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Road vehicles — Determination to forced entry of safety glass constructions used in vehicle glazing — Test of glazing systems

Véhicules routiers — Détermination de la force d'intrusion des constructions de vitres de sécurité utilisées dans les vitres de véhicules — Essai des systèmes de vitres

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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.

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).

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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 35, *Lighting and visibility*.

Introduction

The vast majority of potential attacks using hand-held implements can be narrowed down to two basic types of attack: attack with a sharp instrument and attack with a blunt instrument. Such attacks are reproduced by these procedures using standardized tests. The levels of energy/force used in the tests are designed to reflect strength of attack that is within the limits of human capability.

As the construction of the window frame plays a particularly important role in providing resistance to forced entry, any glazing requiring classification approval by this International Standard needs to be tested within its own original car body section, e.g. its own door assembly.

By defining performance levels of attack resistance, it is possible to classify the intruder resistance properties of a given glazing within a system part.

Road vehicles — Determination to forced entry of safety glass constructions used in vehicle glazing — Test of glazing systems

1 Scope

This International Standard provides test procedures that are designed to assess levels of resistance to forced entry provided by security glazing used in vehicles. Security glazing to be tested shall provide a certain (higher) level of protection against vehicle intrusion than standard safety glazing. This International Standard does not apply to conventional safety glazing material that meets the requirements of international automotive glazing material standards similar, but not limited to ECE R43.

This International Standard's goal is to quantify how much resistance can be provided by particular system parts (security glazing with associated part of the car body) against rapid unauthorized entry into vehicles. The test methods used have been designed more to simulate opportunist theft attacks using simple implements, which could be easily carried about a person rather than by "calculated theft" using specialist tools which a professional thief might use. That range of tools is limited to hand-held and non-powered instruments that could physically provide access to a vehicle.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 513, *Classification and application of hard cutting materials for metal removal with defined cutting edges — Designation of the main groups and groups of application*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 4130, *Road vehicles — Three-dimensional reference system and fiducial marks — Definitions*

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

DIN 5131, *Hatchets*

DIN 7287, *Steel axes and hatchets — Technical specifications*

DIN 53479, *Testing of Plastics and Elastomers; Determination of Density*

3 Terms and definitions

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

3.1
attack test
predetermined series of blows to a specific area of a *system part* (3.13) applied with well-defined energy levels and a *standardized tool* (3.12)

3.2
blunt attack
attempt to break into a vehicle where the energy of attack is exerted onto the *system part* (3.13) by a blunt or rounded impacting tool

3.3
cutting attack
attempt to break into a vehicle where the energy of attack is exerted onto the *system part* (3.13) by a tool with a sharp cutting edge

3.4
displacement test
test to evaluate the level of retention of glazing within its frame or the associated car body using a spherical-faced tool constantly moved against the inside centre of the glazing until a well-defined level of force is reached

3.5
effective mass
mass of a freely moving implement that, driven by the same kinetic energy, would hit the *system part* (3.13) with the same speed as the *effective tool* (3.6) implemented in the test apparatus

Note 1 to entry: Implements with the same effective mass and with same kinetic energy will develop same speed; kinetic energy and speed are the fixed parameters to study interaction between *standardized tool* (3.12) and system part. For technical reasons, additional construction elements are required moving with the standardized tool affecting the relationship between kinetic energy and speed. A procedure is given to measure the effective mass for a given design and facilitate countermeasures.

Note 2 to entry: The effective mass is calculated out of measurement results from a drop test using the effective tool's gravitational force, the stroke height, and the speed at the *impact point* (3.8) as shown in 5.2.

3.6
effective tool
mechanical unit consisting of the standardized tool and all moving parts attached to it

Note 1 to entry: During the entire test procedure, only the *standardized tool* (3.12) itself shall come into contact with the *system part* (3.13).

3.7
forced entry testing
standardized test procedure in two parts (*attack test* (3.1) sequence with blunt tool and attack test sequence with cutting tool) to assess the resistance of glazing within a given part of a car body against forced entry

3.8
impact point
location on the *standardized tool* (3.12) at which first contact to the *system part* (3.13) is made during the *attack test* (3.1)

3.9
level of attack resistance
measure in five discrete steps of the ability of a *system part* (3.13) to resist a forced entry of a certain strength specified by the number of tool impacts, their energies, and forces for displacement

Note 1 to entry: For higher levels of attack resistance, a larger number of impacts as well as higher energies and forces are required.

Note 2 to entry: If a system part passes the *forced entry testing* (3.7) as described, then the system part meets the requirements of the specific level of attack resistance for which it was tested. If the results for the *attack test* (3.1) sequences with cutting and blunt tool are different, the overall test evaluation will correspond to the lower level of the two results.

3.10
pointed attack
attempt to break into a vehicle where the energy of attack is exerted onto the *system part* (3.13) by a pointed tool

Note 1 to entry: Pointed attack can cause the glazing to crack or to develop full, localized penetration of the glass pane.

3.11
resistance to forced entry
ability of a glazing to resist the attempt to penetrate glazing using simple tools

Note 1 to entry: The strength of resistance will be quantified by use of distinct levels called levels of attack resistance.

Note 2 to entry: This property is only appropriate for the *system part* (3.13) under test using standardized conditions and does not take into account all aspects necessary to evaluate resistance to forced entry of a complete vehicle. For example, location of glazing in the vehicle or strategy of the attack could affect this property and are out of the scope of this International Standard.

3.12
standardized tool
testing device that simulates forced entry by cutting, pointed, and *blunt attack* (3.2)

Note 1 to entry: Each device aims to represent a respective category of tools that could potentially be used for forced entry into a vehicle.

3.13
system part
original security glazing and the associated part of the car body (e.g. the window pane and door of a given vehicle)

3.14
test element
part of the *attack test* (3.1) sequence referring to an attack test using one of the *standardized tools* (3.12)

3.15
tool axis
construction line that passes through the tool's *impact point* (3.8) and is in line with the direction of movement immediately before it hits the system part (direction of action)

3.16
tool's direction of action
direction in which the tool is moving immediately before it hits the *system part* (3.13)

Note 1 to entry: If the tool is following a circular path, the direction of action is the tangent to the circular path at the *impact point* (3.8), immediately before tool applies force to the system part.

4 Principle

A wide range of attacks using various hand-held tools will be simulated by only two different test procedures applied to the same kind of system part. The results of both tests will be taken to generate a classification of resistance to forced entry by the use of levels of attack resistance.

Both test procedures, called "attack test sequence with blunt tool" and "attack sequence with cutting tool" cover three test elements, each applied to the same kind of system part, representing all relevant elements of a forced entry with handheld tools.

In a first step of an attack test sequence, the glazing is impacted by a pointed tool. This reflects the attempt to destroy the integrity of the brittle glazing component(s) for a forced entry as a first step, getting access to the vehicle straight away or weaken the system part for further attacks with cutting or blunt tools to finally create a sufficient opening for access.

For the second step of an attack, test sequence attempts are made to create an opening in the glazing, or between the glazing and the surrounding frame large enough to get access to the vehicle. This is done by striking the glazing system part repeatedly using specific tools which represent groups of blunt tools on one hand or cutting tools on the other hand.

If this does not provide the intended opening, the third step of the attack test sequence provides an attempt to remove the remainder of the damaged glazing from the surrounding frame and to thereby create an opening large enough to gain entry.

For a forced entry testing, both attack test sequences are required, consisting of three test elements each (pointed attack, cutting attack, displacement for the first attack test sequence, and pointed attack, blunt attack, displacement as the other attack test sequence).

5 Apparatus

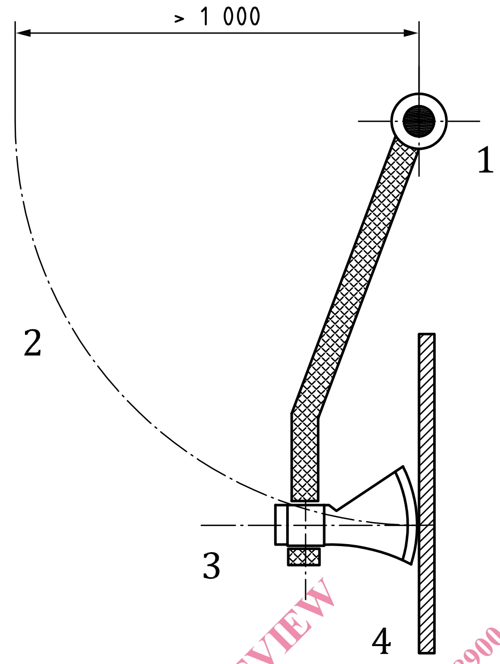
5.1 Description of the apparatus

5.1.1 General

The forced entry testing for a system part consists of two attack test sequences (with blunt and with cutting tool), each with three test elements (pointed attack, cutting or blunt attack, and a displacement test). The three elements of each attack test sequence shall be performed one directly after the other on the same system part, without any need for the part to be taken out of the support frame (see 6.1) during test.

Attack tests are carried out using a mechanical apparatus. This apparatus has one degree of freedom for movement and directs standardized tools, along a circular path with a minimum radius of 1 m and at a well-defined energy, in such a way that the tool axis of the standardized tool is perpendicular to the surface of the glazing at the impact point (see Figure 1). At the moment of impact, the tool axis and impact point's speed vector must be parallel. Construction elements that are fixed to the standardized tool (effective tool) shall be designed in a way that the tool's impact point makes the first contact to the system part. The effective tool shall be designed in a way that distance between its centre of gravity and the rotation axis is at least 0,7 times the distance between the rotation axis and the impact point.

Dimensions in millimetres



Key

1 axis of rotation
2 travelling path of impact point
3 tool axis
4 system part

Figure 1 — Schematic representation of the effective tool

The position of the effective tool as shown in Figure 1 shall be the position at rest. The centre of gravity shall be vertically and directly below the axis of rotation. Special measures to facilitate that are not shown here.

Often, the level of energy for effective tool just driven by gravity is not enough to perform the test according to this International Standard. An additional mechanism is therefore required to accelerate the tool. Description of an apparatus to increase the tool's energy is not given in this International Standard and can be designed according to technical requirements as long as it meets this International Standard's requirements. In this respect, care shall be taken to ensure that the required level of energy is achieved as the tool hits the glazing, and that thereafter, no additional energy is applied. The drive unit delivering the energy must be mechanically disconnected from the effective tool before the tool makes contact with the system part. When idle and disconnected from drive unit, the effective tool shall come to rest and remain static at the intended point of contact with the system part. This shall be the case if the rotation axis is vertical above the effective tool's centre of gravity. There shall be a possibility to adjust the point of contact as well as the orientation of the system part relative to the axis and impact point of the idle standardized tool.

The required level of energy shall be evaluated by measuring the travelling speed of the standardized tool's impact point immediately before hitting the system part under test. Speed measurements must be accurate to ±2 %. The standardized tool's impact point must hit the intended position on the glazing with an accuracy of ±5 mm.

The way in which security glazing is installed for test purpose shall match realistic conditions as closely as possible. Glazing and the associated car body part (see 6.2), jointly referred to here as the "system part," are held by a support construction (described in 6.1) in a fixture.

The fixture shall be rigid in itself and shall be solidly fixed to a firm surface.