



Government
of Canada

Gouvernement
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Canadian General
Standards Board

Office des normes
générales du Canada

CAN/CGSB-4.2

No. 27.7-2023

Supersedes CAN/CGSB-4.2

No. 27.7-2013



Textile test methods

Combustion resistance of mattresses — Cigarette test

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NATIONAL STANDARD OF CANADA

CAN/CGSB-4.2
No. 27.7-2023

Supersedes CAN/CGSB-4.2
No. 27.7-2013

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CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS
FRANÇAISE ET ANGLAISE.

ICS 59.080.30

Published January 2023 by the
Canadian General Standards Board
Ottawa, Ontario K1A 0S5

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Translation of this National Standard of Canada was conducted by the Government of Canada.

Preface

This National Standard of Canada CAN/CGSB-4.2 No. 27.7-2023 supersedes the 2013 edition.

Changes since the previous edition

- Added definitions for “charring” and “melting”.
- Expanded criteria for acceptable ignition sources to allow the use of cigarettes based on their percent full length burn instead of burn rate.
- Clarified where to take specimens from a sample based on the mattresses’ intended use and the handling of specimens where a reading of 75 on the durometer cannot be attained.
- Added tolerance for template used to mark 50 mm line and a numeric value for “still-air conditions”.

The following definitions apply in understanding how to implement this National Standard of Canada:

- "shall" indicates a **requirement**;
- "should" indicates a **recommendation**;
- "may" is used to indicate that something is **permitted**;
- "can" is used to indicate that something is **possible**, for example, that an organization is able to do something.

Notes accompanying clauses do not include requirements or alternative requirements. The purpose of a note accompanying a clause is to separate explanatory or informative material from the text. Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

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Introduction

This National Standard of Canada was developed to provide flammability requirements for mattresses intended for consumer use, with the aim to reduce the unreasonable risk of property damage, burn injuries and deaths from fires associated with mattresses. The standard determines the combustion resistance of a mattress when exposed to a smouldering ignition source, under defined conditions.

Canada has a regulatory framework in place to protect Canadians from product-related hazards and to promote the safe use of products. Flammability requirements for mattresses intended for consumer use are set out in the *Mattresses Regulations* under the *Canada Consumer Product Safety Act*. The Regulations incorporate the Canadian General Standards Board standard CAN/CGSB-4.2 No. 27.7, entitled *Textile test methods — Combustion resistance of mattresses — Cigarette test*, as the national test method for determining the combustion resistance of mattresses.

Textile test methods

Combustion resistance of mattresses — Cigarette test

1 Scope

This National Standard of Canada assesses the combustion resistance of mattresses when in contact with a lighted cigarette. This standard covers the resistance of mattresses to ignition only by a burning cigarette and does not relate to their resistance to any other source of ignition or fire conditions.

The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This standard does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use. CGSB neither assumes nor accepts any responsibility for any injury or damage that may occur during or as the result of tests, wherever performed.

Units of measurement – Quantities and dimensions used in this standard are provided in units from the International System of Units (SI units) with the exception of the gram-force (gf) used to define the performance characteristics of the durometer in section 6.2.

2 Principle

The surface of a mattress assembly is exposed to a lighted cigarette as the standard ignition source in a draft-protected environment. Individual specimens are assessed by observing the maximum distance of charring or melting on the specimen surface in any horizontal direction from the nearest point of the original location of the cigarette and by determining whether combustion continues within the specimen after the cigarette is extinguished.

3 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this National Standard of Canada. The referenced documents may be obtained from the sources noted below.

Note: The contact information provided below was valid at the date of publication of this standard.

An undated reference is to the latest edition or revision of the reference or document in question, unless otherwise specified by the authority applying this standard. A dated reference is to the specified revision or edition of the reference or document in question.

3.1 National Institute of Standards and Technology

NIST Technical Note 1627, *Modification of ASTM E2187 for Measuring the Ignition Propensity of Conventional Cigarettes*

3.1.1 Contact information

The above may be obtained from the National Institute of Standards and Technology (NIST). Web site: <https://www.nist.gov/>.

3.2 ASTM International

ASTM E2187 – 20a, *Standard Test Method for Measuring the Ignition Strength of Cigarettes*

3.2.1 Contact information

The above may be obtained from ASTM International. Web site: <https://www.astm.org/>.

4 Terms and definitions

For the purposes of this National Standard of Canada, the following terms and definitions apply.

charring

formation of carbonaceous residue during pyrolysis or incomplete combustion.

core

the main support system such as springs, foam or fluid that may be present in a mattress.

gram-force (gf)

a metric unit of force (gf). The gram-force is equal to a mass of one gram multiplied by the standard acceleration due to gravity on Earth's surface (approximately 9.8 m/s²).

mattress

a ticking filled with a resilient material used alone or in combination with other products, intended or promoted for sleeping upon (excluding sleeping bags).

melting

phenomena accompanying the softening of a material under the influence of heat (including shrinking, dripping and burning of molten material, etc.).

ticking

the outermost layer of fabric or related material that encloses the upholstery and core.

upholstery

all material, either loose or attached, between the ticking or between the ticking and the core of the mattress.

5 Symbols, acronyms and abbreviated terms

The following abbreviations and acronyms are used in this National Standard of Canada:

ASTM – ASTM International

NIST – National Institute of Standards and Technology

SI – International System of units

6 Apparatus and materials

6.1 Flammability tester (see Figures 1 and 2): an uncovered flame-resistant box approximately 300 mm x 300 mm x 300 mm. Within the box, a platform (approximately 295 mm x 295 mm) is mounted on a scissor jack. The test specimen, which is mounted on this platform, can be clamped into position by raising the jack and compressing the edges against a clamping surround. The firmness of the specimen can be varied by adjusting the height of the platform. The box cover shown in Figures 1 and 2 is used to extinguish the fire in the box.

6.2 Firmness tester (durometer): the purpose of this instrument is to measure the firmness of the mattress assembly under test. Measurement is achieved by local depression of the specimen with a spring loaded probe, reaction to the spring loading being displayed on a dial gauge. The durometer¹ should measure force up to 142 gf and have an accuracy of ± 2.8 gf, and should have a flat circular probe tip measuring 1 cm².

6.3 Cigarette: the cigarette shall be without filter tip and made from natural tobacco, 85 mm \pm 2 mm long with a tobacco packing density of 270 kg/m³ \pm 20 kg/m³, and a mass of 1.1 g \pm 0.1 g at 65% \pm 2% relative humidity (RH) and a temperature of 20 °C \pm 2 °C. The cigarette shall either:

- a) burn its entire length in 1500 s \pm 150 s, when conditioned at 21 °C \pm 3 °C and 35% to 50% RH, ignited at one end and placed horizontally on the surface of a glass fibre fabric² (205 g/m² \pm 5 g/m²); or
- b) burn full length greater than 85 percent of the time when tested using the modified test procedure described in the NIST Technical Note 1627, *Modification of ASTM E 2187 for Measuring the Ignition Propensity of Conventional Cigarettes*³.

6.4 Polyurethane foam⁴: 300 mm \pm 5 mm x 300 mm \pm 5 mm x 25 mm \pm 5 mm with a density of 16 kg/m³ to 42 kg/m³ and a firmness of 21 to 61 as measured by the prescribed durometer.

6.5 Rule: graduated in millimetres to measure specimen thickness.

6.6 Template: as shown in Figure 3, all measurements with a tolerance of ± 1 mm.

6.7 Anemometer: to measure the air velocity.

6.8 Fire extinguisher: should be immediately available at all times at the test location.

7 Test specimens

7.1 Test specimens shall be 300 mm \pm 5 mm x 300 mm \pm 5 mm. In the case of a quilted ticking or a deep panel scroll ticking, the specimens shall be cut so the stitch line is as close as possible to the centre of the mattress assembly.

¹ A durometer that conforms to these requirements is model 302SL, available from ITM Instruments Inc., 20800 Industrial Boulevard, Ste-Anne-de-Bellevue, Quebec H9X 0A1, telephone: 514-457-7280, Web site: <https://www.itm.com/> or Pacific Transducer Corp. (PTC) Instruments, 2301 Federal Avenue, Los Angeles, California 90064-1482 U.S.A., telephone: 877-782-2329., Web site: <https://www.ptc1.com/>, or any other equivalent product.

² Glass fibre fabric that conforms to these requirements is style No. 978 (60 in. wide) available from Testfabrics, Inc., 415 Delaware Avenue, PO Box 3026, West Pittston, Pennsylvania 18643 U.S.A., telephone: 570-603-0432, Web site: <https://www.testfabrics.com/>, or any other equivalent product.

³ A cigarette that conforms to these specifications is the Standard Reference Material (SRM) 1196a, *Standard Cigarette for Ignition Resistance Testing* available from the NIST, 100 Bureau Drive, Stop 2300, Gaithersburg, Maryland 20899-2300 U.S.A., telephone: 301-975-2200, Web site: <https://www.nist.gov/>, or any other equivalent product.

⁴ Polyurethane foam that conforms to these requirements is available from Foamite, 1000 Edgeley Boulevard, Vaughan, Ontario L4K 4V4, telephone: 888-362-6483, Web site: <https://www.foamite.com/>, or any other equivalent product.

7.2 Ten specimens shall be tested, unless otherwise specified. If the mattress is designed to be used on both sides, take five specimens from each side. If the mattress is designed to be used on one side only (e.g. a pillow top mattress), take the ten specimens from the side intended to be used.

7.3 Test specimens shall exclude any spring or fluid assembly and shall include:

- a) the entire mattress assembly, where its thickness does not exceed 50 mm, or, notwithstanding c) and d), where it can be reasonably accommodated in the flammability tester;
- b) all of the ticking and upholstery, where the thickness of such ticking and upholstery does not exceed 50 mm, measured in an unrestrained condition;
- c) the outermost 50 mm of ticking and upholstery measured in an unrestrained condition, where the thickness of such ticking and upholstery is greater than 50 mm; or
- d) the outermost 50 mm of ticking and plastic, natural or synthetic rubber measured in an unrestrained condition, where the mattress is a plastic, natural or synthetic rubber assembly exceeding 50 mm in thickness.

8 Conditioning

8.1 Specimens shall be conditioned at 35% to 50% RH and a temperature of $21\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ for at least 24 h immediately prior to testing.

8.2 Cigarettes used as an ignition source shall be removed from their packaging and conditioned under the same parameters as in Section 8.1 prior to use.

9 Procedure

9.1 The flammability tester shall be placed in an area providing both draft-protected conditions during the test and effective ventilation after the test. Testing shall be conducted under atmospheric conditions of 35% to 50% RH and a temperature of $21\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.

9.2 Remove the front panel of the flammability tester and place the test specimen on the platform.

9.3 Verify the durometer in accordance with the manufacturer's instructions.

9.4 Place the durometer on a level section of the mattress, never on a stitch line, and as close to the centre of the specimen as possible.

9.5 Turn the jack handle clockwise until the prescribed durometer registers a firmness reading of 75. If this figure cannot be met, a layer of polyurethane foam described in Section 6.4 shall be mounted immediately beneath the specimen assembly and become part of it. For some samples, two layers of polyurethane foam may be required to achieve the necessary firmness. If a firmness reading of 75 is exceeded by the relaxed test specimen, the test shall be carried out without applying any tension to the specimen. If a firmness reading of 75 cannot be achieved with two layers of foam, keep the foam in place and proceed with testing.

9.6 Place an unlit cigarette on the mattress assembly surface in a central position. In the case of a quilted ticking or a deep panel scroll ticking, the cigarette should be placed with as much of the length of the cigarette as possible in a stitch line. This stitch line should be as close as possible to the centre of the mattress assembly.

9.7 Draw a line around the cigarette such that any given point on the line is at a distance of 50 mm from the closest point of the cigarette. A template as shown in Figure 3 may be used to facilitate this procedure.

9.8 After ensuring still-air conditions (air velocity <0.3 m/s), remove the cigarette. Mark each conditioned cigarette at a distance of 80 mm from one end. Ignite the cigarette. Once the burning reaches the mark, replace it on the test specimen as close as possible to its former position.

9.9 Terminate the test either:

- a) when combustion of the ticking exceeds a distance of 50 mm in any horizontal direction from the cigarette location (i.e., crosses the line); or
- b) 10 min after the cigarette has extinguished, even if it has not burned its entire length.

9.10 Determine whether charring or melting on the specimen surface extends to the line drawn 50 mm from the original location of the cigarette.

9.11 If charring or melting on the specimen surface does not extend beyond the 50 mm line, examine all layers of the specimen for the presence of continuing combustion 10 min after the cigarette has extinguished.

9.12 Ventilate the test area.

10 Report

10.1 Report the following information for each specimen:

- a) Whether charring or melting on the specimen surface extends more than 50 mm in any horizontal direction from the original location of the cigarette.
- b) Whether any combustion continues in the specimen 10 min after the cigarette has extinguished.
- c) If the cigarette extinguished before burning its entire length.
- d) The reading of the durometer.

10.2 Report to include the number of this method: CAN/CGSB-4.2 No. 27.7-2023.

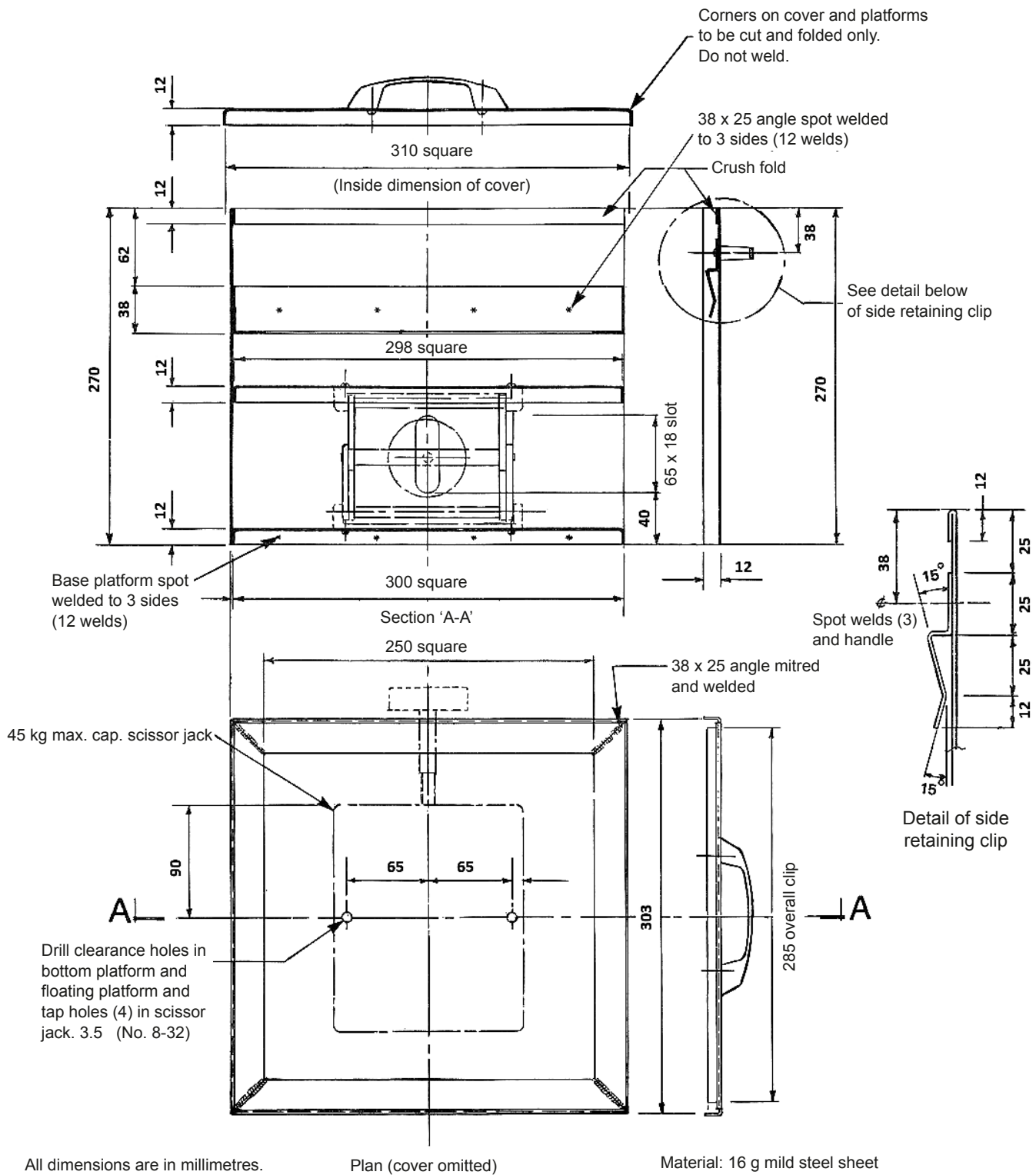


Figure 1 — General arrangement of mattress fire testing box

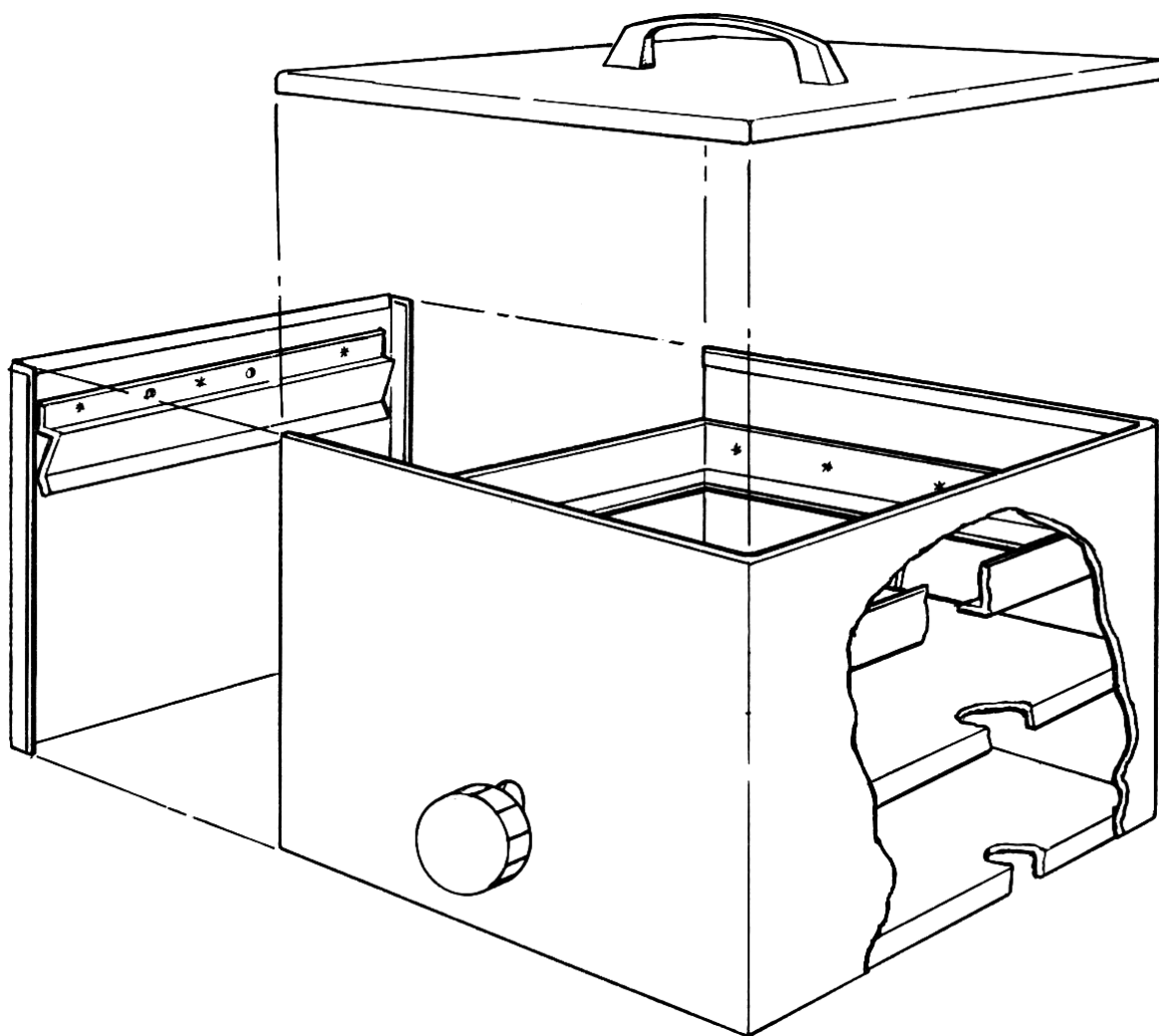


Figure 2 — Pictorial view of mattress fire testing box

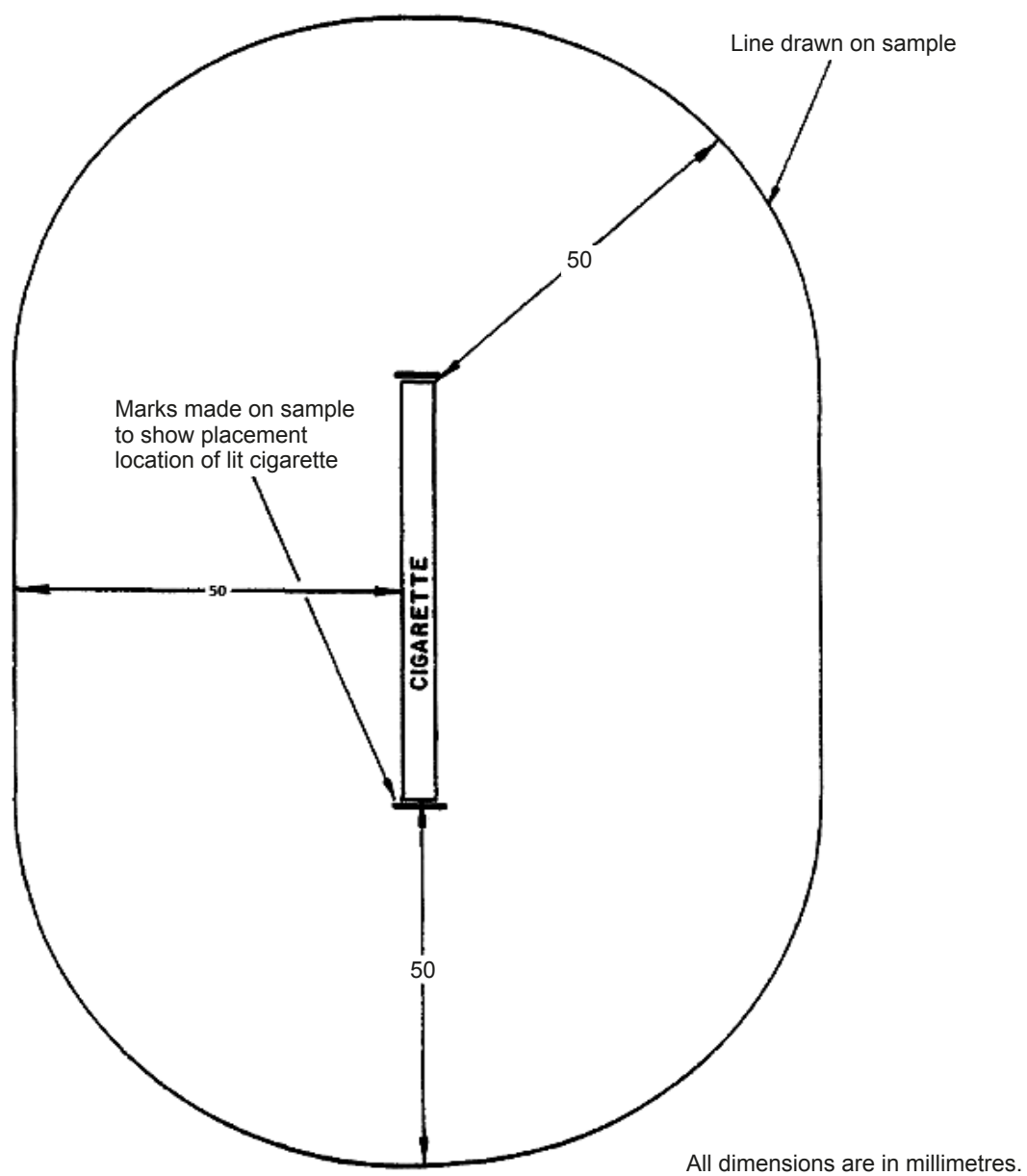


Figure 3 — Template — all dimensions with a tolerance of ± 1 mm