
**Glass in building — Forced-entry security
glazing —**

**Part 3:
Test and classification by manual attack**

*Verre dans la construction — Vitrages de sécurité contre infractions —
Partie 3: Essai et classification par assaut manuel*

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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 16936-3 was prepared by Technical Committee ISO/TC 160, *Glass in building*, Subcommittee SC 2, *Use considerations*.

ISO 16936 consists of the following parts, under the general title *Glass in building — Forced-entry security glazing*:

- Part 1: Test and classification by repetitive ball drop
- Part 2: Test and classification by repetitive impact of a hammer and axe at room temperature
- Part 3: Test and classification by manual attack
- Part 4: Test and classification by pendulum impact under thermally and fire stressed conditions

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Introduction

ISO 16936 assesses security-glazing products that are more familiarly known as “anti-vandal”, “anti-bandit”, and detention glazing products. Because there is no single test that will cover such a wide range of resistance to attack, four separate test methods are provided to assess the forced-entry resistant properties of security glazing. It is not intended that any particular test method be associated with the terms “anti-vandal” or “anti-bandit”, since these terms can be only loosely defined and there is considerable overlap in their definition.

The test method specified in this part of ISO 16936 is a physical test using personnel and equipment and does not reproduce the conditions of real human attack. The test relies heavily on the competence and experience of personnel performing the test. The classification determined may not necessarily be reproducible and is therefore considered as comparative of various glazing constructions.

The selection of tools to be used for the simulated attack is based on an attack which can be carried out without regard to noise, smoke, vibration, etc. generated during the attack.

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Glass in building — Forced-entry security glazing —

Part 3: Test and classification by manual attack

1 Scope

This part of ISO 16936 sets forth a physical test method for security-glazing designed to resist actions of manual attack by delaying access of objects and/or persons to a protected space for a short period of time. Its application is limited to the evaluation and the classification of the resistance of forced-entry security glazing against the following threats:

- blunt tool impacts;
- sharp tool impacts;
- thermal stress;
- chemical stress (optional).

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It is not applicable to the use of power (motor- or engine-driven) tools or devices, explosives, military ordnance and tools, and processes or devices requiring more than two persons to transport and operate.

NOTE Classifications have not been assigned to specific applications and glazing classification must be specified on an individual basis for every application.

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 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ASTM A 53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*

EN 3:2004, *Portable Fire Extinguishers*

UL 154, *Standard for Carbon Dioxide Fire Extinguishers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 action of force
deliberate action on the part of a person made with the intention of creating a hole in the security-glazing product by the use of manually held implements or by the use of thrown objects

3.2 attack face
face of a test piece marked by the manufacturer and/or supplier that is designed to face the attack

3.3 category of resistance
classification of the capability of a security-glazing product to resist actions of force

3.4 protected space
space protected against access by the completed installation

3.5 sample
specified number of test pieces which together are representative of the security-glazing product intended to comply with a particular category of resistance in this part of ISO 16936

3.6 security-glazing composition
specific construction of a glazing product

NOTE A product is deemed to be of the same or superior security-glazing composition if individual plies are exchanged with others of a different colour, but without significant effect on the resistance to actions of force, and/or additional glazing products are installed on either face of the security-glazing product, laminated to it or with an air space, and/or additional equipment such as alarm wires, heating wires, printing, or surface coatings (on part or all of the surface) are incorporated into the security-glazing product, provided that this does not significantly affect the resistance to actions of force.

3.7 security-glazing product
product based on glass with or without plastics with a single or multiple ply construction, where the individual plies are of uniform thickness over the whole area of the product

NOTE A security-glazing product is usually transparent or translucent, and provides a specific resistance to the actions of force.

3.8 test piece
specified piece of security-glazing product submitted to a specified test procedure

3.9 tool set
set of tools allocated for use for a particular resistance class

4 Sampling

The sample submitted for testing shall consist of one test piece. To ensure against invalid test results because of errors during the test, it is advisable to submit at least one extra test piece. Replicate testing is recommended. Cut-outs and holes in security-glazing products should be avoided where possible, as these can affect the resistance of the product.

The test piece shall be $(1\ 100 \pm 5)$ mm long \times (900 ± 5) mm wide. The edges shall be free from visible chips, cracks and flaws. Glass samples should be lightly abraded for ease of handling.

The surface to be impacted shall be marked on each test piece.

Each test piece shall be conditioned vertically and be self-supporting at (18 ± 3) °C, for at least 12 h immediately prior to the test.

5 Test piece support apparatus

Security-glazing products should be installed in a frame which can give appropriate resistance to impact and which also provides a suitable support for the security-glazing product. See Figure 1.

The test piece support apparatus shall

- be inherently rigid,
- have an unyielding connection to a solid base and/or sturdy wall,
- ensure plane and parallel clamping of the test piece in a vertical position,
- be designed in such a way that the test piece touches only the clamping frame during the test,
- ensure clamping of the test piece on all four edges with an edge cover of (30 ± 5) mm,
- have the clamping frame, i.e. the fixed stop and adjustable stop, covered on the contact area of the test piece with rubber strips 30 mm wide and 4 mm thick of hardness 40 IHRD to 60 IHRD according to method N of ISO 48:1994,
- ensure that the edges of the test piece are clamped with a uniform pressure of (140 ± 20) kN/m²,
- allow mounting of the test piece in such a way that the bottom edge of the exposed faces (protected and assaulted) of the test piece shall be no higher than 80 cm nor lower than 70 cm from the horizontal surface supporting the operators.

6 Tool set

The tool set shall be stored at the test temperature for at least 12 h immediately prior to the test.

6.1 Blunt impacting tools

6.1.1 Sledgehammer, 3,0 kg, double-faced, drop forged steel head with a 910 mm handle.

6.1.2 Pipe, steel, 100 mm, in accordance with ASTM A 53, 90° cut-off.

6.1.3 Ram, two-man, 54 kg steel with a 100 mm square strike face and two 25 mm round handles mounted perpendicular to the longitudinal centreline extending 305 mm beyond the extremity of two opposing sides.

6.1.4 Ball-peen hammer, 0,5 kg, drop-forged steel head with a 410 mm handle.

6.2 Sharp impacting tools

6.2.1 Ripping bar, forged steel bar with slotted claw and chisel ends, 610 mm long.

6.2.2 Cold chisel, 200 mm long and a blade width of 22 mm, to be struck with a 0,25 kg claw hammer.

6.2.3 Structural steel angle, 510 mm × 50 mm, 6 mm thick, AISI-M1020, 90° cut-off.

6.2.4 Pipe, steel, 40 mm, Schedule 80 in accordance with ASTM A 53, 90° cut-off.

6.2.5 Fireman's pickaxe, head drop-forged steel, 3 kg, 910 mm long.

6.2.6 Wood splitting maul, 3,5 kg heat-treated steel head with 75 mm cutting edge and 910 mm handle.

6.3 Thermal stress tools

6.3.1 CO₂ fire extinguisher, steel cylinder conforming to EN 3 or UL 10BC or equivalent filled with 9 kg CO₂.

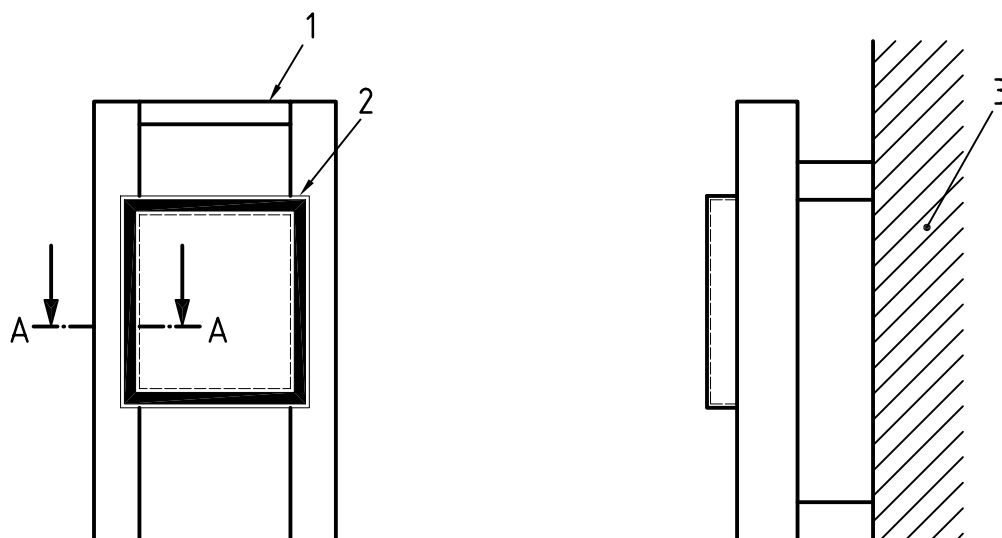
6.3.2 Propane torch, 5,5 kg to 7 kg cylinder with general purpose tip No. HT-880-2.9 or equivalent.

6.4 Chemically deteriorating materials (optional)

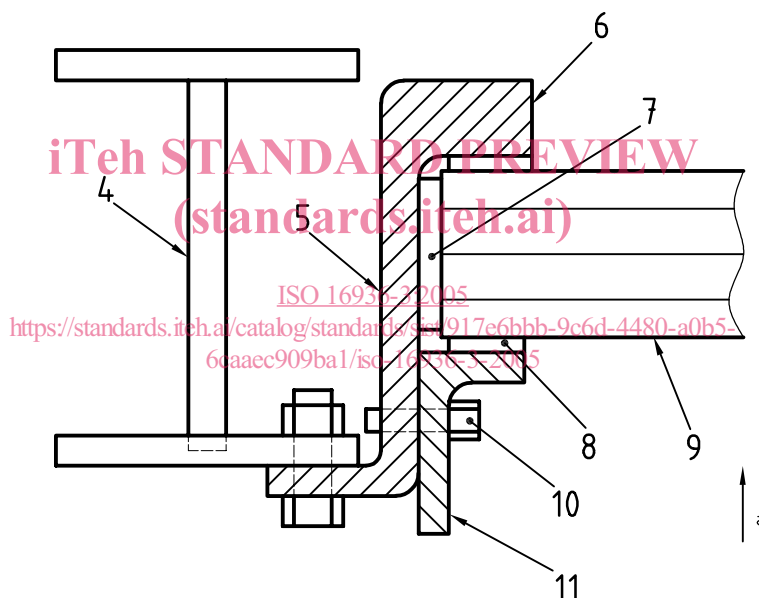
6.4.1 Gasoline, unleaded premium, 93 octane or equivalent.

6.4.2 Solvent containing acetone (minimum of 95 % concentration — technical grade).

6.4.3 Atomising dispenser, hand-operated pump-type similar to those used for dispensing window cleaning products (polypropylene or polyethylene).



A-A (7:1)



Key

- 1 150 mm wide, steel
- 2 900 × 1 100 mm test piece
- 3 concrete wall
- 4 support structure
- 5 150 × 90 × 16 mm steel angle-iron
- 6 32 mm square steel block
- 7 neoprane setting block
- 8 glazing tape
- 9 glazing
- 10 socket head cap screw
- 11 loose stop

^a Direction of attack.

Figure 1 — Test piece support apparatus and glazing test frame (detail)