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Watch cases and accessories — Gold alloy coverings —

Part 3:

Abrasion resistance tests of a type of coating
on standard gauges

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*Boîtes de montres et leurs accessoires — Revêtements d'alliage d'or —
Partie 3: Essais de résistance à l'abrasion d'un type de revêtement sur
éprouvettes normalisées*

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Reference number
ISO 3160-3:1993(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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 3160-3 was prepared by Technical Committee ISO/TC 114, *Horology*, Sub-Committee SC 6, *Precious metal coverings*.

ISO 3160 consists of the following parts, under the general title *Watch cases and accessories — Gold alloy coverings*:

- *Part 1: General requirements* [ISO 3160-3:1993](https://standards.iteh.ai/iso-3160-3-1993)
- *Part 2: Determination of fineness, thickness, corrosion resistance and adhesion*
- *Part 3: Abrasion resistance tests of a type of coating on standard gauges*

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Watch cases and accessories — Gold alloy coverings —

Part 3:

Abrasion resistance tests of a type of coating on standard gauges

1 Scope

This part of ISO 3160 specifies two test methods for wear and tear to be applied to a gold alloy coating in order to determine the degree of resistance to wear of this type of coating. The test methods are applicable to a standard gauge and not directly to objects treated with the tested type of coating. The quality level is compared to that of a standard gauge.

This part of ISO 3160 describes:

- dimensions and characteristics of the standard gauge,
- standard coating,
- test methods,
- determination of wear, and
- qualitative comparison scales.

ISO 2361:1982, *Electrodeposited nickel coatings on magnetic and non-magnetic substrates — Measurement of coating thickness — Magnetic method.*

ISO 2819:1980, *Metallic coatings on metallic substrates — Electrodeposited and chemically deposited coatings — Review of methods available for testing adhesion.*

ISO 3160-1:1982, *Watch cases and accessories — Gold alloy coverings — Part 1: General requirements.*

ISO 3160-2:1992, *Watch cases and accessories — Gold alloy coverings — Part 2: Determination of fineness, thickness, corrosion resistance and adhesion.*

ISO 3497:1990, *Metallic coatings — Measurement of coating thickness — X-ray spectrometric methods.*

ISO 3543:1981, *Metallic and non-metallic coatings — Measurement of thickness — Beta backscatter method.*

ISO 4516:1980, *Metallic and related coatings — Vickers and Knoop microhardness tests.*

ISO 4524-5:1985, *Metallic coatings — Test methods for electrodeposited gold and gold alloy coatings — Part 5: Adhesion tests.*

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 3160. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3160 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

3 Definitions

For the purposes of this part of ISO 3160, the following definitions apply.

3.1 wear: Deterioration caused by use through mechanical removal of material.

3.2 abrasion: Wear of a material by a hard substance through friction.

3.3 abrasion resistance: Capacity to endure wear of a material by a hard substance through friction.

3.4 adhesion: Strength of the bond between a coating and its substrate, expressed as the force per unit area required to separate them.

4 Standard gauge and coatings

4.1 Standard gauge

4.1.1 Dimensions (see figure 1)

The standard gauge shall have the following dimensions:

- diameter of the flat reference surface: $d_1 = 18 \text{ mm}$
- total diameter: $d_2 = 24 \text{ mm} \pm 0,2 \text{ mm}$
- total thickness: $e = 12 \text{ mm} \pm 0,2 \text{ mm}$
- radius of connection of the flat reference surface with the side: $R = 3 \text{ mm} \pm 0,1 \text{ mm}$

Dimensions in millimetres

$$R = 3 \text{ mm} \pm 0,1 \text{ mm}$$

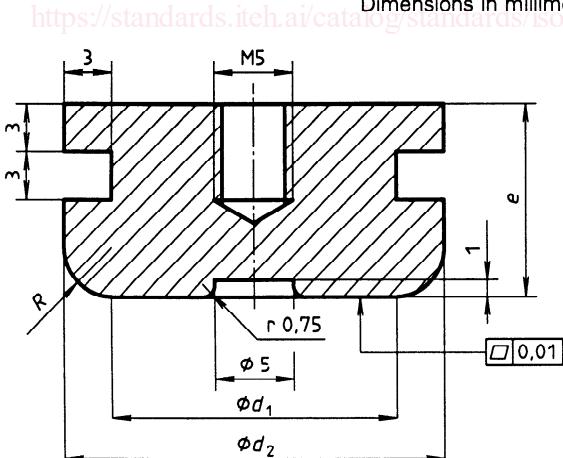


Figure 1 — Details of the standard gauge

4.1.2 Characteristics

The arithmetical mean deviation of the roughness profile, R_a , of the reference surface shall be a maximum of $0,5 \mu\text{m}$ before application of the covering.

The basic material of the standard gauge shall be a copper alloy, lead free, with a minimal Vickers hardness of $120 \text{ HV } 0,2$ (see ISO 4516).

4.2 Standardized reference coating (Watts nickel) on a standardized gauge designed for abrasion tests

This coating, deposited directly onto the gauge, is designed to measure the wear depth caused by the items used in the tests described in 5.1 and 5.2.

NOTES

1 If the thickness is measured by X-ray fluorescence, a non-coated standardized gauge of the same material should be available in order to determine the zero point, as well as a nickel-plated gauge of known thickness used as a standard.

2 If the thickness of the nickel coating is measured by the beta-ray backscatter method, a sufficient undercoating (for example gold or gold alloy) can be provided under the nickel; some standardized gauges should be provided, having the same undercoating and coated with known thicknesses of nickel, close to the one to be measured.

The coating bath shall have the following composition:

— nickel sulfate hexahydrate ($\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$):	300 g/l
— nickel chloride hexahydrate ($\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$):	60 g/l
— boric acid (H_3BO_3):	40 g/l
— saccharine (sodium salt):	0,025 g/l

The working conditions shall be as follows:

— pH:	3,5 to 4,5
— temperature:	50 °C
— density of current:	2 A/dm ² to 3 A/dm ²

This coating shall have a thickness of between $5 \mu\text{m}$ and $10 \mu\text{m}$, measured on the reference surface, and a Vickers hardness of between 220 and $240 \text{ HV } 0,01$.

4.3 Characteristics of the undercoat applied under the gold alloy coating to be tested

The bath used for the undercoating applied under the gold alloy coating to be tested shall be identical to that described in 4.2 with the exception of the percentage of saccharine (sodium salt) which shall be 1 g/l , in order to obtain a brilliant coating.

4.4 Adhesion of the gold alloy coating to be tested

The gold alloy coating to be tested shall have a good degree of adhesion, which can be checked by one of the methods described in ISO 2819 and ISO 4524-5.