
**Protective clothing — Mechanical
properties — Determination of resistance to
puncture**

*Vêtements de protection — Propriétés mécaniques — Détermination de la
résistance à la perforation*

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ISO 13996:1999

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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 3.

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 13996 was prepared by Technical Committee ISO/TC 94, *Personal safety — Protective clothing and equipment*, Subcommittee SC 13, *Protective clothing*.

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Protective clothing — Mechanical properties — Determination of resistance to puncture

1 Scope

This International Standard specifies a test method for measuring the puncture resistance of protective clothing or materials used for these products.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 2231, *Rubber- or plastics-coated fabrics — Standard atmospheres for conditioning and testing.*

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile/compression testing machines.*

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3 Term and definition

For the purposes of this International Standard, the following term and definition apply.

3.1

puncture resistance

maximum force required to push a spike with a specified speed through the test specimens

NOTE It is expressed in newtons.

4 Test specimens

Take four representative test specimens from the sample, each of 50 mm minimum diameter, so that the specimens fit between the bolt holes of the clamps.

5 Test method

5.1 Apparatus

5.1.1 Tensile testing machine, type CRE as defined in ISO 7500-1.

It shall be capable of

- a vertical travel of at least 100 mm,
- a constant rate of compression of (100 ± 10) mm/min,

and include a recording apparatus for the force and deformation.

5.1.2 Test spike, made of steel, with a minimum hardness of 60 HRC.

It shall have the dimensions and the characteristics as shown in Figure 1.

The test spike shall be checked by an optical enlargement after every 500 tests or at least once a year. When testing materials, which wear out the test spike, the optical checks should be done more frequently. If this check shows that the test spike dimensions do not comply with the dimensions of Figure 1, the test spike shall be discarded.

Control of the dimensions of the test spike is important. It is recommended that every test laboratory maintain an internal reference material to carry out regular checks on the results of the testing.

5.1.3 Clamping rings, to prevent slippage during the test.

They shall consist of two steel plates, at least 10 mm thick, each having a $(20 \pm 0,5)$ mm diameter hole in the centre and four clamping bolts, as shown in Figure 2.

NOTE Gripping aids can be used if necessary to prevent slippage or to reduce damage to the specimen.

5.2 Conditioning

The specimens shall be conditioned and the test shall be conducted in the standard atmosphere as described in ISO 2231, i.e. at a relative humidity of (65 ± 5) % and a temperature of (20 ± 2) °C. Conditioning at a specified relative humidity may be omitted if it can be shown that the results for the type of material under test were not affected.

5.3 Procedure

Secure the specimen between the clamping rings (5.1.3) with the outer surface exposed to the test spike (5.1.2). Tighten the nuts sufficiently to ensure no slippage of, or damage to, the specimen. Place the specimen and the clamping rings in the tensile testing machine (5.1.1). Advance the spike onto and through the specimen at a rate of (100 ± 10) mm/min. If the spike fails to penetrate after a movement of 25 mm after contact with the specimen, the test is terminated. This shall be referred to in the test report.

Repeat the procedure on the remaining specimens.

Record for each test the maximum force (in newtons) needed to penetrate the specimen.

6 Calculation of results

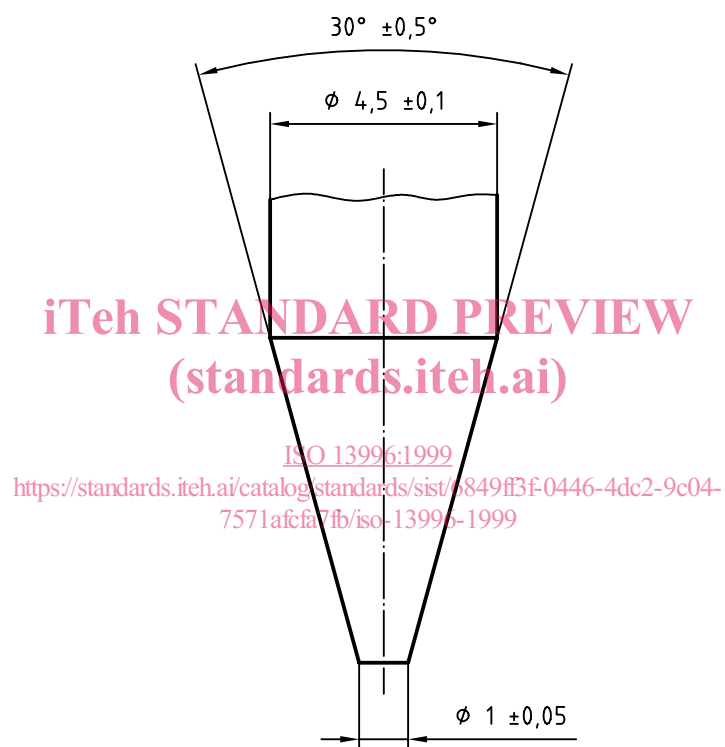
Calculate the arithmetical mean of the maximum force (in newtons) needed to puncture the four test specimens, rounded to the nearest integer.

7 Test report

The test report shall include the following information:

- the number and the date of this International Standard;
- all details necessary for the identification of the sample tested;
- the results obtained for each test specimen;
- the mean value in newtons;
- any deviation from the procedure outlined in this International Standard.

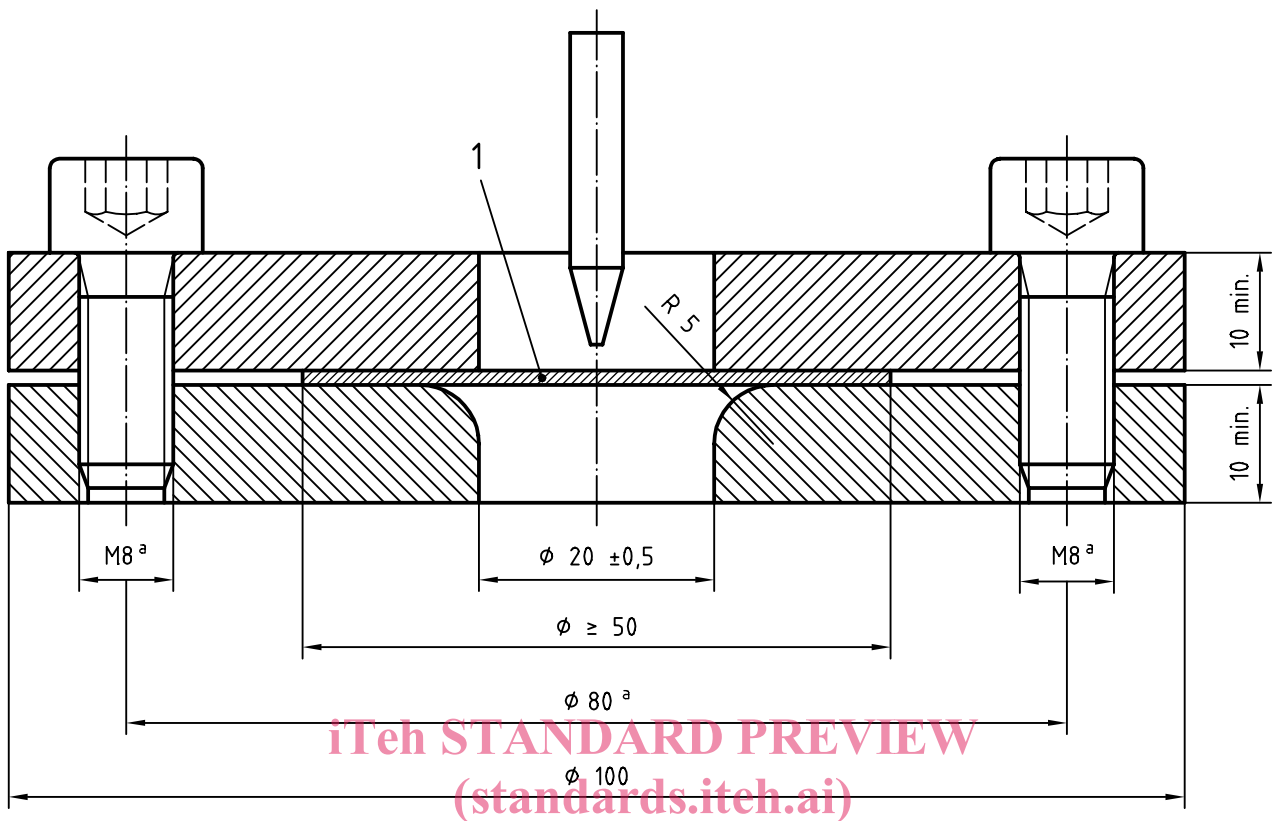
Dimensions in millimetres



Material: Steel 60 HRC

Figure 1 — Test spike

Dimensions in millimetres



Key

1 Specimen

^a These figures are not critical.

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Figure 2 — Typical clamp arrangement

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