

Bunsen Burner Discussion

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**Federal Aviation
Administration**



Vertical Bunsen Burner Test for Cabin and Cargo Compartment Materials

- **Scope**: This test method is intended for use in determining the resistance of materials to flame when tested according to the 60-second and 12-second Vertical Bunsen Burner Tests specified in Federal Aviation Regulation (FAR) 25.853 and FAR 25.855
- **Definitions**:
 - **Ignition Time**: Length of time the burner flame is applied to the specimen. It can be either 60 seconds or 12 seconds for this test.
 - **Flame Time**: Time in seconds that the specimen continues to flame after the burner flame is removed from beneath the specimen. Surface burning that results in a glow but not in a flame is not included.

Vertical Bunsen Burner Test for Cabin and Cargo Compartment Materials

- **Definitions** (continued)
 - Drip Flame Time: Drip flame time is the time in seconds that any flaming material continues to flame after falling from the specimen to the floor of the chamber. If no material falls from the specimen, the drip flame time is reported to be 0 seconds, and the notation “No Drip” is also reported. If there is more than one drip, the drip flame time reported is that of the longest flaming drip. If succeeding flaming drips reignite earlier drips that flamed, the drip flame time reported is the total of all flaming drips.

Vertical Bunsen Burner Test for Cabin and Cargo Compartment Materials

- **Definitions** (continued)
 - Burn Length: The distance from the original specimen edge to the farthest evidence of damage to the test specimen due to that area's combustion including areas of partial consumption, charring, or embrittlement but not including areas sooted, stained, warped, or discolored nor areas where material has shrunk or melted away from the heat.

Vertical Bunsen Burner Test for Cabin and Cargo Compartment Materials

- **Requirements:**

- Flame Time: The average flame time for all of the specimens tested will not exceed 15 seconds for either the 12-second or the 60-second vertical test.
- Drip Flame Time: The average drip extinguishing time for all of the specimens tested will not exceed 3 seconds for the 60-second vertical test or 5 seconds for the 12-second vertical test.
- Burn Length: The average burn length for all of the specimens tested will not exceed 6 inches (152 mm) for the 60-second vertical test or 8 inches (203 mm) for the 12-second vertical test.

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

- **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 FAR 25.
- **Definitions**:
 - **Ignition Time**: Length of time the burner flame is applied to the specimen. For this test, the ignition time is 30 seconds.
 - **Flame Time**: Time in seconds that the specimen continues to flame after the burner flame is removed from under the specimen.

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

- **Definitions** (continued)
 - Glow Time: 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.

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

- **Requirements:**

- Flame Time: The average flame time for all specimens tested will not exceed 15 seconds.
- Flame Penetration: The Bunsen burner flame will not penetrate any of the specimens tested.
- Glow Time: The average glow time for all specimens tested will not exceed 10 seconds.

Horizontal Bunsen Burner Test for Cabin, Cargo Compartment, and Miscellaneous Materials

- **Scope**: This test method is intended for use in determining the resistance of materials to flame when tested according to the 15-second horizontal Bunsen burner tests specified in FAR 25.853.
- **Definitions**:
 - **Ignition Time**: Length of time the burner flame is applied to the specimen. For this test, the ignition time is 15 seconds.
 - **Burn Rate**: the rate at which a flame front moves over a specified distance on a test specimen, under specified test conditions. In this test, it is the rate with which a flame front moves across a test specimen mounted horizontally.

Horizontal Bunsen Burner Test for Cabin, Cargo Compartment, and Miscellaneous Materials

- **Requirements:**
 - Burn rate: The average burn rate for all the specimens tested will not exceed 2.5 inches/minute for FAR 25.853(b-2) or 4 inches/minute for FAR 25.853(b-3), per Code of Federal Regulations (CFR), Title 14, January 1, 1990.

60-Degree Bunsen Burner Test for Electric Wire

- **Scope**: This test method is intended for use in determining the resistance of electric wire insulation to flame when tested according to the 30-second, 60-degree Bunsen burner test specified in FAR 25.869.
- **Definitions**:
 - **Ignition Time**: Length of time the burner flame is applied to the specimen. The ignition time for this test is 30 seconds.
 - **Flame Time**: Time in seconds that the specimen continues to flame after the burner flame is removed from beneath the specimen. Surface burning that results in a glow but not in a flame is not included.

60-Degree Bunsen Burner Test for Electric Wire

- **Definitions** (continued)
 - Drip Flame Time: time in seconds that any flaming material continues to flame after falling from the specimen to the floor of the chamber. If there is more than one drip, the drip flame time reported is that of the longest flaming drip. If succeeding flaming drips reignite earlier drips that flamed, the drip flame time reported is the total of all flaming drips.
 - Burn Length: Length of damage along the wire above and below the point of burner flame impingement and due to that area's combustion, including areas of partial consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discolored nor areas where material has shrunk or melted away from the heat

60-Degree Bunsen Burner Test for Electric Wire

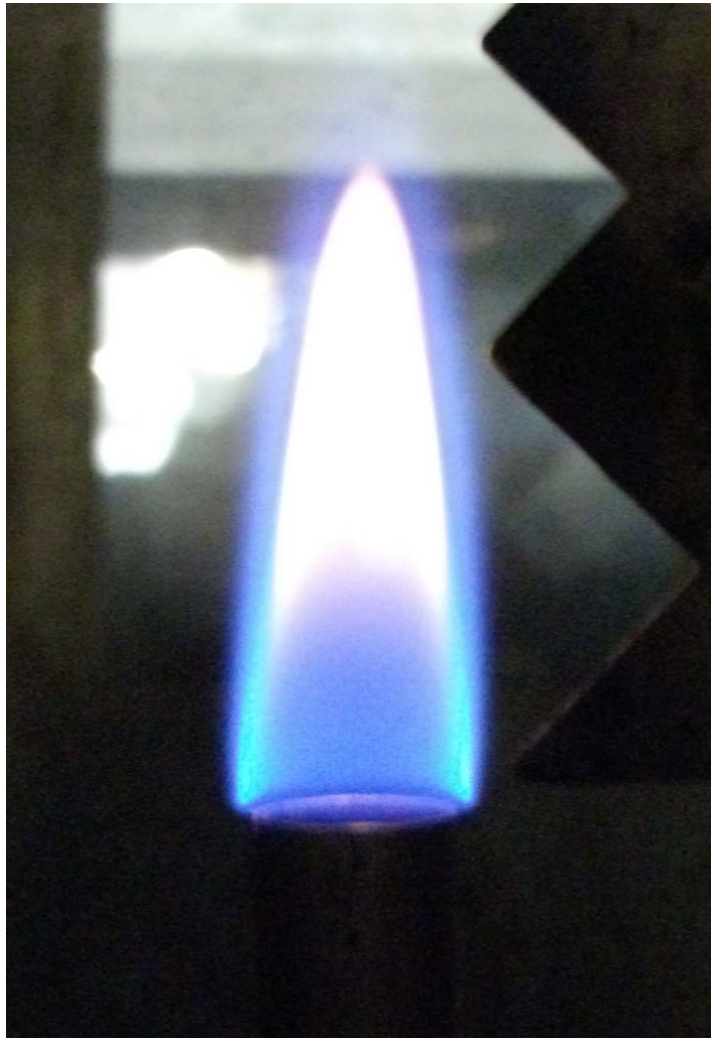
- **Requirements:**

- Extinguishing Time: The average extinguishing time for all the specimens tested will not exceed 30 seconds.
- Drip Extinguishing Time: The average drip extinguishing time for all the specimens tested will not exceed 3 seconds.
- Burn length: The average burn length for all the specimens tested will not exceed 3 inches (76 mm).
- Wire Breakage: It will not be considered a failure if the wire breaks during the test.

Bunsen Burner Flame Discussion

- The methane flame is transparent and is somewhat difficult to see
- There are no adjustments in setting the flame height except gas flow
- The gas delivery pressure is set
- The blue aura around the perimeter of the flame is part of the flame and the flame height must be set with the “blue aura tip”
- Some labs use a “revealing (or illuminating) medium” such as salt to enhance the flame profile
- Everyone running the Bunsen burner tests should be using a burner for natural gas (not propane)

Bunsen Burner Flame Discussion



Bunsen Burner Flame Discussion

- **Flame Placement**

- Historically, test practices regarding burner flame placement have not been uniform or consistent within either the FAA or aircraft manufacturers. The most common placement used in the past was specified in the original issue of this handbook
- Materials used in contemporary (especially post heat release) designs produce burn lengths and flame times that are considerably less than the acceptance criteria for certification (6 inches and 15 seconds), regardless of where the flame is placed. Although where the burner flame is applied is not of important pass/fail significance in this test, placing it directly under the specimen face generally represents a worst-case situation.
- The FAA should accept data for certification using the flame placement described in the original portion of this handbook, or using the flame placed under the exposed face of the test specimen. However, the FAA and aircraft manufacturers have agreed that in the future, the preferred placement of the burner flame is under the middle of the lower edge of the face of the specimen.

Bunsen Burner Flame Discussion

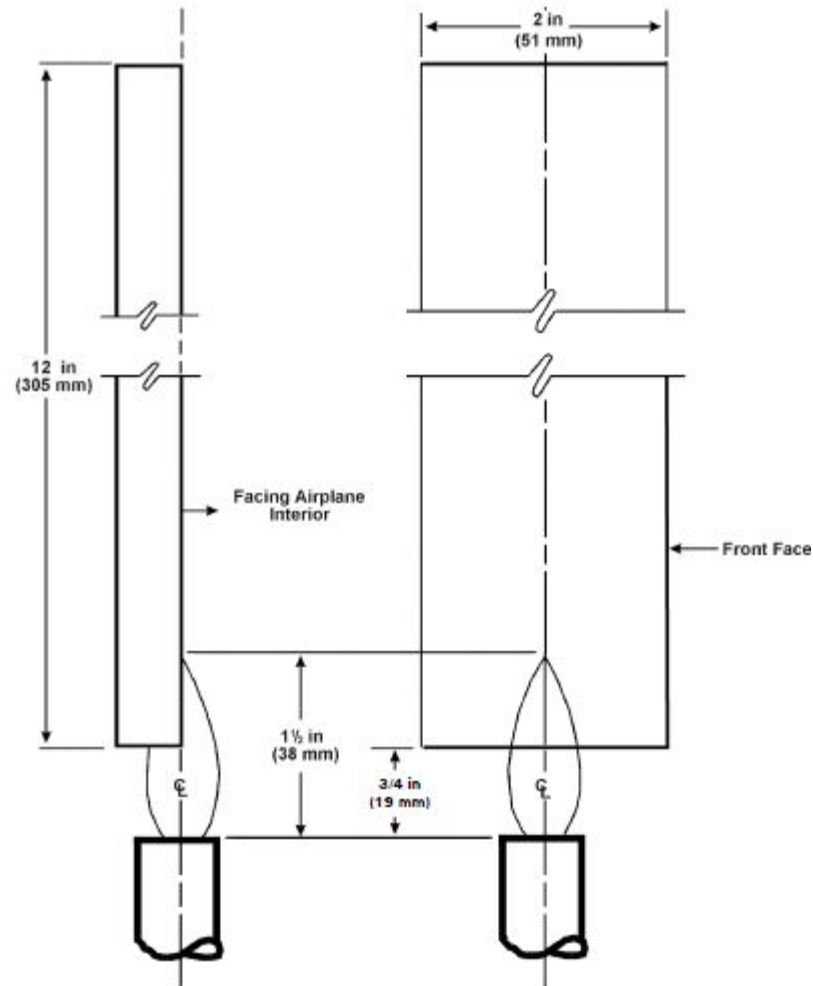


Figure 1-5. Flame Position on Vertical Specimens