Users’ Guide for the Vertical Bunsen Burner Test for Cabin and Cargo Compartment Materials

FAA Handbook Chapter 2

Issued by:

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IMPORTANT NOTE

This guide does not purport to replace or overrule any sections of DOT/FAA/AR-00/12 or any relating standard to this apparatus. It is recommended that this standard, or the most recent version, is read in conjunction with this guide.

Users finding difficulties with these procedures, or encountering anomalous conditions not described in the documentation are urged to contact Fire Testing Technology Limited. User comments are specifically invited, and will be incorporated into future editions of this guide. Telephone: +44 (0)1342 323600, Fax: +44 (0)1342 323608 or e-mail: support@fire-testing.com

IMPORTANT SAFETY NOTE

This test method requires the gas flowing from the burner to be ignited manually. Under normal operating conditions the gas is ignited and the flame continues to burn. If the flame is not ignited or it extinguishes then a potentially hazardous accumulation of flammable gas can result.

Should this condition occur, immediately turn the gas on/off valve to the ‘off’ position to turn off the gas supply. Then open the cabinet door to vent the excess gas.

For this reason the equipment must be supervised at all times.
1. The FTT Bunsen Burner Test for Cabin and Cargo Compartment Materials FAA Handbook Chapter 2

1.1 Introduction

This test method is intended for use in determining the resistance of materials to flame when tested according to the 30-second 45 degree Bunsen Burner Tests specified in Federal Aviation Regulation (FAR) 25.853 and FAR 25.855. The main components of the apparatus are:

- Test Cabinet
- Burner (including Burner Positioning System and Flame Height Indicator)
- Specimen Holder
- Timer

1.2 Definitions

- **Ignition Time**: Ignition time is the length of time the burner flame is applied to the specimen. The ignition time for this test is 30 seconds.

- **Flame Time**: Flame time is the time in seconds that the specimen continues to flame after the burner flame is removed from beneath the specimen.

- **Glow Time**: Glow time is the length of time in seconds that the specimen continues to glow after any flaming combustion ceases following the removal of the ignition flame.

- **Flame Penetration**: Flame penetration occurs if the Bunsen burner flame penetrates (passes through) the test specimen through a hole or crack in the specimen that forms during the test ignition time. Flaming combustion on the top of the specimen that results from auto ignition is not considered flame penetration in this test.
1.3 Safety Precautions and Procedures

1. Some specimens may produce severe flaming during a test. Therefore, adequate means of extinguishing the specimen should be available. Recommended means of extinguishment are a hand water spray or compressed nitrogen with can be directed to the burning area along with any other means such as fire extinguishers etc.

2. This test method may involve hazardous materials, operations and equipment. Therefore, we specifically exclude any liability whatsoever for claims arising from use or misuse of this equipment. It is the responsibility of whoever uses the equipment to consult and establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

3. All service inputs must be made secure.

4. The equipment must be supervised at all times.

5. This equipment must only be operated by authorised personnel who are fully conversant with the safety requirements. The operator must have a thorough knowledge of the chemical properties of the materials under test and what combustion products can be expected from them.

6. Care should be taken to avoid contact with hot surfaces produced from the burning of the material. It is recommended that heat-protective gloves (not household rubber) are worn when working in burner area and when removing a specimen holder.

7. The products of pyrolysis and burning of the materials under test may be carcinogenic, toxic, or otherwise hazardous. An auxiliary breathing device and protective glasses may have to be worn before opening the chamber door. It may be noted that highly corrosive residues may permeate and degrade heat-protective gloves. Butyl gloves must be worn underneath the heat-protective gloves for complete protection in such cases.

8. The installation, positioning and provision of services to the equipment must have the approval of the Safety Officer.
2. Installation

2.1 Services Required

2.1.1 Environment
It is suggested that the Test Cabinet be located inside an exhaust hood to facilitate clearing the cabinet of smoke after each test.

2.1.2 Gas Supply
A supply of Methane gas (99% minimum purity) will be available. A suitable methane regulator capable of providing pressures down to the range of 0-5 psi must be fitted on the gas supply. The supplied control valve system provides an on/off valve, gas flow meter to adjust the gas flow rate and flashback arrestor for gas safety.

2.1.3 Conditioning
Specimens will be conditioned at 70º ± 5ºF (21º ± 3ºC) and 50% ± 5% relative humidity for 24 hours minimum. Remove only one specimen at a time from the conditioning environment immediately before testing.

2.2 Installation

1. The instrument is supplied in several parts. Unpack the apparatus and check the parts against the checklist supplied. Any discrepancies or missing items must be reported to FTT before installing the apparatus.

2. Assemble the test cabinet, sample support & burner. Note: The top baffle plate must be removed to insert the sample support bar into its’ locating holes. See figures 1, 2, 3 & 4.

3. Place the Test Cabinet on a workbench under an extraction hood.

4. A 6mm methane hose is supplied that must be connected between the methane supply and the instrument.

   **Note:** The client MUST ensure that an adequate pressure regulator is fitted to the methane supply.

At the side of the cabinet is an ‘on/off’ control valve with a hose port pointing vertically downwards. Slide the hose over this port and secure the hose using the clip provided.

The other end of the hose must be connected to the methane gas supply.
Figure 1, Test Chamber Assembly (Shown with door removed)

Figure 2, Sample Support Assembly
Figure 3, Vertical Burner Assembly.

Figure 4, Top Baffle Assembly
5. Ensure that the needle valve on the burner is fully closed (turned fully clockwise).
6. Ensure that the ‘on/off’ valve on the side of the cabinet is fully open (handle is pointing vertically upwards).
7. Ensure that the gas flow meter on the side of the cabinet is set to approximately half of its maximum flow rate.
8. Turn on the methane gas and adjust the line pressure to approx. 0.2 bar.
9. Check the methane line, up to the burner for signs of leaks, using appropriate methods (e.g. leak detector spray or soapy water). Any leaks MUST be sealed before continuing.
10. Open the needle valve and, using a taper, or other suitable means, ignite the methane at the tip of the burner.
11. Adjust the gas flow meter to increase the gas flow rate and ensure that the flame length increases. Decrease the gas flow rate and ensure that the flame length decreases.
12. Turn the ‘on/off’ valve ‘off’ and allow the flame to extinguish.
13. Turn off the methane supply.

   Note: Before testing a specimen the flame height and position of the burner must be set as described in Section 3.4

14. The unit is now ready for use.
3. Test Apparatus

3.1 Test Cabinet

The Test Cabinet is an enclosure constructed from stainless steel sheet, with a special heat-resistant glazed door for observation from the front. The chamber is complete with vent holes and baffles to allow smoke to clear from the cabinet whilst avoiding drafts. The inside walls of the chamber are painted matt black to facilitate viewing of the test specimen and flaming activity. A linear carriage mechanism is provided to allow the correct positioning of the burner flame in relation to the test specimen whilst the Cabinet door is closed.

3.2 Burner

The Burner is mounted on a linear rail and carriage so that it moves smoothly left to right in a horizontal plane along the centreline of the Test Cabinet. The user controls this movement from the outside. The Cabinet is fitted with an ‘On/Off’ gas valve, a flow meter to enable accurate control of the flame height, a flashback arrestor for gas safety and tubing for connection to the laboratory methane supply.

3.3 Specimen Holder

The specimen holder is fabricated of corrosion-resistant stainless steel and is capable of securely positioning the specimen at a 45-degree angle to the vertical flame/burner, as shown in figure 2. The holder is able to accommodate specimens up to 1 inch (25 mm) thick.

3.4 Flame Height Indicator

The flame is adjusted using the gas flow meter mounted on the side of the test chamber and the combustion air flow adjustment collar located at the base of the burner tube. The height is measured with the ‘flame height indicator’ which can be located on the burner tube as shown in Figure 3 using the clamp bolt to secure the gauge in place on the tube with the nozzle of the tube level with the lower position indicator. See Figure 6.

When the flame height indicator is in place it measures 7/8” (height of the inner cone) and 1 ½” (height to the tip of the flame) from the top of the burner barrel. These two measurements are used to setup the proper flame profile when using methane as the burner fuel.

Following the adjustment of the flame to the correct proportions the gauge should be removed. The flame is extinguished by turning off the gas supply valve mounted on the side of the test chamber (not the flow adjuster on the flow meter), releasing the clamp bolt and sliding the gauge off the burner tube. Following flame calibration the methane gas supply pressure and the gas flow rate should be recorded for reference purposes. The flame height indicator is used to setup the flame profile only and MUST be removed before moving the burner into position for a test.
CAUTION: FLAME HEIGHT INDICATOR WILL BE VERY HOT AFTER RUNNING THE BURNER. HEAT PROTECTIVE GLOVES MUST BE WORN WHEN HANDLING IT.

Figure 6. Flame Gauge

(showing correct alignment of the flame gauge and the burner tube).

3.5 Timing Device

The timing of all events is recorded using a stopwatch calibrated to the nearest 0.1 second.
4. Procedure

4.1 General

The following experimental procedure has been based on the ‘Aircraft Materials Fire Test Handbook (April 2000)’. It should be used in conjunction with the latest edition of the standard so that correct operating protocols are administered.

- Follow the test specimen’s preparation guidelines given in section 2.4 of the FAA Handbook chapter 2. Insert the flame height indicator as detailed above.
- Turn the gas control valve to the ‘on’ position.
- Light the burner using a taper or other suitable tool.
- Close the cabinet door.
- Adjust the gas flow meter to achieve the proper flame height in accordance with section 3.4 above. When a stable flame of the correct proportions has been achieved turn off the gas supply valve to extinguish the test flame.
- Open the cabinet door and remove the flame height indicator using suitable heat protective gloves.
- Insert the specimen into the specimen holder, ensuring the lower edge of the specimen is in line with the lower edge of the specimen holder.
- Using the burner push rod on the front of the cabinet, position the burner directly beneath the midpoint of the test specimen. The Sample support height should be adjusted to ensure the centre point of the specimen is 25mm directly above the centre of the burner tube to ensure that the top 1/3 of the test flame is in contact with the sample during flame exposure.
- The position of the burner slide handle should be noted to ensure correct location of the burner during the test. Self adhesive tape and a felt tipped marker can be used to temporarily mark the burner position.
- Check that the burner will stop at the correct position moving the burner out of position and returning to the marked position. The stop mark should be adjusted until consistent correct positioning is achieved.
- Position the burner at least 3 inches from the specimen using the burner push rod.
- Turn on the gas supply and relight the test flame as detailed above. If a stable flame of the correct proportions is not achieved the flame must be re-calibrated as above. Under no circumstances may the flame be allowed to come into contact with any part of the test sample prior to the start of the test.
- Close the cabinet door and keep it closed during the test.
- Using the burner push rod move the burner into the pre-determined position to bring the flame into contact with the test sample. Start the timer immediately on positioning the burner.
- Apply the flame for 30 seconds and then withdraw it by moving the burner at least 3 inches from the specimen or by turning the gas off.
- If flaming material falls from the test specimen, determine the drip flame time for the specimen.
- Determine the flame time for the specimen.
• After all flaming ceases, open the cabinet door slowly to clear the test cabinet of fumes and smoke. The exhaust fan in the extraction hood may be turned on to facilitate clearing smoke and fumes.
• Remove the test sample.
• Remove any material from the bottom of the cabinet that fell from the specimen and clean the test chamber to remove any residue released during the test. If necessary, clean the test cabinet window and the burner slide prior to testing the next specimen.

Note: DUE TO THE POSSIBILITY OF THE PRESENCE OF CORROSIVE AGENTS PRODUCED DURING THE TEST IT IS RECOMMENDED THAT PROTECTIVE CLOTHING AND EYE PROTECTION IS WORN DURING THE CLEANING OF THE CHAMBER AND SAMPLE SUPPORTS.