

Chapter C1

45-Degree Bunsen Burner Test for Cargo Compartment Liners and Waste Stowage Compartment Materials

C1.1 Scope

This test method is intended for use in determining the resistance of materials to flame penetration and to flame and glow propagation when tested according to the 30-second, 45-degree Bunsen burner test specified in 14 CFR 25.

C1.2 Definitions

C1.2.1 Ignition Time

Ignition time is the length of time the burner flame is applied to the sample. For this test, the ignition time is 30 seconds. Ignition time should start only after the flame has stabilized and is properly positioned under the test sample.

C1.2.2 Flame Time

Flame time is the time in seconds that the sample continues to flame after the burner flame is removed from under the sample.

C1.2.3 Glow Time

Glow time is the length of time in seconds that the sample continues to glow after any flaming combustion ceases following the removal of the ignition flame.

C1.2.4 Flame Penetration

Flame penetration occurs if the Bunsen burner flame penetrates (passes through) the test sample through a hole or crack in the sample that forms during the test ignition time. Flaming combustion on the top of the sample that results from auto ignition is not considered flame penetration in this test.

C1.3 Test Apparatus

C1.3.1 Test Cabinet

Tests will be conducted in a draft-free cabinet or other equivalent enclosure acceptable to the FAA. The test cabinet must have a viewing window set up such that both sides of the sample can be observed during testing. It is suggested that the cabinet be located inside an exhaust hood to facilitate clearing the cabinet of smoke after each test. Stainless steel or other corrosion-resistant metal, 0.04-inch thick (1 mm), will be used for the bottom surface of the chamber. Refer to appendix I for more details on the test cabinet.

C1.3.2 Sample Holder

The sample holder will be fabricated of corrosion-resistant metal and will be capable of securely positioning the sample at a 45-degree angle, with the vertical as shown in Figure C1-1. The holder will be able to accommodate samples up to 1-inch (25 mm) thick.

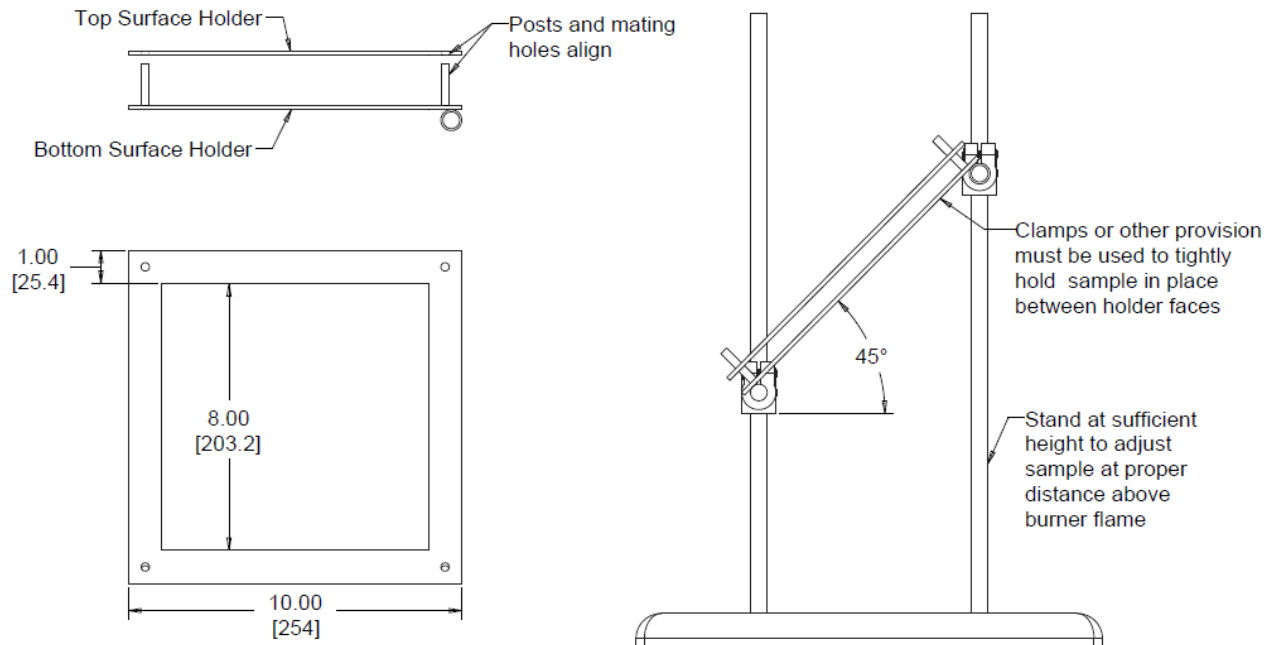


Figure C1-1. 30-second, 45-degree Bunsen burner test-sample frame and stand

C1.3.3 Burner

The burner must be a Bunsen or Tirrill type. The burner must have a 0.375-inch (10 mm) inside diameter barrel. A Tirrill burner is equipped with a needle valve located at the bottom of the burner barrel to adjust the gas flow rate and, thereby, adjust the flame height. If using a Bunsen burner, there must be a means of regulating the gas flow (e.g., a needle valve) to achieve the flame height, and all aspirating holes at the bottom of the burner must be closed. Either burner should have a $0.036 + 0.0002/-0.0003$ -inch orifice. Refer to appendix I for more burner details.

C1.3.3.1 Burner Fuel

A diffusion flame using methane gas of 99 percent certified purity (CP) must be used (i.e., without adding air through the aspirating holes at the bottom of the burner barrel).

C1.3.3.2 Plumbing for Gas Supply

The necessary gas connections and the applicable plumbing will be essentially as shown in Figure C1-2. A control-valve system with a delivery rate designed to furnish gas to the burner inlet under a pressure of 2.5 ± 0.25 psi (17 ± 2 kPa) at the burner inlet must be installed between the gas supply and the burner. If using a Bunsen burner, a needle valve

needs to be placed between the fuel pressure regulator and burner inlet to control the flame height.

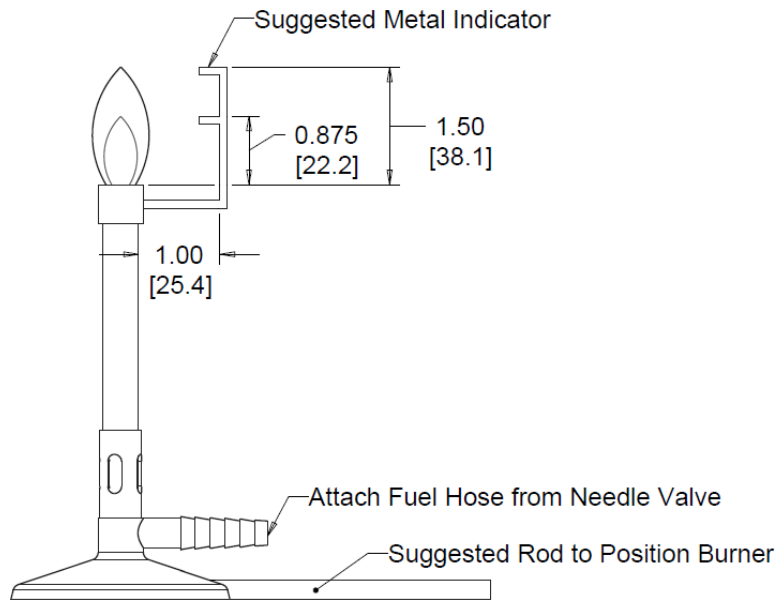


Figure C1-2. Burner plumbing and burner flame-height indicator

C1.3.3.3 Flame-Height Indicator

A flame-height indicator may be used to aid in setting the height of the flame. A suitable indicator has a prong extending 1.5 inches (38 mm) above the top of the burner barrel, is attached to the burner barrel, and is spaced 1 inch (25 mm) away from the burner barrel, as shown in Figure C1-2. If using methane as the burner fuel, it is desirable to have two prongs for measuring the flame height, one prong to indicate the height of the inner cone of the flame, and one prong to indicate the height of the tip of the flame. For methane, it has been determined that the proper flame profile is achieved when the height of the inner cone is 0.875 inch (22 mm) and the tip of the flame is 1.5 inches (38 mm) long. The tip of the methane flame is blue, transparent, and difficult to see. It is more easily seen if there is no light on the flame, as in a darkened room. However, the inner cone of the flame is more visible and easily seen.

C1.3.3.4 Burner Positioning

There will be means provided to position the burner directly below the center of the sample and also to move it at least 3 inches (76 mm) from the sample.

C1.3.4 Timer

A stopwatch or other device, accurate to within ± 1 second per 8 hours (± 3 sec per day), must be used to measure the time of application of the burner flame, the flame time, and the glow time.

C1.4 Test Samples

C1.4.1 Sample Selection

Samples tested will be either cut from a fabricated part as installed in the aircraft or cut from a section simulating a fabricated part (e.g., cut from a flat sheet of material or from a model of the fabricated part). The sample may be cut from any location in the fabricated part. Fabricated units, such as sandwich panels, will not be separated into individual component layers for testing.

C1.4.2 Sample Number

Each separate set of samples prepared for testing will consist of at least three samples (multiple places).

C1.4.3 Sample Size

The sample will be a square large enough to allow an exposed area of 8 inches (203 mm) by 8 inches (203 mm). A nominal sample size of 10 inches (254 mm) by 10 inches (254 mm) has been found satisfactory; however, actual sample size is dependent on the details of the sample holder selected for the test equipment.

C1.4.4 Sample Thickness

The sample thickness will be the same as that of the part to be qualified for use in the aircraft, with the following exceptions:

C1.4.4.1 If the part construction is used in several thicknesses, the minimum thickness will be tested.

C1.4.4.2 Parts that are smaller than the size of a sample and cannot have samples cut from them will be tested using a flat sheet of the material used to fabricate the part in the actual thickness used in the airplane.

NOTE: According to § 25.853, the sample thickness must be no thicker than the minimum thickness to be qualified for use in the airplane. If the test facility has questions concerning the flammability of a thicker sample, then testing may be conducted and test data recorded for further review.

C1.5 Conditioning

Condition samples at $70^{\circ} \pm 5^{\circ}\text{F}$ ($21^{\circ} \pm 3^{\circ}\text{C}$) and $50\% \pm 5\%$ relative humidity for 24 hours minimum. Remove only one sample at a time from the conditioning environment immediately before testing.

NOTE: As stated in § 25.853, only one sample may be removed at a time from the conditioning chamber prior to being subjected to the flame. Some facilities, however, have conditioning chambers located in areas remote from the testing area. In this case, it is permissible to remove

more than one sample at a time only if each sample is placed in a closed container (a plastic stowage bag is acceptable) and protected from contamination, such as dirty lab tops and soot in the air, until the sample is subjected to the flame.

C1.6 Procedure

C1.6.1 Burner Adjustment

C1.6.1.1 Ensure that the air supply to the burner is shut off.

C1.6.1.2 Open the valve in the gas line fully and light the burner.

C1.6.1.3 Adjust the needle valve on the burner to achieve the proper 1.5-inch (38-mm) flame height in accordance with section C1.3.3.3.

C1.6.2 Test Procedure

C1.6.2.1 Place the burner at least 3 inches (76 mm) from where the edge of the sample will be located during the test.

C1.6.2.2 Place the sample in the holder with the surface to be exposed when installed in the aircraft toward the flame. The sample will be positioned so that one-third of the height of the flame is in contact with the material when the test is in progress.

C1.6.2.3 Close the cabinet door and keep it closed during the test. It is important to note that the test should be watched carefully while it is being conducted. This applies to all samples.

C1.6.2.4 The timer must be started immediately on positioning the burner. Position the burner so that the center of the burner barrel is under the center of the bottom surface of the sample, as shown in Figure C1-3.

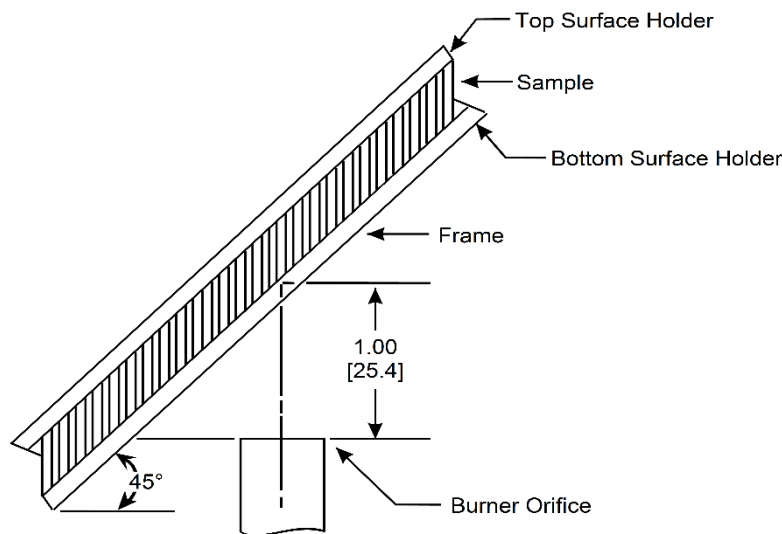


Figure C1-3. Flame position on 30-second, 45-degree Bunsen burner test sample

C1.6.2.5 Apply the flame for 30 seconds and then withdraw it by moving the burner at least 3 inches away from the sample or by turning the gas off. Some laboratories turn the gas off on completion of the test; however, the majority of test facilities, including the original equipment manufacturers (OEMs), withdraw the flame by moving the burner away from the sample.

C1.6.2.6 Determine the flame time for the sample.

C1.6.2.7 Determine the glow time for the sample.

C1.6.2.8 Determine if flame penetration occurs.

C1.6.2.9 After all flaming ceases, open the cabinet door slowly to clear the test cabinet of fumes and smoke. The exhaust fan may be turned on to facilitate clearing of smoke and fumes. Remove any material from the bottom of the cabinet that fell from the sample. The operator should refer to the facility's safety manual for further information dealing with smoke and flammability byproducts.

C1.6.2.10 If necessary, clean the test cabinet window prior to testing the next sample.

C1.7 Report

C1.7.1 Material Identification

Fully identify the material tested, including thickness.

C1.7.2 Flame Time

Report the flame time for each sample and determine and record the average flame time for all samples tested.

C1.7.3 Glow Time

Report the glow time for each sample tested to the nearest second. Determine and record the average glow time for all samples tested.

C1.7.4 Flame Penetration

Report whether the Bunsen burner flame penetrated the sample for each sample tested.

C1.8 Requirements

C1.8.1 Flame Time

The average flame time for all samples tested will not exceed 15 seconds.

C1.8.2 Flame Penetration

The Bunsen burner flame will not penetrate any of the samples tested.

C1.8.3 Glow Time

The average glow time for all samples tested will not exceed 10 seconds.