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**STANDARD METHOD OF FIRE TEST FOR HEAT AND VISIBLE
SMOKE RELEASE FOR DISCRETE PRODUCTS**

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Copies of this National Standard of Canada may be ordered from ULC Standards.

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

STANDARD METHOD OF FIRE TEST FOR HEAT AND VISIBLE SMOKE
RELEASE FOR DISCRETE PRODUCTS

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STANDARD METHOD OF FIRE TEST FOR HEAT AND VISIBLE SMOKE RELEASE FOR DISCRETE PRODUCTS

PREFACE

This is the First Edition of the Standard Method of Fire Test for Heat and Visible Smoke Release for Discrete Products, CAN/ULC-S142.

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

This Standard has been developed in compliance with the requirements of 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.

Appendices A and B, identified as Normative, form a mandatory part of this Standard.

Appendix C, identified as Informative, is for information 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 First Edition National Standard of Canada is based on, and supersedes, the First Edition of ULC/ORD-C2043-00.

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.

The review and action to revise or reaffirm this Standard will not exceed 5 years from the date of publication, unless the Standard is identified as fitting within a stabilized category, whereby the review will commence within the appropriate time frame set out by ULC Standards.

This Standard is intended to be used for conformity assessment.



1 SCOPE

1.1 This is a fire test method for determining the fire performance and smoke characteristics of discrete products (including but not limited to electrical and plumbing equipment). These products are subjected to an open flame ignition source and evaluated using a product calorimeter to determine the rate of heat release and the rate of smoke release of the burning product samples.

NOTE: Discrete products as used in this Standard refers to stand-alone, non-continuous product that are not installed in a continuous manner that could be tested in the tunnel equipment referenced in the Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies, CAN/ULC-S102. Examples of these types of products are speakers, valves, etc.

1.2 This test method does not provide information on the performance of products in other fire or test conditions. This test does not investigate the toxicity of the products of combustion.

1.3 This test does not cover the constructional, electrical, or other performance requirements of the product.

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.

Document 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 E800-14, Standard Guide for Measurement of Gases Present or Generated During Fires

Documents Published by ULC Standards (prior to May, 2010, identified as Underwriters Laboratories of Canada)
171 Nepean Street, Suite 400, Ottawa, ON K2P 0B4 Canada
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- CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- CAN/ULC-S102.4-10, Standard Method of Test for Fire and Smoke Characteristics of Electrical Wiring, Cable and Non-Metallic Raceways
- CAN/ULC-S138:06-R2016 (Reaffirmed), Standard Method of Test for Fire Growth of Insulated Building Panels in a Full-Scale Room Configuration

Other References

- Janssens, M., Measuring Rate of Heat Release in Full-Scale Fire Tests by Oxygen Consumption, Fire Technology, Vol. 27, August 1991, pp. 234-249.

- Janssens, M. and Parker, W.J., Oxygen Consumption Calorimetry, in Heat Release in Fires, edited by Babrauskas, V. and Grayson, S.J., Elsevier Applied Science, New York, 1992.
- Parker, W., Calculations of the Heat Release Rate by Oxygen Consumption for Various Applications, NBSIR 812-2427-1, 1982.
- McCaffrey, B. and Heskestad, G., Combustion and Flame, Vol. 26, 1976, pp. 125-127.

3 APPARATUS

3.1 GENERAL

3.1.1 The apparatus includes the following main components: an ignition source, a steel angle frame enclosure, a hood and exhaust duct, velocity measuring instrumentation, gas sampling and analysis equipment, smoke measuring instruments, and a data acquisition system.

3.1.2 The test building in which the test apparatus is located shall have vents for the discharge of the combustion products and have provision for fresh air intake.

3.2 IGNITION SOURCE

3.2.1 The propane gas burner used as the ignition source shall have dimensions of 318 mm by 318 mm by 102 mm (12-1/2 in by 12-1/2 in by 4 in). The burner shall be constructed of nominal 6.4 mm (1/4 in) steel with a nominal 12.7 mm (1/2 in) diameter steel gas inlet pipe. The pipe shall extend into the burner 127 mm (5 in) and a 152 mm (6 in) nominal metal diffuser plate shall be positioned over the outlet of the gas pipe. A fine mesh metal screen shall be placed on top of the diffuser plate. The burner field shall be filled with silica sand. See Figure 1.

3.3 TEST FRAME ENCLOSURE AND BURNER

3.3.1 A steel angle frame shall be used to support the test specimen. The frame shall measure 914 mm (36 in) high by 711 mm (28 in) wide by 1.2 m (48 in) long and be comprised of nominal 38 mm by 38 mm (1-1/2 in by 1-1/2 in) angles as illustrated in Figures 2 and 3.

NOTE: Other construction may be used where the alternative construction has been shown to provide equivalent results.

3.3.2 Nominal 12.7 mm (1/2 in) thick by 1.07 m (42 in) wide ceramic boards shall be secured to the steel angle frame to form an enclosure as illustrated in Figure 2. The boards shall be secured to the frame to extend 457 mm (18 in) above the top of the steel angle frame creating a 305 mm (12 in) gap at the base of the frame. The ceramic board enclosure is permitted to contain glazed observation windows for visual and photographic documentation.

3.3.3 The test frame enclosure and burner shall be positioned on a ceramic fibre blanket. The gas burner shall be positioned in the centre of the test frame on top of a noncombustible support material.

3.3.4 Guidance on the mounting of the test specimens within the test frame enclosure is described in Appendix A, Guidance to Mounting Methods.

3.4 HOOD AND EXHAUST DUCT

3.4.1 The hood and exhaust duct system for collecting the combustion products shall have sufficient capacity and be designed so that all of the combustion products during a test shall be collected. The exhaust capacity shall be at least $3.5 \text{ m}^3 \cdot \text{s}^{-1}$ at normal pressure and a temperature of 25 °C.

NOTE: For an example of a hood and exhaust duct design and a gas collection schematic, see Figures 5 and 6. See Subsection C1, Design of Gas Collection and Exhaust System, for additional information.

3.5 GAS COLLECTION SYSTEM

3.5.1 General

3.5.1.1 The gas exhaust collection system shall be constructed using the following components: a blower, steel hood, duct, bi-directional probe, thermocouple(s), oxygen measurement system, smoke obscuration measurement system (white light photocell lamp/detector or laser), and combustion gas sampling and analysis system. See Figure 5.

3.5.1.2 The system for collecting the smoke (which includes gaseous combustion products) shall have sufficient capacity and be designed so that all the combustion products leaving the burning test specimen shall be collected. The capacity of the evacuation system shall be designed so that it will exhaust, minimally, all combustion gases leaving the test specimen. See Clause C1.1.6.

3.5.1.3 Place probes for the sampling of combustion gas and measurement of flow rate. See Subsection C2, Instrumentation in Exhaust Duct. The flow rate in the exhaust duct shall be measured by a bi-directional probe, or an equivalent measuring system, with an accuracy of at least $\pm 6\%$. The response time to a stepwise change of the duct flow rate shall not exceed 5 s to reach 90 % of the final value.

3.5.1.4 All measurements of smoke obscuration, gas concentrations, or flow rates shall be made at a position in the exhaust duct where the exhaust is mixed uniformly so that there is a nearly uniform velocity across the duct section. To ensure uniform mixing of the exhaust, a straight section of duct shall be provided before the measuring system having a length equal to at least eight times the inside diameter of the duct. If a measuring system is positioned at a distance of less than 8 diameters, the achievement of equivalent results shall be demonstrated.

3.5.1.5 The sampling lines shall be constructed of a material not influencing the concentration of the combustion gas species to be analyzed. The following sequence of the gas train has been shown to be acceptable: sampling probe, soot filter, cold trap, gas path pump, vent valve, plastic drying column and carbon dioxide removal columns (if used), flow controller and oxygen analyzer. See Figure 6 and Subsection C2, Instrumentation in Exhaust Duct, for additional information. Alternative designs of the sampling line shall yield equivalent results. The gas train shall include appropriate spanning and zeroing facilities.

3.5.2 Oxygen Measurement

3.5.2.1 The oxygen concentration shall be measured with an accuracy of $\pm 0.01\%$ oxygen, or better, in order to have adequate measurements of the rate of heat release. The combustion gas sample shall be taken from the end of the sampling line. Calculate the time delay, including the time constant of the instrument, from the test room since it is a function of the exhaust duct flow rate. The time delay shall not exceed 60 s.

3.6 OPTICAL DENSITY

3.6.1 An optical system shall be installed for measuring light obscuration across the centerline of the exhaust duct. The optical density of the smoke shall be determined by measuring the light transmitted with a photometer system consisting of a white light source and a photocell/detector or a laser system as described in Subsection C2.4, Smoke Obscuration.