



CAN/ULC-S102:2018

**STANDARD METHOD OF TEST FOR SURFACE BURNING
CHARACTERISTICS OF BUILDING MATERIALS AND
ASSEMBLIES**



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STANDARD METHOD OF TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS AND ASSEMBLIES

PREFACE

This is the Eighth Edition of the Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies, CAN/ULC-S102.

This Edition of the Standard was developed by the ULC Standards Task Group on Surface Burning Characteristics and has been formally approved by the ULC Standards Committee on Fire Tests.

This Standard has been developed in compliance with the requirements of the Standards Council of Canada (SCC) for accreditation of a Standards Development Organization.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Appendix A, identified as normative, forms a mandatory part of this Standard.

Appendix B and C, identified as informative, are for informational purposes only.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This Eighth Edition National Standard of Canada is based on, and now supersedes, the Seventh Edition.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patent rights. ULC Standards shall not be held responsible for identifying any or all such patent rights.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a “yes” or “no” answer based on the literal text of the requirement concerned.

This CAN/ULC-S102 standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com/canada>.

This Standard is intended to be used for conformity assessment.

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1 SCOPE

1.1 This method of test for surface burning characteristics of building materials is applicable to any type of building material that, by its own structural qualities or the manner in which it is applied, is capable of supporting itself in position or may be supported in the test furnace as described in this Standard (see Appendix A) or in a manner comparable to its recommended use.

1.2 The following materials shall be tested and classified in accordance to CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies:

- A Materials which cannot be tested as described in Clause 1.1 without the use of supporting material that is not representative of the intended installation;
- B Materials which, when tested in the manner described in Clause 1.1, melts or drips, or otherwise disintegrates and continues to burn on the floor of the test chamber;
- C Materials designed for use in a relatively horizontal position with only its top surface exposed to air; or
- D Thermoplastic materials.

1.3 For material with a low thermal inertia which demonstrate anomalous behaviour in the test chamber (see Clause 9.2.4), the materials shall additionally be tested in accordance with CAN/ULC-S127, Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Foam Plastic Building Materials. See Appendix C.

1.4 For multilayer or composite materials in which only the surface materials melts or drips during the test and the remainder of the test specimen remains self-supporting, one test is conducted with support and one test is conducted without support. An additional test in conformance with the requirements of CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies, shall be conducted. Triplicate testing shall then be conducted and reported using the method that produces the highest Flame Spread Value (FSV).

1.5 Where a material cannot be readily determined to be thermoplastic or thermoset, one test is conducted in accordance with this standard and one additional test in conformance with requirements of CAN/ULC-S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies. Triplicate testing shall then be conducted and reported using the method that produces the highest FSV.

1.6 The primary purpose of the test is to determine the comparative burning characteristics of the material or assembly under test by evaluating the flame spread over its surface when exposed to a test fire and thus establish a basis on which surface burning characteristics of different materials or assemblies may be compared, without specific considerations of all the end use parameters that might affect these characteristics.

1.7 Smoke Developed Value (SDV) and Flame Spread Value (FSV) are recorded in this test. However, there is not necessarily a relationship between these two measurements.

1.8 It is the intent of this method to register performance during the period of exposure, and not to determine suitability for use after the test exposure.

1.9 This method does not establish standards of performance for specific applications. It is a means of evaluating the response of materials, products or assemblies to a particular fire exposure under controlled laboratory conditions.

1.9.1 The Flame Spread Rating (FSR) and the Smoke Developed Classification (SDC) determined by this Standard shall be restricted to the application of applicable to the materials and assemblies as tested. See Appendix A for specific mounting methods for various materials and assemblies.

2 REFERENCE PUBLICATIONS

2.1 The documents shown below are referenced in the text of this Standard. Unless otherwise stated elsewhere in this Standard such reference shall be considered to indicate the edition and/or revisions of the document available at the date on which the Committee approved this ULC Standard.

Documents Published by the American Society for Testing and Materials (ASTM International)
100 Barr Harbour Drive, PO Box C700, West Conshohocken, PA 19428-2959 U.S.A.
Telephone: (610) 832-9585
www.astm.org

- ASTM D4442-15, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials

Document published by National Lumber Grades Authority (NLGA)
960 Quayside Drive, Suite 406, New Westminster, B.C. V3M 6G2 Canada
Telephone: (604) 524-2393
www.nlga.org

- Standard Grading Rules for Canadian Lumber, January 2014

Document Published by the National Research Council Canada (NRC)
1200 Montreal Road, Bldg. M-58, Ottawa, ON K1A 0R6 Canada
Telephone: (613) 993-9101 or 1-877-672-2672
www.nrc-cnrc.gc.ca

- National Building Code of Canada, 2015

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- CAN/ULC-S102.2:2018, Standard Method of Test for Surfacing Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- CAN/ULC-S114:2018, Standard Method of Test for Determination of Non-Combustibility in Building Materials
- CAN/ULC-S127-14, Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Foam Plastic Building Materials

3 SIGNIFICANCE

3.1 This method defines the relative surface burning characteristics under specific test conditions. Although the procedure is applicable to materials, products and assemblies used in building construction for development of comparative surface spread of flame data, test results may not reflect the relative surface burning characteristics of tested materials under all building fire conditions.

3.2 The "fire hazard" of any material in the light of present knowledge cannot be evaluated on the basis of any one test. A body of tests, each measuring one or more characteristics of a material, product, or assembly, may be needed for full assessment. These assessments are intended as aids to those who have the responsibility for determining acceptable levels of potential hazard. The overall fire hazard of a material as it is to be used can only be determined by an analysis of its behaviour under several test conditions in addition to a further analysis which includes consideration of building construction, occupancy, location, and fire protection features.

4 GLOSSARY

NOTE: Terms used in this Standard are defined as follows:

4.1 FLAME SPREAD RATING (FSR) — A number derived from the average of a minimum of three 'flame spread values'

4.2 FLAME SPREAD VALUE (FSV) — A number indicating a comparative measure derived from observations made during the progress of the boundary of a zone of flame during the test for surface burning characteristics

4.3 SMOKE DEVELOPED CLASSIFICATION (SDC) — A number derived from the average of a minimum of three 'smoke developed values'

4.4 SMOKE DEVELOPED VALUE (SDV) — A number indicating a comparative measure derived from smoke obscuration data collected during the test for surface burning characteristics

4.5 TEST SPECIMEN — Representative piece of the product which is to be tested together with any substrate or treatment

Note: The test specimen may include an air gap.

4.6 THERMOPLASTIC — For the purpose of this Standard, a material that is plastic or deformable, and which melts or drips when heated

5 TEST EQUIPMENT

5.1 The test furnace, as shown in Figures 1 and 2, shall consist of a test chamber having an inside width of 450 ± 10 mm, a depth of 300 ± 10 mm measured from the bottom of the test chamber to the ledge of the inner walls on which the test specimen is supported (including the 3 mm thickness of ceramic-fabric gasket tape), and a length of 7600 mm. The sides and base of the test chamber shall be lined with an insulating masonry material as illustrated in Figure 2, consisting of a suitable brick with properties conforming to Clause 5.2. One side shall be provided with observation windows flush with the outer face of the furnace (see Figure 2). The dimensions of the openings on the inner face of the furnace wall shall be 70 ± 6 mm by 290 ± 40 mm. The windows shall be located such that not less than 280 mm of the test specimen width can be observed. Multiple windows shall be located along the test chamber so that the entire length of the test sample may be observed from outside the test furnace. The windows shall be pressure tight as described by Clauses 7.2.3 and 7.2.4.

5.2 The insulating firebrick shall have the following properties:

Maximum recommended temperature	1424 ± 5 °C
Bulk Density	0.77 ± 0.046 g/cm ³
Thermal Conductivity at Mean Temperature of	W/(m•°C) (± 5%)
205 °C	0.24
425 °C	0.27
625 °C	0.32
870 °C	0.37
1095 °C	0.46
1315 °C	0.56

5.3 The ledges shall be fabricated of structural materials capable of withstanding the rigors of continuous testing, level with respect to the length and width of the test chamber and each other.

5.4 The lid shall consist of a removable, non-combustible (metal and mineral composite) structure, insulated with nominal 50 mm thick mineral composition material as shown in Figure 2 and of a size necessary to completely cover the test chamber and the test samples. The lid shall be in an unwarped and flat condition, and shall contact the test specimen at all points. The mineral composition material shall have physical characteristics comparable to the following:

Maximum Temperature: 650 °C

Bulk Density: 200 ± 25 kg/m³

Thermal Conductivity (150-370 °C): 0.065 to 0.094 W/(m• °C)

The entire lid assembly shall be protected with flat sections of nominal 13 mm thick mineral composition material (nominal density 720 kg/m³, $k = 0.14 \text{ W/(m}\cdot\text{°C)} \pm 5\%$ at 540 °C), maintained in an unwarped and uncracked condition through continued replacement. This protective board is to be secured to the furnace lid. When in place, the top shall be completely sealed against the leakage of air into the test chamber during the test period.

5.5 One end of the test chamber, designated as the "fire end", shall be provided with two gas burners delivering flames upward against the surface of the test sample. The burners shall be spaced 300 ± 10 mm from the fire end of the test chamber and 190 ± 10 mm below the under surface of the test sample. Gas to the burners shall be provided through a single inlet pipe distributed to each burner port through a tee-section. The outlets shall be 19 mm street elbows. The plane of the port shall be parallel to the test chamber floor, such that the gas is directed upward toward the test specimen. Each port shall be positioned with its center line 100 ± 10 mm on each side of the center line of the test chamber so that the flame is evenly distributed over the width of the exposed test specimen surface (see Figure 2).

5.6 The controls used to assure constant flow of gas to the burners during period of use shall consist of a pressure regulator, a gas meter calibrated to read in increments of not more than $2 \times 10^{-3} \text{ m}^3$, a manometer to indicate gas pressure in pascals (Pa), a quick-acting gas shut-off valve, a gas metering valve, and an orifice plate in combination with a water manometer to assist in maintaining uniform gas flow conditions. An air intake, fitted with a vertically sliding shutter extending the entire width of the test chamber, shall be provided at the fire end, 1400 ± 100 mm upstream of the burner, to provide an air inlet port 75 ± 2 mm high, measured from the floor level of the test chamber. A draft gauge to indicate static pressure shall be located at the center line of the test chamber, 25 ± 10 mm below the ceiling and 380 ± 10 mm downstream from the inlet shutter.

Note: A temperature and pressure-compensating gas mass-flow controller and meter equipment can also be used to measure the gas usage.

5.7 The other end of the test chamber, designated as the “vent end”, shall be fitted with a gradual rectangular-to-round transition piece, not less than 500 mm in length, with a cross-sectional area of not less than $1.3 \times 10^5 \text{ mm}^2$ at any point. The transition piece shall in turn be fitted to a nominal 400 mm diameter flue pipe. The movement of air shall be by an induced draft system having a total draft capacity of at least 40 Pa with a sample in place, the shutter at the “fire end” open the normal $75 \pm 2 \text{ mm}$, and the damper in the wide open position.

5.8 A light source shall be mounted on a horizontal section of the 400 mm diameter vent pipe at a point where it will be preceded by a straight run of pipe (at least 12 diameters or 4800 mm and not more than 30 diameters or 12 m) from the vent end of the test chamber, with the light beam directed upward along the vertical axis of the vent pipe. The vent pipe shall be insulated with at least 50 mm of high-temperature mineral-composition material from the vent end of the test chamber to the photometer location. A photoelectric cell of which the output is directly proportional to the amount of light received shall be mounted over the light source and connected to a suitable data recording device capable of sampling at intervals not exceeding 5 s. The distance between the light source lens and the photocell lens shall be $900 \pm 100 \text{ mm}$. The cylindrical light beam shall pass through sealed 75 mm diameter openings at the top and bottom of the 400 mm diameter duct, with the resultant light beam centered on the photocell. The illumination at the photocell shall be $2150 \pm 100 \text{ lx}$.

5.9 Linearity of the photometer system shall be verified periodically by interrupting the light beam with calibrated neutral density filters. The filters shall cover the full range of the recording instrument. Transmittance values measured by the photometer, using neutral density filters, are to be within $\pm 3\%$ of the calibrated value for each filter.

5.10 An automatically controlled damper to regulate the draft pressure shall be installed in the vent pipe downstream of the smoke-indicating attachment. The damper shall be provided with a manual override.

5.11 Other manual or automatic draft regulation devices or both may be incorporated to maintain fan characterization and air-flow control throughout test periods.

5.12 A 1 mm diameter thermocouple, with $10 \pm 3 \text{ mm}$ of the junction exposed in the air, shall be inserted through the floor of the test chamber so that the tip is $25 \pm 1 \text{ mm}$ below the top surface of the ceramic fibre gasket tape, $7000 \pm 10 \text{ mm}$ from the center line of the burner ports, at the center of its width.

5.13 Two 1 mm diameter thermocouples embedded 3 mm below the backwall surface of the test chamber and at midheight of the wall shall be mounted in refractory or Portland cement, carefully dried to avoid cracking. These thermocouples shall be mounted at distances of $4000 \pm 15 \text{ mm}$ and $7090 \pm 15 \text{ mm}$ from the center line of the burner ports.

5.14 The room in which the test furnace is located shall have provision for a free inflow of air during the test to maintain the room at atmospheric pressure during the entire test run.

6 TEST SPECIMENS

6.1 Appendix A identifies the test specimen mounting methods for certain products. The test specimen shall be at least 50 mm wider (nominally $500 \pm 20 \text{ mm}$) than the interior width of the test chamber and shall total $7315 \pm 15 \text{ mm}$ in length. The test specimen shall consist of a continuous unbroken length, or of sections placed end-to-end with no gaps covering the total length of the test chamber. A $350 \pm 5 \text{ mm}$ length of uncoated sheet steel of not less than 1.34 mm thick shall be placed on the test specimen mounting ledge in front of and under the test specimen in the upstream end of the test chamber. Test

specimens shall be truly representative of the material and/or the manner of assembly for which classification is required to a depth of at least the lesser of 50 mm or the depth of thermal involvement during the test (usually no more than 25 mm).

6.1.1 Properties adequate for identification of the materials or ingredients, or both, of which the test specimen is made shall be determined and recorded.

6.2 The test specimen shall be conditioned to a constant mass at a temperature of 23 ± 3 °C and at a relative humidity of 50 ± 5 %.

6.3 For hygroscopic materials, the moisture content of the sample immediately prior to test shall be determined and recorded. A constant mass for hygroscopic materials is achieved when the change in mass over 72 h is 1 % or less.

7 CALIBRATION OF TEST EQUIPMENT

7.1 FREQUENCY OF CALIBRATION

7.1.1 Calibration of the test chamber using the procedure specified in Section 7, Calibration of Test Equipment, shall be conducted at least once per calendar year and after any maintenance which potentially affects calibration values currently in effect.

Note: Examples of such maintenance are re-bricking of the test chamber or lid reconstruction.

7.2 AIR LEAKAGE AND FAN PERFORMANCE

7.2.1 Place a 6 mm inorganic reinforced cement board with the properties described in Clause 7.2.2 on the ledge of the test chamber, then place the lid of the test furnace in position.

7.2.2 The inorganic reinforced cement board shall be non-combustible (meeting the requirements of CAN/ULC-S114, Standard Method of Test for Determination of Non-Combustibility in Building Materials), and uncoated, with a density of 1445 ± 160 kg/m³.

7.2.3 Establish a draft, in the test chamber with the fire-end shutter open 75 ± 2 mm and with the control damper in the wide open position, so that the draft manometer has a reading of approximately 40 Pa. Close and seal the fire-end shutter without changing the position of the control damper. The manometer reading shall increase to at least 100 Pa, an indication that no excessive air leakage exists.

7.2.4 Conduct a supplemental leakage test quarterly and prior to each calibration. Seal the furnace at the fire shutter and at the location of the control damper. Place a smoke bomb in the test chamber. Pressurize the test chamber to 100 ± 30 Pa and then ignite the bomb. Observe all points of smoke particle leakage and then seal.

7.3 AIR VELOCITY

7.3.1 Place a 6 mm inorganic reinforced cement board meeting the properties in Clause 7.2.2 on the ledge of the test chamber, then place the lid of the test furnace in position.

7.3.2 Provide an air supply to the test chamber at a temperature of 23 ± 3 °C and a relative humidity of 50 ± 5 %.