



# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material<sup>®</sup> 1202

#### Fabric Smoldering Ignition Testing Materials

This Standard Reference Material (SRM) is intended to be used for flammability tests in which reproducible mass loss from smoldering is measured. The evaluation metric is the percent mass loss of the polyurethane foam after the specimen assembly is exposed to a burning SRM 1196 cigarette for 45 minutes. A unit of SRM 1202 is a single test specimen, which consists of two pieces of a reproducibly high-smoldering standard polyurethane foam, two pieces of denim upholstery fabric, a piece of cotton fabric, and one pack of SRM 1196 Standard Cigarette for Ignition Resistance Testing, which contains 20 cigarettes.

**Certified Mass Loss Value:** The certified mass loss value is given below. A NIST certified value is a value for which NIST has the highest confidence in its accuracy and that all known or suspected sources of bias have been investigated or taken into account [1].

Certified Mass Loss Value:  $16 \% \pm 2 \%$

The true value of the relative mass loss (defined as the difference between the initial and final mass divided by the initial mass) is believed to lie between 14 % and 18 %, with approximate 95 % confidence. This is the result of a Type A evaluation of measurement uncertainty, and uses a coverage factor  $k = 2.1$ , based on 25 degrees of freedom [2].

The certified mass loss value is the average of 26 values of relative mass loss determined (see “Instructions for Handling, Storage, and Use”), and the associated measurement uncertainty expresses how well NIST believes it knows the true value of relative mass loss. If a user of this SRM were to perform a single measurement of relative mass loss under exactly the same conditions that prevailed at NIST during certification, then that value of relative mass loss should lie between 8 % and 24 % with approximate 95 % confidence. To determine whether measurements of relative mass loss made by users of this SRM are consistent with the certified value, users should employ an appropriate statistical test, as described in the user’s guide for this SRM [3].

**Expiration of Certification:** The certification of **SRM 1202** is valid, within the measurement uncertainty specified, until **30 June 2014**, provided the SRM is handled and stored in accordance with the instructions given in this certificate (see “Instructions for Handling, Storage, and Use”). The certification is nullified if the SRM is damaged, contaminated, or otherwise modified.

**Maintenance of SRM Certification:** NIST will monitor this SRM over the period of its certification. If substantive technical changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

The coordination of the technical measurements leading to certification was performed by R.D. Davis of the NIST Fire Research Division. Staff of the NIST Fire Research Division made the mass loss measurements at NIST.

Statistical consultation on experiment design and analysis of the certification data were performed by J.J. Filliben and S. Lund of the NIST Statistical Engineering Division.

Support aspects involved in the issuance of this SRM were coordinated through the NIST Office of Reference Materials.

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*Certificate Revision History on Last Page*

Robert L. Watters, Jr., Director  
Office of Reference Materials

## NOTICE AND WARNINGS TO USERS

This SRM contains a pack of SRM 1196 cigarettes. There are substantial safety hazards associated with exposure to both primary and second-hand smoke from cigarettes. These cigarettes are only to be used under the laboratory conditions described in ASTM E2187-09.

## INSTRUCTIONS FOR HANDLING, STORAGE, AND USE

**Handling and storage:** Prior to conditioning, the SRM materials (i.e., foam, fabric, and vacuum-sealed cigarettes) are to be stored at  $24\text{ }^{\circ}\text{C} \pm 4\text{ }^{\circ}\text{C}$ , less than  $55\% \pm 5\%$  Relative Humidity (RH), and in the absence of insects. All SRM materials are to be stored without being deformed (i.e., do not wrinkle the fabrics, do not crush the foam, and do not crush the cigarettes). The testing materials must not be exposed to any direct ultraviolet light during storage, conditioning, and testing. Note: After the vacuum-sealed cigarettes have been opened, they should be stored as described in the Certificate of Analysis for SRM 1196 [4].

**Use:** Additional information regarding detailed set up and apparatus used are given in the user's guide [3]. For the test, a safety enclosure under an overhead canopy hood should be used to reduce air currents that may impact performance and as an engineering safety device to isolate and remove any hazardous off-gases from the test (see Material Safety Data Sheet). Airflow immediately above the cigarette position (see Figure 1) is recorded just prior to placing the ignited cigarette on the substrate. The airflow value is recorded in the test report sheets prior to sample ignition. Airflow should be  $130\text{ ft/min} \pm 30\text{ ft/min}$  ( $0.66\text{ m/s} \pm 0.15\text{ m/s}$ ).

**Conditioning of the material:** Materials must be assembled for a minimum of 24 h at a RH of  $55\% \pm 5\%$  and a temperature of  $22\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$  prior to testing. Figure 1 shows the mock-up assembly of the material.

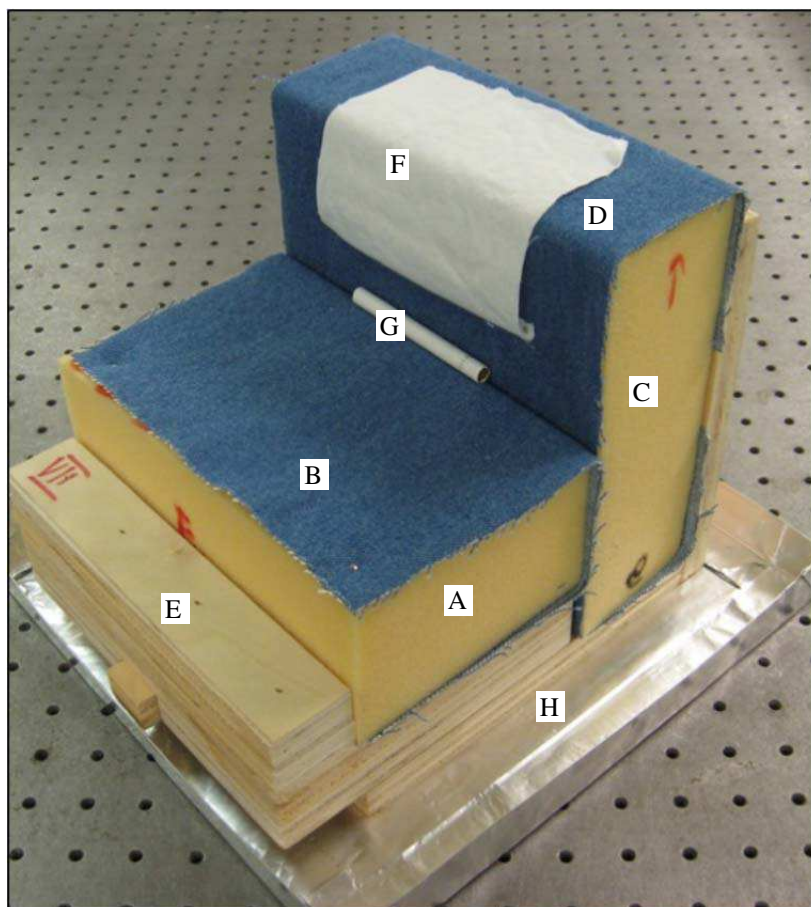


Figure 1. Fully constructed mock-up assembly before cigarette ignition.

A: "front" foam specimen  
E: sample holder

B: "front" fabric  
F: cigarette cover sheeting

C: "back" foam specimen  
G: cigarette

D: "back" fabric  
H: aluminum foil tray.

## Building the mock-up

1. Measure the dimensions of the foam pieces with a ruler.
2. Weigh each fabric piece and each foam specimen individually before assembling.
3. Wrap each piece of foam securely with a piece of fabric. To keep the fabric in place, use pins (standard straight pins, not provided). Pin the corners of the bigger piece of fabric to the back of the larger foam specimen (“back” foam specimen) with four pins, one at each corner of the fabric. Arrange the edges of the fabric symmetrically on the back of the foam specimen so that a 2 in. (51 mm) wide strip is left uncovered in the middle. Pin the smaller piece of fabric to the top and bottom of the smaller foam specimen (“front” foam specimen) with four pins, one at each corner of the fabric so that one of the 8.0 in  $\times$  3.0 in (203 mm  $\times$  76 mm) sides of the foam specimen is left uncovered. Measure the dimensions of the foam pieces afterwards with a ruler to make sure that the specimens have not changed shape from the pressure of handling and wrapping them. Repeat the wrapping process, if any changes in shape are noted.
4. Place the two wrapped foam specimens in the wooden sample holder (E in Figure 1) [3]. The “back” foam specimen should be placed upright in the back of the frame (C and D in Figure 1); the “front” foam specimen should be laid flat on the bottom of the frame (A and B in Figure 1).
5. The orientation of the fabric on the foam specimens (e.g., rise direction) or the sewing pattern in the fabric may affect the smolder propagation on the mock-up. Always build the assembly by applying the same configuration to the components (Figure 2).



Mock-up #1, Correct



Mock-up #2, Incorrect

Figure 2: Close-ups of the mock-ups with two different fabric orientations of the front and back specimens. The red arrows show the fabric pattern's orientation. Mock-up #1 has the same fabric orientation. Mock-up #2 does not. A: “front” fabric on “front” foam specimen and B: “back” fabric on back foam specimen.

6. Tighten the two parts of the sample holder by pushing the two pieces of the frame together so that a straight-line contact is achieved without compressing the foam pieces.
7. Center the cigarette cover sheeting 2 in. (51 mm) below the top edge of the “back” foam piece and pin its top corners with two pins.
8. Fold the sheeting over the top of the “back” specimen (Figure 1).
9. Place the assembled mock-up in a tray made of heavy duty aluminum foil measuring 12.0 in.  $\times$  12.0 in.  $\times$  0.5 in. (305 mm  $\times$  305 mm  $\times$  13 mm) (W  $\times$  L  $\times$  H) (Figure 1), and place the entire assembly in the safety enclosure.

Prior to running the test, ensure that all relevant calibrations and safety precautions have been taken including ensuring that the CO detection and hood are operational and spray and squirt bottles filled with water are available.

## Running the test

1. The cigarette should be ignited and burned 0.2 in. (5 mm) and allowed to smolder until 0.6 in. (15 mm).
2. Place the cigarette in the center of the mock-up where the “back” and “front” specimens meet. The whole cigarette should be centered, not just its smoldering tip.
3. Cover the cigarette with the cotton sheeting. Using heat-resistant or leather gloves manually smooth the sheeting along the cigarette so that the sheeting touches the cigarette and no air pockets between the cigarette and sheeting remain.
4. Close the front panel of the enclosure.

5. After 40 minutes, the occupants of the lab should prepare for the opening of the enclosure, which includes use of respiratory protection. Move all of the items and tools needed to the end of the test (e.g., spray and squirt bottles filled with water, scale, heat-resistant or leather gloves, metal spatulas, heavy-duty aluminum foil for disposal) to within reach.
6. At 45 minutes, open the enclosure and dismantle the mock-ups in the metal tray.
  - a. First remove the cover sheeting from the “back” specimen and place in the metal tray (since the larger specimen smolders more).
    - i. Remove the fabric, weigh it on the balance, and then extinguish it with a spray bottle in the metal tray. One may wish to employ a properly tared metal or foil sheet to protect the balance pan.
    - ii. Weigh the still-smoldering foam specimen on the balance with care. In order to prevent the smoldering char core from accidental separation from the specimen, lay it down on the balance so that the core is on top. A wide metal spatula may be used to keep the core in place while handling between the platform and balance and then between the balance and metal tray. After weighing, carve the smoldering core off into the metal tray with a spatula and extinguish it with the spray and/or squirt bottle.
  - b. Repeat this process for the “front” fabric and foam.
  - c. After extinguishing, wrap the charred fabrics and charred cores with the aluminum foil that was placed in the metal tray earlier. Move this package into a storage hood.
7. After extinguishing all of the items and recording the data, lab occupants should wait for 10 to 15 minutes before taking off their respirators.
8. After the test, check the specimens three times at 10 minute intervals for visible smoke and flip them over with a spatula to check both the bottom and top to make sure that the smoldering was extinguished properly.

## REFERENCES

- [1] May, W.; Parris, R.; Beck II, C.; Fassett, J.; Greenberg, R.; Guenther, F.; Kramer, G.; Wise, S.; Gills, T.; Colbert, J.; Gettings, R.; MacDonald, B.; *Definition of Terms and Modes Used at NIST for Value-Assignment of Reference Materials for Chemical Measurements*; NIST Special Publication 260-136 (2000); available at <http://www.nist.gov/srm/publications.cfm> (accessed Dec 2012).
- [2] JCGM 100:2008; *Evaluation of Measurement Data – Guide to the Expression of Uncertainty in Measurement* (ISO GUM 1995 with Minor Corrections); Joint Committee for Guides in Metrology (JCGM) (2008); available at [http://www.bipm.org/utls/common/documents/jcgm/JCGM\\_100\\_2008\\_E.pdf](http://www.bipm.org/utls/common/documents/jcgm/JCGM_100_2008_E.pdf) (accessed Dec 2012); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at <http://www.nist.gov/pml/pubs/index.cfm> (accessed Dec 2012).
- [3] Davis, R.; *Standard Operating Procedures for Smolder Ignition Testing of Upholstery Fabrics*; NIST Technical Note 1775 (2012); available at [https://www-s.nist.gov/srmors/view\\_detail.cfm?srm=1202](https://www-s.nist.gov/srmors/view_detail.cfm?srm=1202) (accessed Dec 2012).
- [4] SRM 1196; *Standard Cigarette for Ignition Resistance Testing*; National Institute of Standards and Technology; U.S. Department of Commerce: Gaithersburg, MD (29 November 2012) available at [https://www-s.nist.gov/srmors/view\\_detail.cfm?srm=1196](https://www-s.nist.gov/srmors/view_detail.cfm?srm=1196) (accessed Dec 2012).

<b>Certificate Revision History:</b> 11 December 2012 (Editorial changes); 26 June 2012 (Original certificate date).
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*Users of this SRM should ensure that the Certificate of Analysis in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail [srminfo@nist.gov](mailto:srminfo@nist.gov); or via the Internet at <http://www.nist.gov/srm>.*