for unannealed (not heat treated) plate, sheet, or strip have been established by this specification. Unless otherwise specified, material supplied under this specification will be supplied in the annealed condition.

## 9. Metallurgical Properties

9.1 Unless otherwise stated, the materials supplied under these specifications shall be in the fully annealed condition.

9.2 Other conditions, such as cold-worked or stress-relieved, can be specified as agreed upon between the purchaser and the manufacturer at the time of the purchase.

## 10. Special Requirements

10.1 None specified.

## 11. Significance of Numerical Limits

11.1 For the purpose of determining compliance with the specified limits for requirements of the properties listed in the following table, an observed value or a calculated value shall be rounded as indicated in accordance with the rounding methods of Practice E29.

Property	Rounded Unit for Observed or Calculated Value
Chemical composition, and tolerances (when expressed as decimals)	nearest unit in the last right-hand place of figures of the specified limit
Tensile strength and yield strength	nearest 1000 psi (10 MPa)
Elongation	nearest 1 %

## 12. Permissible Variations in Dimensions

12.1 *Thickness*—The variation in thickness of strip, sheet, and plate is given in the following table:

12.1.1 Plate, Sheet and Strip, Table 4.

**TABLE 1 Chemical Requirements**

Element	Content, max, weight %				
	Electron-Beam Cast (R05200) Vacuum-Arc Cast (R05200) Unalloyed Tantalum	Sintered (R05400) Unalloyed Tantalum	Electron-Beam Cast (R05255) Vacuum-Arc Cast (R05255) 90 % Tantalum 10 % Tungsten	Electron-Beam Cast (R05252) Vacuum-Arc Cast (R05252) 97.5 % Tantalum 2.5 % Tungsten	Electron Beam Cast (R05240) Vacuum-Arc Cast (R05240) 60 % Tantalum 40 % Niobium
C	0.010	0.010	0.010	0.010	0.010
O	0.015	0.03	0.015	0.015	0.020
N	0.010	0.010	0.010	0.010	0.010
H	0.0015	0.0015	0.0015	0.0015	0.0015
Fe	0.010	0.010	0.010	0.010	0.010
Mo	0.020	0.020	0.020	0.020	0.020
Nb	0.100	0.100	0.100	0.50	35.0–42.0
Ni	0.010	0.010	0.010	0.010	0.010
Si	0.005	0.005	0.005	0.005	0.005
Ti	0.010	0.010	0.010	0.010	0.010
W	0.05	0.05	9.0–11.0	2.0–3.5	0.050
Ta	remainder	remainder	remainder	remainder	remainder

**TABLE 2 Additional Chemical Requirements for Finished Product (When Specified by the Purchaser)**

Element	Content, max, weight %				
	Electron-Beam Cast (R05200) Vacuum-Arc Cast (R05200) Unalloyed Tantalum	Sintered (R05400) Unalloyed Tantalum	Electron-Beam Cast (R05255) Vacuum-Arc Cast (R05255) 90 % Tantalum 10 % Tungsten	Electron-Beam Cast (R05252) Vacuum-Arc Cast (R05252) 97.5 % Tantalum 2.5 % Tungsten	Electron Beam Cast (R05240) Vacuum-Arc Cast (R05240) 60 % Tantalum 40 % Niobium
O	0.025	0.035	0.025	0.025	0.025
N	0.010	0.010	0.010	0.010	0.010
H	0.0015	0.0015	0.0015	0.0015	0.0015
C	0.020	0.020	0.020	0.020	0.020

**TABLE 3 Mechanical Properties for Annealed Plate, Sheet, and Strip**

Grade and Form	Annealed Condition		
	Ultimate Tensile Strength, min, psi (MPa)	Yield Strength, min, psi (MPa) (2 % Offset)	Elongation, min, % (1-in. Gage Length)
Unalloyed tantalum (R05200) (R05400) Plate, sheet and strip	<0.060 in. thick	30 000 (207)	20
	≥0.060 in. thick	25 000 (172)	30
90 % tantalum – 10 % tungsten (R05255) Sheet and strip	70 000 (482)	60 000 (414)	15
	Plate	70 000 (482)	20
97.5 % tantalum – 2.5 % tungsten (R05252) <0.125 in. thick	40 000 (276)	30 000 (207)	20
	≥0.125 in. thick	40 000 (276)	25
60 % tantalum – 40 % niobium (R05240) <0.060 in. thick	35 000 (241)	20 000 (138)	25
	≥0.060 in. thick	35 000 (241)	25

**TABLE 4 Dimensional Tolerances for Tantalum Sheet and Plate**

Thickness of Tantalum in. (mm)	Tolerance on Thickness, <sup>A</sup> plus or minus, in. (mm)		Tolerance on Width (Slit), <sup>B</sup> plus or minus, in. (mm)		Tolerance on Sheared Lengths, in. (mm)			
	Width under 6 in. (152.4 mm)	Width 6 to 24 in. (152.4 to 609.6 mm)	Width under 6 in. (152.4 mm)	Width 6 to 24 in. (152.4 to 609.6 mm)	Length 12 in. (304.8 mm) and Under		Length over 12 in. (304.8 mm)	
					Plus	Minus	Plus	Minus
0.0051 to 0.010 (0.129 to 0.254)	0.0005 (0.0127)		0.012 (0.305)		1/16 (1.59)	0	1/4 (6.35)	0
0.011 to 0.015 (0.279 to 0.381)	0.0007 (0.0178)	0.001 (0.0254)	0.015 (0.381)	0.015 (0.381)	1/16 (1.59)	0	1/4 (6.35)	0
0.016 to 0.020 (0.406 to 0.508)	0.0008 (0.0203)	0.0015 (0.0381)	0.015 (0.381)	0.015 (0.381)	1/16 (1.59)	0	1/4 (6.35)	0
0.021 to 0.030 (0.533 to 0.762)	0.0015 (0.0381)	0.0025 (0.0635)	0.020 (0.508)	0.025 (0.635)	1/16 (1.59)	0	1/4 (6.35)	0
0.031 to 0.060 (0.787 to 1.524)	0.0025 (0.0635)	0.0035 (0.0889)	0.025 (0.635)	0.030 (0.762)	1/16 (1.59)	0	1/4 (6.35)	0
0.061 to 0.090 (1.549 to 2.286)	0.004 (0.1016)	0.005 (0.1270)	0.025 (0.635)	0.035 (0.889)	1/16 (1.59)	0	1/4 (6.35)	0
0.091 to 0.125 (2.311 to 3.175)	0.006 (0.1524)	0.007 (0.1778)	...	...	1/16 (1.59)	0	1/4 (6.35)	0
0.126 to 0.187 (3.200 to 4.750)	0.010 (0.2540)	0.010 (0.2540)	...	...	1/16 (1.59)	0	1/4 (6.35)	0

<sup>A</sup> Tolerance on thickness of sheet over 24 in. (609.6 mm) wide shall be ±10 % of the thickness.

<sup>B</sup> Tolerance on width of sheared sheet shall be + 1/4 in. (6.35 mm), – 0 in. (0 mm).

12.2 *Width*—The variation in width is give in the following table:

12.2.1 Plate, Sheet and Strip, **Table 4**.

12.3 *Length*—The variation in length is given in the following table:

12.3.1 Plate, Sheet and Strip, **Table 4**.