Designation: B296 – 20

Standard Practice for Temper Designations of Magnesium Alloys, Cast and Wrought[1]

This standard is issued under the fixed designation B296; 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 (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice covers a system for designating the tempers of magnesium alloys, cast and wrought. The designations used in ASTM specifications under the jurisdiction of Committee B07 for magnesium alloy castings and wrought products conform to this practice.[2]

1.2 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Basis of Codification

2.1 The designations for temper are used for all forms of magnesium and magnesium-alloy products except ingots and are based on the sequence of basic treatments used to produce the various tempers.

2.2 The temper designation follows the alloy designation, the two being separated by a dash.

2.3 Basic temper designations consist of letters. Subdivisions of the basic tempers, where required, are indicated by a digit or digits following the letter. These designate specific sequences of basic treatments, but only operations recognized as significantly influencing the characteristics of the product are indicated. Should some other variation of the same sequence of basic operations be applied to the same alloy, resulting in different characteristics, then additional digits are added to the designation.

NOTE 1—In material specifications containing reference to two or more tempers of the same alloy which result in identical mechanical properties, the distinction between the tempers should be covered in suitable explanatory notes.

2.4 The temper designations and the subdivisions are fully defined and explained in Table 1. A brief outline for quick reference is given in Table 2.

3. Referenced Documents

3.1 *ANSI Standard:*[3]

ANSI H35.1/H35.1M American National Standard Alloy and Temper Designation Systems for Aluminum

4. Keywords

4.1 cast and wrought alloys; magnesium alloys; temper designations

[1] This practice is under the jurisdiction of the ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.04 on Magnesium Alloy Cast and Wrought Products.

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[2] The designations used in ASTM Committee B07 specifications for aluminum-alloy wrought and cast products conform to the American National Standard H35.1/H35.1M.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

TABLE 1 Temper Designations

Temper Designation and Sub-division (if any)	Description
F	*As Fabricated* —Applies to products that acquire some temper from shaping processes not having special control over the amount of strain hardening or thermal treatment.
O	*Annealed, Recrystallized*—Applies to the softest temper of wrought products.
H	*Strain Hardened (Wrought Products Only)*—Applies to products that have their strength increased by strain hardening with or without supplementary thermal treatments to produce partial softening. Two or more digits always follow the H.
H1	*Strain Hardened Only*—Applies to products that are strain hardened to obtain the desired mechanical properties without supplementary thermal treatment. The number following this designation indicates the final degree of strain hardening.
H2	*Strain Hardened and Then Partially Annealed*—Applies to products that are strain hardened more than the desired final amount and then reduced in strength to the desired final amount by partial annealing. The number following this designation indicates the final degree of strain hardening remaining after the product has been partially annealed.
H3	*Strain Hardened and Then Stabilized*—Applies to products that are strain hardened and then stabilized by a low temperature heating to slightly lower their strength and increase ductility. This designation applies only to alloys which, unless stabilized, gradually age soften at room temperature. The number following this designation indicates the degree of strain hardening remaining after the product has been strain hardened a specific amount and then stabilized.
Subdivisions of H1, H2, and H3	The digit following the designations “H1,” “H2,” and “H3” indicates the final degree of strain hardening. Tempers between 0 (annealed) and 8 (full hard) are designated by numerals 1 through 7. Material having a strength about midway between that of the 0 temper and that of the 8 temper is designated by the numeral 4 (half hard); between 0 and 4 by the numeral 2 (quarter hard); between 4 and 8 by the numeral 6 (three-quarter hard); and so forth. The third digit, when used, indicates a variation of a two-digit H temper. It is used when the degree of control of temper or the mechanical properties are different from but close to those for the two-digit H temper to which it is added. Numerals 1 through 9 may be arbitrarily assigned for an alloy and product to indicate a specific degree of control of temper or specified mechanical property limits.
W	*Solution Heat-treated*—An unstable temper applicable only to alloys that spontaneously age at room temperature after solution heat treatment. This designation is specific only when the period of natural aging is indicated: for example, W ½ hour.
T	*Thermally Treated to Produce Stable Tempers Other Than F, O, or H*—Applies to products that are thermally treated, with or without supplementary strain hardening, to produce stable tempers. One or more digits always follow the T. Numerals 1 through 10 have been assigned to indicate specific sequence of basic treatments, as shown below.
T1	*Cooled From an Elevated Temperature Shaping Process and Naturally Aged to a Substantially Stable Condition* —Applies to products for which the rate of cooling from an elevated temperature shaping process, such as casting, or extruding, is such that their strength is increased by room temperature aging.
T3	*Solution Heat Treated and Then Cold Worked*—Applies to products that are cold worked to improve strength, or in which the effect of cold work in flattening and straightening is recognized in applicable mechanical properties.
T4	*Solution Heat Treated and Naturally Aged to a Substantially Stable Condition*—Applies to products that are not cold worked after solution heat treatment, or in which the effect of cold work in flattening or straightening may not be recognized in applicable mechanical properties.
T5	*Cooled From an Elevated-temperature Shaping Process and Then Artificially Aged*— Applies to products that are cooled from an elevated temperature shaping process, such as casting or extruding, and then artificially aged to improve mechanical properties or dimensional stability or both.
T6	*Solution Heat Treated and Then Artificially Aged*—Applies to products that are not cold worked after solution heat treatment, or in which the effect of cold work is flattening or straightening may not be recognized in applicable mechanical properties.
T7	*Solution Heat Treated and Then Stabilized*—Applies to products that are stabilized to carry them beyond the point of maximum strength to provide control of some special characteristics.
T8	*Solution Heat Treated, Cold Worked, and Then Artificially Aged*—Applies to products that are cold worked to improve strength, or in which the effect of cold work in flattening or straightening is recognized in applicable mechanical properties.
T9	*Solution Heat Treated, Artificially Aged, and Then Cold Worked*—Applies to products that are cold worked to improve strength.
T10	*Cooled From an Elevated Temperature Shaping Process, Artificially Aged, and Then Cold Worked*—Applies to products that are artificially aged after cooling from an elevated temperature shaping process, such as casting or extruding, and then cold worked to further improve strength. A period of natural aging at room temperature may occur between or after the operations listed for tempers T3 through T10. Control of this period is exercised when it is metallurgically important. Additional digits may be added to designations T1 through T10 to indicate a variation in treatment that significantly alters the characteristics of the product.