



# AEROSPACE MATERIAL SPECIFICATION

AMS4901™

REV. U

Issued 1952-11  
Revised 2019-10  
Superseding AMS4901T

Titanium Sheet, Strip, and Plate  
Commercially Pure  
Annealed, 70.0 ksi (485 MPa)  
(Composition similar to UNS R50700)

## RATIONALE

AMS4901U is a Five-Year Review and update of this specification that adds ASTM E539 and ASTM E2994 as analytical methods (3.1), allows continuous annealing (3.4.1), prohibits unauthorized exceptions (3.9) and revises reports (4.4.2) and identification (5.1).

### 1. SCOPE

#### 1.1 Form

This specification covers one grade of commercially-pure titanium in the form of sheet, strip, and plate up through 1.000 inch (25.40 mm), inclusive.

#### 1.2 Application

These products have been used typically for parts requiring moderate, sustained strength up to 400 °F (204 °C) and oxidation resistance up to 600 °F (316 °C), but usage is not limited to such applications.

### 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.

#### 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](http://www.sae.org).

AMS2242 Tolerances, Corrosion and Heat Resistant Steel, Iron Alloy, Titanium, and Titanium Alloy Sheet, Strip, and Plate

AMS2249 Chemical Check Analysis Limits, Titanium and Titanium Alloys

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AMS2368	Sampling and Testing of Wrought Titanium Raw Materials Except Forging and Forging Stock
AMS2750	Pyrometry
AMS2809	Identification Titanium and Titanium Alloy Wrought Products
AS6279	Standard Practices for Production, Distribution, and Procurement of Metal Stock
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](http://www.astm.org).

ASTM A480/A480M	General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip
ASTM E8/E8M	Tension Testing of Metallic Materials
ASTM E112	Determining Average Grain Size
ASTM E290	Semi-Guided Bend Test for Ductility of Metallic Materials
ASTM E384	Microindentation Hardness of Materials
ASTM E539	Analysis of Titanium Alloys by X-Ray Fluorescence Spectrometry
ASTM E1409	Determination of Oxygen and Nitrogen in Titanium and Titanium Alloys by Inert Gas Fusion
ASTM E1447	Determination of Hydrogen in Titanium and Titanium Alloys by the Inert Gas Fusion Thermal Conductivity/Infrared Detection Method
ASTM E1941	Determination of Carbon in Refractory and Reactive Metals and Their Alloys by Combustion Analysis
ASTM E2371	Analysis of Titanium and Titanium Alloys by Direct Current Plasma and Inductively Coupled Plasma Atomic Emission Spectrometry
ASTM E2994	Analysis of Titanium and Titanium Alloys by Spark Atomic Emission Spectrometry and Glow Discharge Atomic Emission Spectrometry

## 3. TECHNICAL REQUIREMENTS

### 3.1 Composition

Shall conform to the percentages by weight shown in Table 1; carbon shall be determined in accordance with ASTM E1941, hydrogen in accordance with ASTM E1447, oxygen and nitrogen in accordance with ASTM E1409, and other elements in accordance with ASTM E539, ASTM E2371, or ASTM E2994. Other analytical methods may be used if acceptable to the purchaser.

**Table 1 - Composition**

Element	Min	Max
Iron	--	0.50
Oxygen	--	0.40
Carbon	--	0.08
Nitrogen	--	0.05 (500 ppm)
Hydrogen	--	0.015 (150 ppm)
Other Elements, each (3.1.1)	--	0.10
Other Elements, total (3.1.1)	--	0.30
Titanium	remainder	

3.1.1 Determination not required for routine acceptance.

3.1.2 Check Analysis

Composition variations shall meet the applicable requirements of AMS2249.

3.2 Melting Practice

Alloy shall be produced by electron beam cold hearth or plasma arc cold hearth melting method or shall be multiple melted with the final melting cycle under vacuum. When multiple melted, the first melt shall be made by vacuum consumable electrode, nonconsumable electrode, electron beam cold hearth, or plasma arc cold hearth melting practice. The subsequent melt or melts shall be made using vacuum arc remelting (VAR) practice. Alloy additions are not permitted in the final melt cycle.

3.2.1 The atmosphere for nonconsumable electrode melting shall be vacuum or shall be argon and/or helium at an absolute pressure not higher than 1000 mm of mercury.

3.2.1.1 The electrode tip for nonconsumable electrode melting shall be water-cooled copper.

3.3 Condition

The product shall be supplied in the following condition:

3.3.1 Sheet and Strip

Hot rolled, with or without subsequent cold reduction, annealed, and, unless anneal is performed in an atmosphere yielding a bright finish, descaled having a surface appearance comparable to a commercial corrosion-resistant steel sheet No. 2D finish (see 8.2).

3.3.2 Plate

Hot rolled, annealed, descaled, and flattened, having a surface appearance comparable to a commercial corrosion-resistant steel No. 1 finish (see 8.2). Plate product shall be produced using standard industry practices designed strictly for the production of plate stock to the procured thickness. Bar, billet, forgings, or forging stock shall not be substituted for plate.

3.4 Annealing

The product shall be annealed by heating to a temperature within the range 1200 to 1500 °F (649 to 816 °C), holding at the selected temperature within  $\pm 25$  °F ( $\pm 14$  °C) for a time commensurate with the thickness and the heating equipment and procedure used, and cooling as required. Pyrometry shall be in accordance with AMS2750.

3.4.1 When continuous annealing is used for sheet and strip, process parameters (e.g., furnace temperature set points, heat input, travel rate, etc.) for continuous heat treating lines shall be established by the material producer and validated by testing of product to requirements of 3.5.