

**MIL-STD-412**  
**28 May 1957**

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**MILITARY STANDARD**

**ALLOY DESIGNATION SYSTEM**

**FOR**

**TITANIUM**



**MIL-STD-412**  
**28 May 1957**

**OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE**  
**WASHINGTON 25, D. C.**

**Supply and Logistics**

**28 May 1957**

**Alloy Designation System**  
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1. This standard has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force, effective immediately.
2. In accordance with established procedure, the Standardization Division has designated the Ordnance Corps, The Bureau of Aeronautics, and the Air Force, respectively, as Army-Navy-Air Force custodians of this standard.
3. Recommended corrections, additions, or deletions should be addressed to the Standardization Division, Office of the Assistant Secretary of Defense (Supply and Logistics), Washington 25, D. C.

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**FOREWORD**

The alloy designation system for titanium described herein is based on the system devised by the American Iron and Steel Industry and the Aluminum Association.

This document serves to standardize the alloy nomenclature for titanium alloys throughout the titanium industry and the Department of Defense.

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## MILITARY STANDARD

### ALLOY DESIGNATION SYSTEM FOR TITANIUM

#### 1. SCOPE

1.1 This standard establishes a uniform system for designating the major alloying elements, the respective percentages of these elements, and the temper for titanium alloy.

#### 2. REFERENCED DOCUMENTS

2.1 The following document forms a part of this standard. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

##### AMERICAN SOCIETY FOR TESTING MATERIALS

ASTM Designation E 29 — Recommended Practice For Designating Significant Places in Specified Limiting Values

(Copies of ASTM Standard Designations may be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Penn.).

#### 3. DEFINITIONS

3.1 **Alloying element.** An alloying element is defined as an element (other than the base metal) having a minimum content greater than zero either directly specified or computed in accordance with the percentages specified for other elements. The amount present is the mean of the range (or the minimum percentage if only that is specified) before rounding-off.

#### 4. GENERAL REQUIREMENTS

There shall always be a minimum of four digits in the basic designation for binary and ternary alloys, and a minimum of six digits for complex alloys. The basic designation shall be prefixed by "Ti" to indicate titanium. The temper of the alloy shall be indicated by a suffix to the basic designation. The assignment of each digit shall be as described herein.

#### 5. DETAIL REQUIREMENTS

5.1 **Alloying elements.** The first two digits (four-digit system) or the first three digits (six-digit system) shall designate the major alloying elements (see 3.1). The digits used to represent the alloying elements shall be those specified in table I. The alloying elements shall be those specified in the greatest amount and shall be arranged in order of decreasing percentages or in numerical order if of equal percentages. Thus 0XXX indicates unalloyed titanium; 1XXX indicates titanium-aluminum alloy; and 235XXX indicates titanium-chromium-iron-molybdenum alloys, etc.

TABLE I. *Digits Representing Alloy Elements*

0 — Unalloyed titanium	5 — Molybdenum
1 — Aluminum	6 — Tin
2 — Chromium	7 — Vanadium
3 — Iron	8- and 9 — Reserved for other alloy systems
4 — Manganese	

5.2 **Percentage of alloying elements.** The two or three digits representing the alloying elements shall be immediately followed by the elements' representative percentages rounded off to whole numbers. In rounding-off percentages, the procedure described in ASTM Designation: E 29 shall be used.

5.2.1 When a range is specified for the alloying element, the rounded-off mean shall be used in the designation.

5.2.2 When only a minimum percentage is specified for the alloying element, the rounded-off minimum percentage shall be used in the designation.

5.3 **Titanium designation.** The basic alloy designation shall be preceded by "Ti" to indicate the base metal.

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**5.4 Temper designation.** The temper designation, which is used on all metal forms, shall follow the alloy designation and shall be separated therefrom by a dash. The temper designation shall be indicated by letters as specified in table II.

**TABLE II. *Temper Designations***


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O	— Annealed
F	— As rolled or as fabricated
HT	— Solution heat treated
HTA	— Solution heat treated and aged
A	— Aged

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