



SURFACE VEHICLE STANDARD

J993™

JAN2018

Issued 1967-07
Reaffirmed 1989-01
Stabilized 2018-01

Superseding J993 JAN1989

Alloy and Temper Designation Systems for Aluminum

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Metals Technical Executive Steering Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2018 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
<http://www.sae.org>

SAE WEB ADDRESS:

Full document details: SAE J993_201801

SAE values your input. To provide feedback on this Technical Report, please visit http://standards.sae.org/J993_201801

1. **Scope**—This standard provides systems for designating wrought aluminum and wrought aluminum alloys, aluminum and aluminum alloys in the form of castings and foundry ingot, and the tempers in which aluminum and aluminum alloy wrought products and aluminum alloy castings are produced.
2. **References**—There are no referenced publications specified herein.
3. **Wrought Aluminum and Aluminum Alloy Designation System (See 6.1)**—A system of four-digit numerical designations is used to identify wrought aluminum and wrought aluminum alloys. The first digit indicates the alloy group as shown in Table 1. The last two digits identify the aluminum alloy or indicate the aluminum purity. The second digit indicates modifications of the original alloy or impurity limits.
- 3.1 **Aluminum**—In the 1xxx group for minimum aluminum purities of 99.00% and greater, the last two of the four digits in the designation indicate the minimum aluminum percentage (Note 5.2). These digits are the same as the two digits to the right of the decimal point in the minimum aluminum percentage when it is expressed to the nearest 0.01%. The second digit in the designation indicates modifications in impurity limits. If the second digit in the designation is zero, it indicates that there is no special control on individual impurities; integers 1 through 9, which are assigned consecutively as needed, indicate special control of one or more individual impurities or alloying elements.

TABLE 1—DESIGNATION SYSTEM FOR WROUGHT ALUMINUM AND ALUMINUM ALLOY

Composition	Alloy No.
Aluminum, 99.0% min and greater	1xxx
Aluminum alloys grouped by major alloying element ^{(1) (2)(3)}	
Copper	2xxx
Manganese	3xxx
Silicon	4xxx
Magnesium	5xxx
Magnesium and silicon	6xxx
Zinc	7xxx
Other element	8xxx
Unused series	9xxx

- For codification purposes, an alloying element is any element which is intentionally added for any purpose other than grain refinement and for which minimum and maximum limits are specified.
- Standard limits for alloying elements and impurities are expressed to the following places:

Less than 1/1000%0.000X

1/1000 up to 1/100%0.00X

1/100 up to 1/10%

Unalloyed aluminum made by a refining process0.0XX

Alloys and unalloyed aluminum not made by a refining process

0.0X

1/10 through 1/2% 0.XX

Over 1/2%0.X, X.X, etc.

3. Standard limits for alloying elements and impurities are expressed in the following sequence: silicon; iron; copper; manganese; magnesium; chromium; nickel; zinc (Note 1); titanium; other elements (each); other elements (Total); aluminum (Note 2).

NOTE—Additional specified elements having limits are inserted in alphabetical order of their chemical symbols between zinc and titanium, or are specified in footnotes.

NOTE—Aluminum is specified as minimum for unalloyed aluminum, and as a remainder for aluminum alloys.

- Aluminum Alloy**—In the 2xxx through 8xxx alloy groups, the last two of the four digits in the designation have no special significance but serve only to identify the different aluminum alloys in the group. The second digit in the alloy designation indicates alloy modifications (See 6.3). If the second digit in the designation is zero, it indicates the original alloy; integers 1 through 9, which are assigned consecutively, indicate alloy modifications.
- Experimental Alloys**—Experimental alloys are also designated in accordance with this system, but they are indicated by the prefix X. The prefix is dropped when the alloy is no longer experimental. During development and before they are designated as experimental, new alloys are identified by serial numbers assigned by their originators. Use of the serial number is discontinued when the X number is assigned.
- National Variations**—National variations (see 6.4) of wrought aluminum and wrought aluminum alloys registered by another country in accordance with this system are identified by a serial letter (see Section 5) before the numerical designation.

- 4. Cast Aluminum And Aluminum Alloy Designation System¹ (See 6.1)**—A system of four-digit numerical designations is used to identify aluminum and aluminum alloys in the form of castings and foundry ingot. The first digit indicates the alloy group, as shown in Table 2. The second two digits identify the aluminum alloy or indicate the aluminum purity. The last digit, which is separated from the others by a decimal point, indicates the product form, that is, castings or ingot. A modification of the original alloy or impurity limits is indicated by a serial letter (see 6.6) before the numerical designation.
- 4.1 Aluminum Castings and Ingot**—In the 1xx.x group for minimum aluminum purities of 99.00% and greater, the second two of the four digits in the designation indicate the minimum aluminum percentage (see 6.2). These digits are the same as the two digits to the right of the decimal point in the minimum aluminum percentage when it is expressed to the nearest 0.01%. The last digit, which is to the right of the decimal point, indicates the product form: 1xx.0 indicates castings, and 1xx.1 indicates ingot. Special control of one or more individual elements other than aluminum is indicated by a serial letter (see 6.6) before the numerical designation.
- 4.2 Aluminum Alloy Castings and Ingot**—In the 2xx.x through 9xx.x alloy groups, the second two of the four digits in the designation have no special significance but serve only to identify the different aluminum alloys in the group. The last digit, which is to the right of the decimal point, indicates the product form: xxx.0 indicates castings, xxx.1 indicates ingot which has chemical composition limits conforming to 3.2.1, and xxx.2 indicates ingot which has chemical composition limits that differ but fall within the limits for xxx.1 ingot. Alloy modifications (Note 5.3) are indicated by a serial letter (see 6.9) before the numerical designation.
- 4.2.1** Limits for alloying elements and impurities for xxx.1 ingot are the same as for the alloy in the form of castings, except for the limits noted in Table 3.

1. The castings and ingot alloy designation system described herein is not currently in use for some SAE cast aluminum alloys. It is applicable to Aluminum Association (AA) and American National Standards Institute (ANSI), and other, specification systems. Although the chemical composition limits shown in most SAE reports conform to the limits shown for comparable castings and ingots covered in AA and ANSI publications, the designation system described herein is not currently used in SAE Standards and Information Reports.