
International Standard



1190/2

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Copper and copper alloys — Code of designation — Part 2 : Designation of tempers

Cuivre et alliages de cuivre — Code de désignation — Partie 2 : Désignation des états

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (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 set up 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 1190/2 was developed by Technical Committee ISO/TC 26, *Copper and copper alloys*, and was circulated to the member bodies in August 1981.

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

Belgium	India	South Africa, Rep. of
Bulgaria	Ireland	Spain
Canada	Italy	Sweden
China	Japan	Switzerland
Czechoslovakia	Korea, Dem. P. Rep. of	Turkey
Egypt, Arab Rep. of	Netherlands	United Kingdom
Finland	Norway	USA
France	Poland	USSR
Germany, F. R.	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds:

Australia
Hungary

This International Standard cancels and replaces ISO Recommendation R 1191/1-1971, of which it constitutes a technical revision.

Copper and copper alloys — Code of designation — Part 2 : Designation of tempers

1 Scope and field of application

This part of ISO 1190 relates to the designation of coppers, alloyed coppers and copper alloys in terms of their temper.

2 Reference

ISO 1190/1, *Copper and copper alloys — Code of designation — Part 1 : Designation of materials.*

3 Temper designation

3.1 Basis of designation

3.1.1 The temper designations shall be based on the sequence of basic treatments used to produce the various tempers.

3.1.2 The temper designations, which are used for all wrought and cast copper and copper alloy products except ingots, shall follow the material designations (see ISO 1190/1) and be separated therefrom by a hyphen.

3.1.3 Basic temper designations shall consist of letters. Subdivisions of the basic tempers, where required, shall be indicated by a second letter following the letter of the basic temper. These second letters designate a specific sequence of basic treatments, but only those treatments or operations shall be recognized which significantly influence the product characteristics. Special subdivisions could be indicated by a third letter where necessary.

3.1.4 Assignment or revisions of temper designations shall be approved by Technical Committee ISO/TC 26, *Copper and copper alloys.*

3.2 Basic temper designations

-M *As manufactured.* Applies to products of shaping processes in which no special control over thermal condition or strain hardening is exercised.

-O *Annealed.* Applies to *wrought* products which are fully annealed and to *cast* products which are annealed to improve ductility and dimensional stability.

-H *Strain hardened.* (Wrought products only). Applies to products subjected to the application of cold work after annealing or to a combination of cold work and partial annealing/stabilizing in order to secure the specified mechanical properties. The H shall always be followed by a second letter indicating various stages of strain hardening.

-T *Thermally treated to produce tempers other than M, O or H.* Applies to products which have their tensile strength increased by thermal treatment, with or without supplementary strain hardening. The T shall always be followed by a second letter indicating the specific sequence of treatments.

3.3 Subdivisions of basic temper designations

-O *Annealed* : — without any special requirements for grain size.

-OS For copper and copper alloy products required to be specially annealed to obtain restricted grain size ranges.

The designation -OS shall be followed by figures indicating the nominal grain size, the maximum and minimum limits of which are listed for each alloy and product in the relevant document on mechanical properties.

-H *Strain hardened.* Subdivisions for various stages of strain hardening are -HA, -HB, -HC, etc. The designations are in alphabetical order and in ascending order of tensile strength as indicated in the relevant mechanical property documents.

NOTE — If copper and copper alloys should be *stress relieved* after strain hardening to improve stress corrosion characteristics or dimensional stability after machining, this temper as a special subdivision is indicated by the letter "R" as a third digit, for example -HAR, -HCR, etc.

-T *Thermally treated to produce tempers other than M, O or H.*

-TA *Cooled from an elevated temperature shaping process and naturally aged.* Applies to products for which the rate of cooling from an elevated temperature shaping process, such as casting or extrusion, is controlled, or is such that the product is subject to natural ageing. Properties of some alloys in this temper are unstable.

-TB Solution heat treated and naturally aged. Applies to products which receive no cold work after solution heat treatment except as may be required to flatten or straighten them. Properties of some alloys in this temper are unstable.

-TC Cooled from an elevated temperature shaping process, cold worked and naturally aged. Applies to products which are subject to a controlled amount of cold working following controlled cooling from an elevated temperature shaping process, such as forging or extrusion, to improve strength or reduce internal stresses. Properties of some alloys in this temper are unstable.

-TD Solution heat treated, cold worked and naturally aged. Applies to products which are subjected to a controlled amount of cold working following solution heat treatment to improve strength or reduce internal stresses. Properties of some alloys in this temper are unstable.

-TE Cooled from an elevated temperature shaping process and precipitation treated. Applies to products which are precipitation treated following cooling from an elevated temperature shaping process such as casting or extrusion. May be achieved by precipitation treatment of TA temper products or, in some cases, by precipitation treatment of M temper products.

-TF Solution heat treated and precipitation treated. Applies to products which are precipitation treated following TB treatment.

-TG Cooled from an elevated temperature shaping process, cold worked and precipitation treated. Applies to products which are precipitation treated following TC treatment.

-TH Solution heat treated, cold worked and precipitation treated. Applies to products which are precipitation treated following a TD treatment.

-TK Cooled from an elevated temperature shaping process, precipitation treated and cold worked. Applies to products which are subjected to a controlled amount of cold working following a TE treatment.

-TL Solution heat treated, precipitation treated and cold worked. Applies to products which are subjected to a controlled amount of cold working following a TF treatment.

3.4 Further variations of temper designations

If necessary, a third letter (or a digit) may be used to identify two or more variations of a subdivision of basic tempers H and T.

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