



**SLOVENSKI STANDARD**  
**oSIST prEN ISO 22674:2021**

**01-september-2021**

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**Zobozdravstvo - Kovinski materiali za stalne in zamenljive zobne obnove in orodja  
(ISO/DIS 22674:2021)**

Dentistry - Metallic materials for fixed and removable restorations and appliances  
(ISO/DIS 22674:2021)

Zahnheilkunde - Metallische Werkstoffe für festsitzenden und herausnehmbaren  
Zahnersatz und Applikationen (ISO/DIS 22674:2021)

Médecine bucco-dentaire - Matériaux métalliques pour les restaurations fixes et  
amovibles et les appareillages (ISO/DIS 22674:2021)

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**Ta slovenski standard je istoveten z: prEN ISO 22674**

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**ICS:**

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# DRAFT INTERNATIONAL STANDARD

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## Dentistry — Metallic materials for fixed and removable restorations and appliances

*Médecine bucco-dentaire — Matériaux métalliques pour les restaurations fixes et amovibles et les appareillages*

ICS: 11.060.10

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## ISO/DIS 22674:2021(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 106, *Dentistry*, Subcommittee SC 2, *Prosthodontic materials*.

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This third edition cancels and replaces the second edition (ISO 22674:2016), which has been technically revised.

The main changes compared to the previous edition are as follows:

- addition of products produced using additive and subtractive manufacturing;
- revision of definitions and addition of new definitions for modern manufacturing techniques;
- addition of overview of symbols in [Clause 4](#) as [Table 1](#);
- static determination of elastic modulus was added in [8.6.1.3](#) (as additional option);
- requirement for test report was added as [Clause 9](#);
- harmonization of symbols in formulas.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).



## Introduction

Specific qualitative and quantitative requirements for freedom from biological hazard are not included in this document, but it is recommended that, in assessing possible biological hazards, reference has to be made to ISO 10993-1 and ISO 7405.

Requirements for the performance of metals and alloys used for the metallic component of a metal-ceramic restoration contained in this document supersede such requirements formerly contained in ISO 9693. The requirements for the performance of ceramic material and the metal-ceramic bond in metal-ceramic restorative systems continue to be specified in ISO 9693.

Requirements for the proof stress and minimum elongation after fracture for Type 0 metallic materials are not included in this document, but it is recommended to adopt the test procedure given in [Annex A](#) when measuring these properties.

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# Dentistry — Metallic materials for fixed and removable restorations and appliances

## 1 Scope

This document specifies requirements and test methods for metallic materials that are suitable for the fabrication of dental restorations and appliances. Included are metallic materials recommended for use either with or without a ceramic veneer, or recommended for both uses. Furthermore, it specifies requirements with respect to packaging and marking of the products and to the instructions for use of these materials, including products delivered for sale to a third party.

This document also applies to products, which were produced using additive and subtractive manufacturing.

This document does not apply to alloys for dental amalgam (ISO 24234), dental brazing materials (ISO 9333), or metallic materials for orthodontic appliances (ISO 15841) (e.g. wires, brackets, bands and screws).

This document is not applicable to magnetic attachment, which are specified in ISO 13017.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO 1942, *Dentistry — Vocabulary*
- ISO 3696, *Water for analytical laboratory use — Specification and test methods*
- ISO 5832-2, *Implants for surgery — Metallic materials — Part 2: Unalloyed titanium*
- ISO 5832-3, *Implants for surgery — Metallic materials — Part 3: Wrought titanium 6-aluminium 4-vanadium alloy*
- ISO 6344-1, *Coated abrasives — Grain size analysis — Part 1: Grain size distribution test*
- ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*
- ISO 9513, *Metallic materials — Calibration of extensometer systems used in uniaxial testing*
- ISO 9693, *Dentistry — Compatibility testing for metal-ceramic and ceramic-ceramic systems*
- ISO 10271:2020, *Dentistry — Corrosion test methods for metallic materials*
- ISO 12781-1, *Geometrical product specifications (GPS) — Flatness — Part 1: Vocabulary and parameters of flatness*
- ISO 15223-1:2021, *Medical devices — Symbols to be used with medical device labels, labelling and information to be supplied — Part 1: General requirements*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1942 and the following apply.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

**3.1****additive manufacturing**

all manufacturing processes where the final object is build up layer-wise such as selective laser melting, SLM

**3.2****appliance**

prefabricated metallic devices such as attachments, bars

**3.3****as-cast state**

metallurgical condition of the *metallic material* (3.15) in its solid state when removed from the casting machine

Note 1 to entry: This condition is dependent upon the manufacturer's recommended cooling procedure (e.g. bench cooling).

**3.4****base metal**

any metallic element with the exception of *noble metals* (3.16) and silver

**3.5****base-metal alloy**

alloy having a base metal as the principal element

**3.6****bench-cooling**

process whereby a casting is retained in its investment with exposed metal uppermost and placed on a flat, insulating surface at ambient temperature in freely circulating air until its temperature falls to ambient

**3.7****casting alloy**

*metallic material* (3.15) designed for casting into an investment mould

**3.8****ceramic veneer**

thin ceramic surface layer present on a *metallic material* (3.15) restoration to provide an aesthetic effect

**3.9****elastic modulus**

Young's modulus

ratio of elastic stress to elastic strain

**3.10****hardening**

heat-treatment of a *metallic material* (3.15) producing a condition which provides a higher 0,2 % proof stress than the "as-cast" state

Note 1 to entry: If recommended by the manufacturer, explicit instructions are required in the instructions for use.

**3.11****hazardous element**

element that is known for its potential to produce an adverse biological effect

Note 1 to entry: The presence of such an element (as an alloying addition or as an impurity) in a dental alloy does not imply that the alloy, in itself, is hazardous.

**3.12****heat treatment**

any thermal treatment such as stress relieving process, softening, hardening, ceramic firings

**3.13****metal-ceramic restoration**

dental restoration in which a ceramic veneer is bonded to a *metallic material* (3.15) substructure by firing

Note 1 to entry: This can apply also to the *metallic material* (3.15) used for such a restoration. In this context, metal-ceramic alloy is a synonym.

Note 2 to entry: If recommended, such a *metallic material* (3.15) may be used without a ceramic veneer.

**3.14****metallic base**

metal with highest concentration by mass fraction in the alloy

Note 1 to entry: The name of this element shall precede the words “-based *metallic material* (3.15) for dental restoration” or “-based dental casting alloy” or “-based dental metal-ceramic material”, as is appropriate.

**3.15****metallic material**

material having the properties that are associated with an alloy, noble metal or base metal

Note 1 to entry: This may be a pure element, commercially pure metal or an alloy.

**3.16****noble metal**

gold, metals of the platinum group and rhenium

**3.17****one-surface inlay**

inlay restoration that is exposed to the oral environment on one and no more of the surfaces that are used to define the tooth for the purposes of charting

**3.18****softening**

heat-treatment of a *metallic material* (3.15) producing a condition which provides a lower 0,2 % proof stress than the “as-cast” state

Note 1 to entry: If recommended by the manufacturer, explicit instructions are required in the instructions for use.

**3.19****subtractive manufacturing**

all manufacturing processes where a solid material such as milling blank is reduced by milling, grinding, eroding or similar techniques to the final shape

**4 Symbols and classification****4.1 Symbols**

[Table 1](#) gives an overview about the symbols used in this document.

Table 1 — Symbols and their usage

Symbol	Explanation	Usage
$A_{15\text{ mm}}$	percentage elongation after fracture	<a href="#">A.3.3</a>
$b$	breadth	<a href="#">8.6.2.2</a> <a href="#">Figure 3</a> <a href="#">A.1.1, Figure A.1</a> <a href="#">B.2</a> <a href="#">Formula (B.2)</a> <a href="#">C.3.2.1, C.3.2.2</a>
$C_1$	correction factor 1 for the elastic modulus	<a href="#">Formula (2)</a>
$C_2$	correction factor 2 for the shear modulus	<a href="#">Formula (4)</a>
$D$	minimum difference between two readings that the measurement instrument can discriminate	<a href="#">B.1</a> <a href="#">Formula (B.1)</a>
$d$	deflection	<a href="#">8.6.2.2</a>
$E$	elastic modulus	<a href="#">Formula (1)</a> <a href="#">Formula (B.1)</a>
$F$	force	<a href="#">8.6.2.2</a>
$F_{60}$	force required to bring the most highly stressed part of the specimen to 60 % of the material's $R_{p0,2}$	<a href="#">8.6.2.2</a>
$f_1$	fundamental frequency measured in the flexural mode of vibration from acoustic measurement	<a href="#">Formula (3)</a> <a href="#">B.7</a> <a href="#">B.8</a>
$f_2$	fundamental frequency measured for the torsional mode of vibration	<a href="#">Formula (5)</a> <a href="#">B.7</a> <a href="#">B.8</a>
$G$	shear modulus	<a href="#">8.7.3</a> <a href="#">Formula (4)</a>
$h$	thickness	<a href="#">Figure 3</a> <a href="#">8.6.2.2</a> <a href="#">Formula (2)</a> <a href="#">A.1.1</a> <a href="#">Figure A.1</a> <a href="#">B.2, Formula (B.2)</a> <a href="#">B.2, Formula (B.9)</a>
$h_1$	greatest measured thickness	<a href="#">Figure 4</a>
$h_2$	least measured thickness	<a href="#">Figure 4</a>
$L$	length	<a href="#">Figure 3</a> <a href="#">A.1.1, Figure A.1</a> <a href="#">B.2, Formula (B.9)</a>
$L_i$	inner separation of load rollers	<a href="#">8.6.2.1, Figure 5</a>
$L_o$	outer separation of support load rollers	<a href="#">8.6.2.1, Figure 5</a>
$m$	mass	<a href="#">8.6.3.2</a>
$n$	number of individual readings	<a href="#">B.1, Formula (B.1)</a>
$q$	mean of $n$ individual readings	<a href="#">B.1, Formula (B.1)</a>
$q_i$	value of the $i$ th series of readings	<a href="#">B.1, Formula (B.1)</a>
$r$	radius of the specimen	<a href="#">B.2, Formula (B.3)</a>
$R_{p0,2}$	proof stress of 0,2 % non-proportional extension	<a href="#">8.4.1</a>
$S$	cross-sectional area	<a href="#">7.5.2</a>
$S_0$	original cross-sectional area	<a href="#">B.2, Formula (B.3)</a> <a href="#">A.3.3</a>

Table 1 (continued)

Symbol	Explanation	Usage
$u(A)$	standard uncertainty in the measurement of cross-section	<a href="#">B.2, Formula (B.2)</a>
$u(b)$	standard uncertainty in the measurement of breadth of the specimen	<a href="#">B.2, Formula (B.2)</a>
$u(E)$	standard uncertainty in the measurement of elastic modulus;	<a href="#">B.2, Formula (B.8)</a>
$u(F)$	standard uncertainty in the measurement of load force	<a href="#">B.2, Formula (B.4)</a>
$u(f)$	standard uncertainty in frequency	<a href="#">B.2, Formula (B.9)</a>
$u(h)$	standard uncertainty in the measurement of thickness of the specimen	<a href="#">B.2, Formula (B.2)</a>
$u(q)$	standard uncertainty in the measurement of $q$	<a href="#">B.1, Formula (B.1)</a>
$u(r)$	standard uncertainty in the measurement of the radius of the specimen	<a href="#">B.2, Formula (B.3)</a>
$u(\nu)$	combined standard uncertainty in the Poisson ratio	<a href="#">B.2, Formula (B.9)</a>
$u(\Delta L)$	standard uncertainty in the measurements of $\Delta L$	<a href="#">B.2, Formula (B.4)</a>
$x_1$	gauge length of tensile specimen	<a href="#">Figure 1</a> <a href="#">Figure 2</a>
$x_2$	parallel section of tensile specimen	<a href="#">Figure 1</a> <a href="#">Figure 2</a>
$\nu$	Poisson ratio	<a href="#">8.6.2.2</a> <a href="#">B.2, Formula (B.9)</a>
$\Delta d$	change in displacement of the mid-point of the specimen corresponding to the change $\Delta P$ in the load force.	<a href="#">B.2, Formula (B.4)</a>
$\Delta F$	change in the force change in load force corresponding to the change in gauge length	<a href="#">8.6.1.2, Formula (1)</a> <a href="#">B.2, Formula (B.4)</a>
$\Delta h$	separation of outer and inner reference planes	<a href="#">Figure 4</a>
$\Delta L_0$	change in gauge length measured by the extensometer	<a href="#">8.6.1.2, Formula (1)</a> <a href="#">B.2, Formula (B.4)</a>

## 4.2 Classification

For the purposes of this document, a metallic material is classified according to its mechanical properties by a Type number, of which there are six.

Examples of the applications for which these Types are intended are as follows:

- **Type 0:** intended for low stress bearing single-tooth fixed prostheses, e.g. small veneered one-surface inlays, veneered crowns;

NOTE Metallic materials for metal-ceramic crowns produced by electroforming or sintering belong to Type 0.

- **Type 1:** for low stress bearing single-tooth fixed prostheses, e.g. veneered or unveneered one-surface inlays, veneered crowns;
- **Type 2:** for single tooth fixed prostheses, e.g. crowns or inlays without restriction on the number of surfaces;