International Standard 2107

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Aluminium, magnesium and their alloys — Temper designations

Aluminium, magnésium et leurs alliages — Désignation des états

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2107 was developed by Technical Committee ISO/TC 79, *Light metals and their alloys*, and was circulated to the member bodies in March 1982.

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It has been approved by the member bodies of the following countries :

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Canada	Italy	Sweden
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Egypt, Arab Rep. of	Netherlands	USA
Germany, F.R	Nigeria	USSR
Hungary	Norway	
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The member body of the following country expressed disapproval of the document on technical grounds :

France

This International Standard cancels and replaces ISO Recommendation R 2107-1971, of which it constitutes a technical revision.

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Aluminium, magnesium and their alloys — Temper designations

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1 Scope and field of application

This International Standard establishes temper designations for aluminium, magnesium and their alloys.

The designations are intended primarily for use in International Standards concerning aluminium, magnesium and their alloys. Their use in national standards is optional.

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2 Basis of codification

2.1 The temper designations define the sequence of basic treatments used to produce the tempers. Mechanical properties apply to individual alloy-temper-product combinations.

2.2 The temper designation, which is used for all wrought and cast metal products except ingots, follows the designation of the alloy, and is separated therefrom by a dash.

2.3 Basic temper designations consist of letters. If subdivisions of the basic tempers are required, these are indicated by a digit or letter, or combination thereof, following the letter of the basic temper. This further digit/letter combination relates to a specific sequence of basic treatments, but only those treatments or operations which significantly influence the product characteristics are recognized.

3 Basic temper designations

3.1 M — As manufactured

This designation applies to products which acquire some temper from hot shaping processes for which mechanical property limits apply.

3.2 F — As fabricated

This designation applies to products of shaping processes without special control over thermal conditions or strain-hardening and for which no mechanical property limits apply for wrought products.

3.3 O — Annealed

This designation applies to wrought products which are fully annealed to obtain the lowest strength condition, and to cast products which are annealed to improve ductility and dimensional stability.

3.4 H — Strain-hardened (wrought products only)

This designation applies to products subjected to the application of cold work after annealing (or hot forming) or to a combination of cold work and partial annealing or stabilizing in order to secure the specified mechanical properties. The letter H is always followed by a digit and a second letter indicating the final degree of strain-hardening.

3.5 T — Thermally treated, to produce tempers other than M, F, O or H

This designation applies to products which have their strength increased by thermal treatment, with or without supplementary strain-hardening. The letter T is always followed by a second letter indicating the specific sequence of treatments.

4 Subdivisions of basic temper designations

4.1 H — Strain-hardened

4.1.1 For wrought products of aluminium, magnesium and their alloys, subdivisions are made according to the basic operations described in 2.3 and the final degree of strain-hardening, as follows :

a) The combination of basic operations is indicated by the designations :

H1 — strain-hardened;

H2 — strain-hardened and partially annealed;

H3 — strain-hardened and stabilized.

b) The final degree of strain-hardening is indicated by the following designation (the letter X represents 1, 2 or 3 as appropriate) following :

HXH — full hard temper;

HXD — tensile strength approximately midway between that of the **O** temper and that of the **HXH** temper;

HXB — tensile strength approximately midway between that of the **O** temper and that of the **HXD** temper;

HXF — tensile strength approximately midway between that of the **HXD** temper and that of the **HXH** temper;

HXJ — tensile strength in excess of **HXH**.

4.1.2 For aluminium and aluminium alloys, the tensile strength of the hardest temper normally produced (HXH) is determined, unless otherwise approved by ISO/TC 79, from table 1 and is based on the minimum tensile strength of the alloy in the annealed temper.

Table 1

Minimum tensile strength in annealed temper, N/mm² (MPa)	Increase in tensile strength to HH temper, N/mm² (MPa)
up to 40	55
45 to 60	65
65 to 80	75
85 to 100	85
105 to 120	90
125 to 160	95
165 to 200	100
205 to 240	105
245 to 280	110
285 to 320	115
325 and over	120

4.1.2.1 The tensile strength of intermediate tempers, determined as described above, when not ending in 0 or 5, shall be rounded to the next higher 0 or 5.

4.1.2.2 The tensile strength of HXJ tempers shall exceed that of the HXH temper by not less than 10 N/mm² (MPa).

4.2 T — Thermally treated, to produce tempers other than M, F, O or H

4.2.1 TA — Cooled from an elevated temperature shaping process and naturally aged

This designation applies to products for which the rate of cooling from an elevated temperature shaping process, such as casting or extrusion, is controlled so that the product is subject to natural ageing.

4.2.2 TB — Solution heat-treated* and naturally aged

This designation applies to products which receive no cold work after solution heat treatment, except as may be required to flatten or straighten them.

The properties of some alloys in this temper are unstable.

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4.2.3 TC — Cooled from an elevated temperature shaping process, cold worked and naturally aged

This designation applies to products which are cold worked by a controlled amount following controlled cooling from an elevated temperature shaping process, such as forging or extrusion, to improve strength.

The properties of some alloys in this temper are unstable.

4.2.4 TD — Solution heat-treated*, cold worked and naturally aged

This designation applies to products which are cold worked by a controlled amount following solution heat treatment to improve strength or reduce internal stresses.

The properties of some alloys in this temper are unstable.

4.2.5 TE — Cooled from an elevated temperature shaping process and precipitation-treated

This designation applies to products which are precipitation-treated following cooling from an elevated temperature shaping process such as casting or extrusion.

* Cooling from an elevated temperature shaping process is an accepted procedure for attaining solution heat treatment for some alloys, if permitted in international or national standards.

4.2.6 TF — Solution heat-treated* and precipitation-treated

This designation applies to products which are not cold worked after solution heat treatment, except as may be required to flatten or straighten them.

4.2.7 TG — Cooled from an elevated temperature shaping process, cold worked, then precipitation treated

This designation applies to products which are cold worked to improve strength.

4.2.8 TH — Solution heat-treated*, cold worked, and then precipitation-treated

This designation applies to products which are cold worked to improve strength.

4.2.9 TL — Solution heat-treated*, precipitation-treated, and then cold worked

This designation applies to products which are cold worked to improve strength.

4.2.10 TM — Solution heat-treated* and stabilized

This designation applies to products which are stabilized after solution heat treatment to carry them beyond the point of the maximum strength in order to provide control of some special characteristics.

5 Further variations of temper designations

If necessary, additional letters (or digits) may be used to identify two or more variations of a subdivision of basic tempers H and T. Such additional identification will be allotted to specific alloys as the need arises.

6 Aluminium and aluminium alloys

Tempers of aluminium and aluminium alloys may be designated by an alternative system as shown in table 2.

Table 2

ISO 2107 designation	Alternative designation
M	H 112
F	F
O	O
H1B, H2B, H3B	H12, H22, H32
H1D, H2D, H3D	H14, H24, H34
H1F, H2F, H3F	H16, H26, H36
H1H, H2H, H3H	H18, H28, H38
H1J, H2J, H3J	H19, H29, H39
TA	T1
TB	T4
TC	T2
TD	T3
TE	T5
TF	T6
TG	T10
TH	T8
TL	T9
TM	T7

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