INTERNATIONAL STANDARD

ISO 14368-3

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Mineral and sapphire watch-glasses —

Part 3: Qualitative criteria and test methods

Verres de montres minéraux et en saphir —

Partie 3: Critères qualitatifs et méthodes de contrôle

Reference number
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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 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 14368-3 was prepared by Technical Committee ISO/TC 114, *Horology*, Subcommittee SC 13, *Watch-glasses*.

ISO 14368 consists of the following parts, under the general title *Mineral and sapphire watch-glasses*:

— *Part 1: Dimensions and tolerances*

— *Part 2: Assembly to the case by adhesive or using a gasket*

— *Part 3: Qualitative criteria and test methods*

Mineral and sapphire watch-glasses —

Part 3:
Qualitative criteria and test methods

1 Scope

This part of ISO 14368 specifies the nomenclature of defects and the test methods to check them, with minimum physical and aesthetic requirements, for circular mineral and sapphire watch-glasses.

2 Normative references

The following referenced documents are indispensable for the application 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 286-1, *ISO system of limits and fits — Part 1: Bases of tolerances, deviations and fits*

ISO 286-2, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts*

ISO 14368-1:2000, *Mineral and sapphire watch-glasses — Part 1: Dimensions and tolerances*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 286-1, ISO 286-2 and ISO 14368-1 and the following apply.

3.1
defect
fault occurring during manufacture of the material, machining and handling of mineral and sapphire watch-glasses

3.2
chip
chipped edge

3.3
scratch
continuous or discontinuous groove with dulled or shattered sides, the width and depth of which may be irregular

3.4
wave effect
internal defect in the glass

3.5
flaw
localized superficial defect

3.6
stain
local defect caused by chemical attack or deposit

3.7
greying
defect modifying transparency locally, or poorly polished areas (very slight grooves or spots)

3.8
orange peel
polishing defect

3.9
deep defect
bubble
concentration of small bubbles
crystallization defects

EXAMPLE Twinning, particle joint, etc.

3.10
vibrations
external glass faults

4 Symbols

See Figure 1 and ISO 14368-1:2000, Clause 3, for an explanation of the symbols.

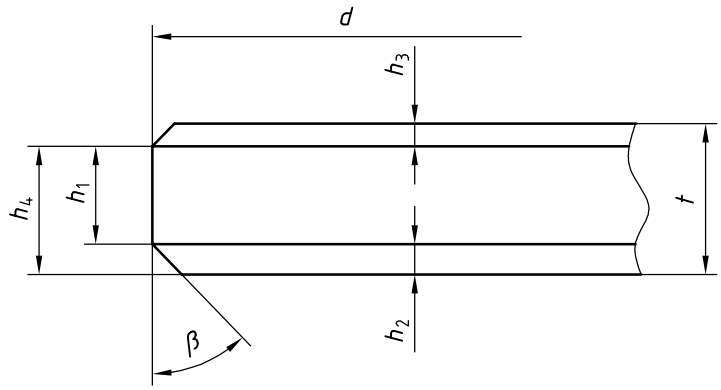


Figure 1 — Details of designations

5 Criteria

5.1 Hardness

5.1.1 Methods of verification

Preferably use the Knoop imprint method because it is more suitable for the verification of chemically treated glasses. As an alternative, the Vickers imprint method may also be used.

5.1.2 Chemically treated glasses

In the case of glasses treated chemically, the hardness varies considerably as a function of the load. The effect of the layer under strain begins to appear with loads of less than 2 N. A load of this magnitude shall not be used for measuring purposes.

5.1.3 Distinction between hardness values

A distinction shall be drawn between the hardness in the depth of the material, which is measured with a load of the order of 10 N and is relatively constant for a particular type of glass, and the surface hardness measured under a load of 0,15 N, which is greatly influenced by the treatment which the glass has undergone. To eliminate these variations, the measurements shall be taken under a load of 1 N. The values shown in Table 1 were obtained with this load.

5.2 Ball impact fracture energy

5.2.1 Support

The support consists of a block of metal (generally brass) recessed to a diameter $d + 0{,}50$ mm and with a hole of diameter $d - 2$ mm. See Figure 2.

Dimensions in millimetres

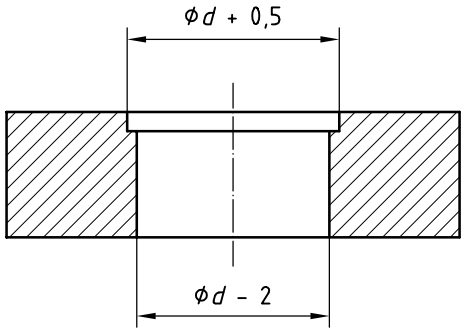
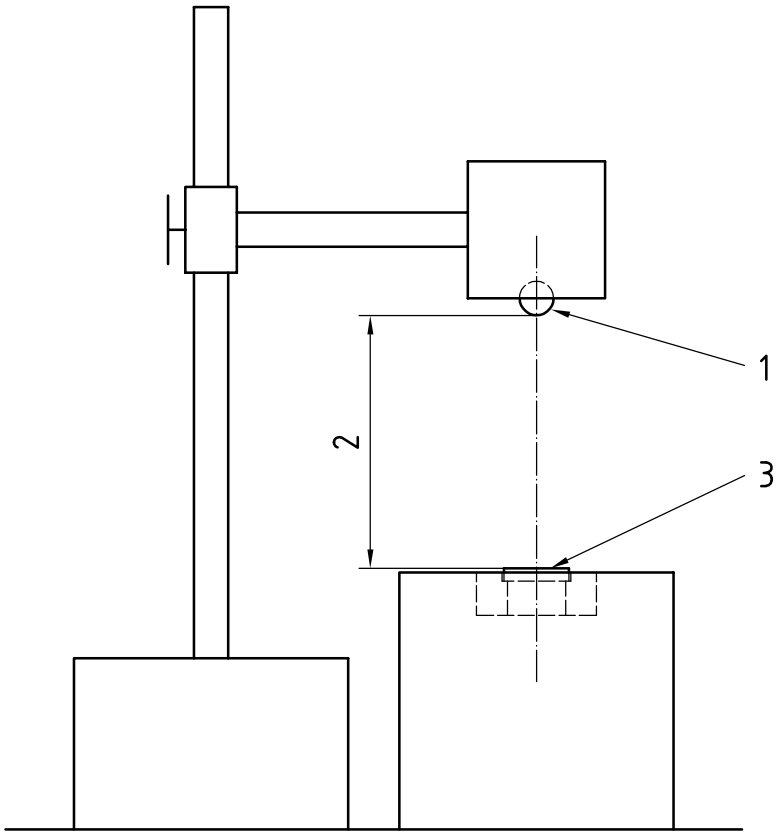


Figure 2 — Details of the support

5.2.2 Test device

The test device is schematically shown in Figure 3.



Key

1 ball held magnetically
2 height of the drop
3 glass fitted without mechanical stress

Figure 3 — Diagram of the test device

For the test to be performed under correct conditions, the ball shall be centered on a cone and held by a magnet or an electro-magnet which is not in contact with the cone.

The diameter of the steel ball used for the test shall be 25 mm and its weight 0,635 N.

As a variant, some instruments may use a steel ball with a diameter of 20 mm and a weight of 0,3 N.

5.2.3 Test procedure

Make sure that the ball, released from its highest point, drops into the centre of the support. Place the glass in its support. Perform a first test, which shall not cause the glass to break when the ball drops. Then perform a series of successive tests, increasing the height of the drop by 25 mm each time until the glass breaks.

5.2.4 Breakage energy

The breakage energy is the product of the weight of the ball, expressed in newtons, and the height of the drop, expressed in metres, that caused the glass to break. The results obtained for mineral and sapphire glasses with a thickness of 1 mm shall be within the limits stated in Table 1.

Table 1 — Criteria for verification of glass mechanical properties

Criteria	Mineral glasses		Sapphire glasses
	Class 1	Class 2	
Hardness HK 0,1	550 to 650	475 to 550	1 800 to 2 200
Breakage energy (in 10^{-4} N·m)	1 600 to 2 100	700 to 1 600	800 to 1 800

NOTE 1 Mineral glasses of Class 1 represent the highest quality.

NOTE 2 The values given in this table correspond to glasses with a thickness of 1 mm and a diameter of 22 mm to 30 mm, placed in position without mechanical restraint for the ball drop test.

NOTE 3 For treated glasses, the breakage energy increases up to 50 % if the glass diameter is between 22 mm and 30 mm.

NOTE 4 For treated glasses, the breakage energy increases by around 115 % if the glass thickness is doubled.

NOTE 5 "Hardness HK 0,1" signifies that the test was performed under a load of 1 N.

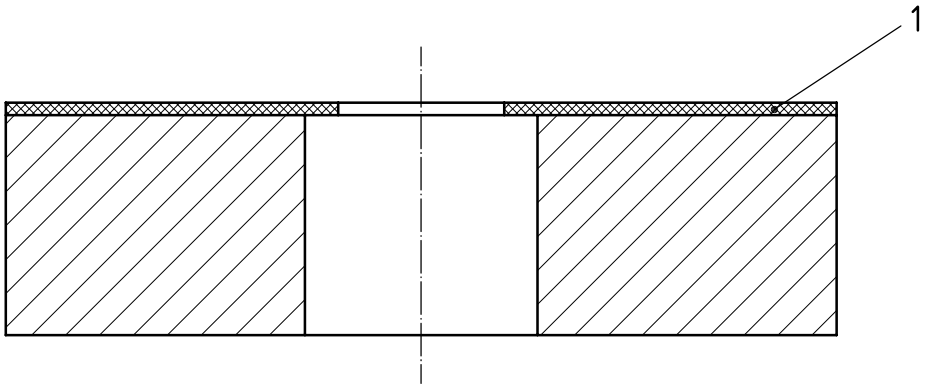
6 Test under static load

6.1 General

The purpose of this test is to determine whether the mineral glass has undergone hardening and reinforcement.

6.2 Support

This support comprises a metal annular block (generally made from brass) with a hole of diameter 14 mm. A rubber plate, 0,5 mm thick, is placed on the surface accommodating the glass under test. This rubber plate, the hardness of which varies between 60 and 80 Shore A, also has a hole, the diameter of which is slightly smaller than that of the support.



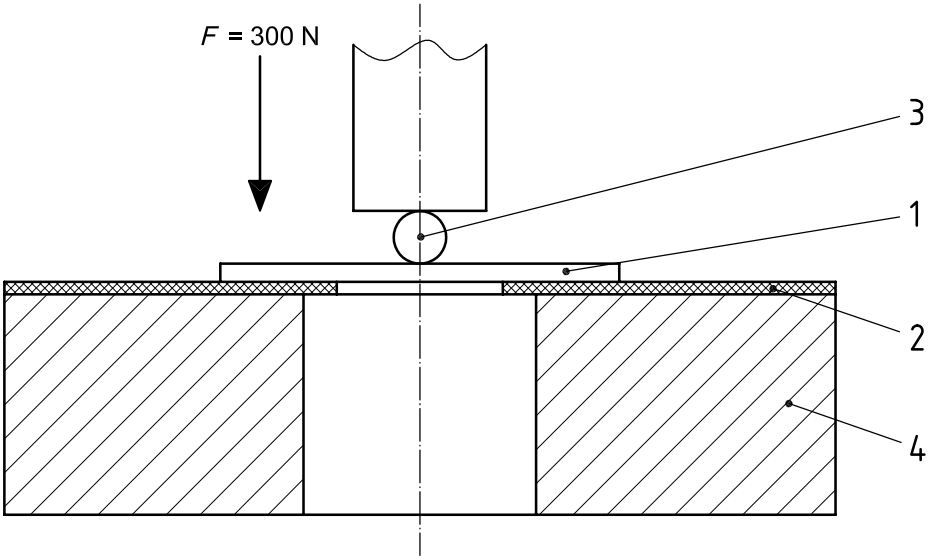
Key

1 rubber plate (0,5 mm thick)

Figure 4 — Details of the support

6.3 Test device

The test device is schematically depicted in Figure 5.



Key

1 glass
2 rubber plate (0,5 mm thick)
3 steel ball (D = 3,175 mm)
4 support

Figure 5 — Diagram of the test device

6.4 Test procedure

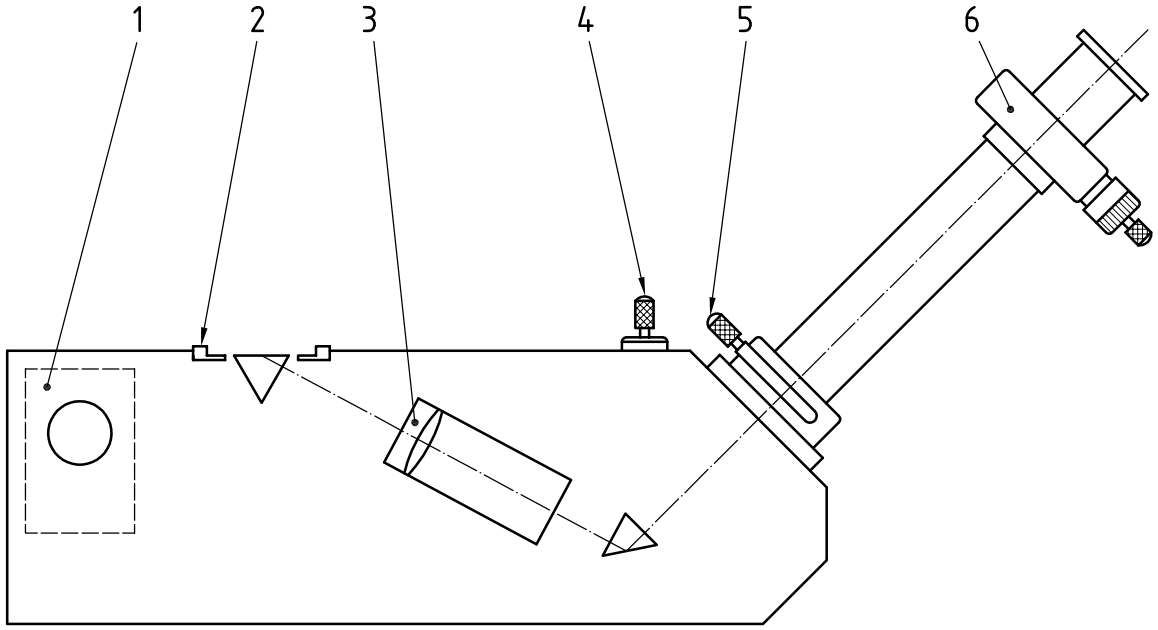
Place the glass, without mechanical restraint, on the rubber plate in the centre of the support. Place a steel ball of diameter 3,175 mm at the centre of the mineral glass under test, and apply a load of 300 N to the ball. This load is used for mineral glass with a thickness of 1 mm and a diameter of 22 mm to 30 mm. The load, in newtons, shall be adapted for other dimensions.

If the mineral glass is not damaged during the above test, then it may be assumed that the glass has been reinforced.

7 Measuring surface stress

7.1 Test device

The test device is a commercially available optical device as depicted in Figure 6.



Key

1 low-pressure sodium lamp
2 supporting plate
3 objective
4 interrupter
5 deflector
6 ocular

Figure 6 — Diagram of the optical measuring device

7.2 Test procedure

Place the mineral glass under test in the centre of the supporting plate. Measure the value of the surface stress and the depth of the surface stress layer. It is assumed that the mineral glass has been reinforced if the value of the surface stress and the depth of the surface stress layer comply with the pertinent specified values according to the application.

For further information, see the manufacturer's instruction manual for the device.

Annex A
(informative)

Method of checking the appearance

A.1 Visual inspection

This method consists in making a visual examination of the watch-glasses at a distance of 30 cm with the naked eye to assess the defects referred to in 3.2 to 3.10 (the test time shall be defined by agreement between the customer and the supplier).

A.2 Work station

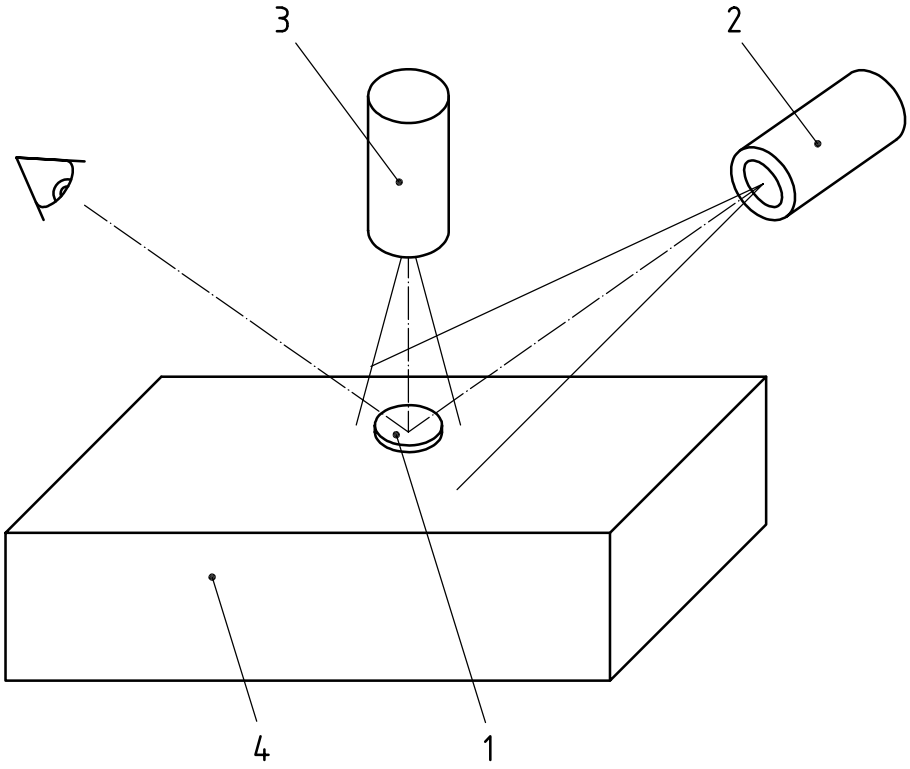
The superficial defects shall be inspected in a dark work station, which prevents (by using black curtains) natural and artificial parasitic light from influencing the results.

A.3 Equipment

Use a 1 500 lx, vertical and horizontal light consisting, for example, of two horizontal and vertical light beams from a floodlight (see Figure A.1), or any other apparatus designed for the visual inspection of surfaces.

A.4 Quality criteria

In the case of some of the possible defects mentioned, acceptance or rejection is subjective as it depends on human factors which cannot be rigorously quantified.



Key

1 glass undergoing inspection
2 horizontal light source
3 vertical light source
4 table or bench

Figure A.1 — Inspection device

ICS 39.040.10

Price based on 9 pages