

Chapter B2 Test Method to Determine the Flammability and Flame Propagation Characteristics of Thermal/Acoustic Insulation Materials

B2.1 Scope

B.2.1.1 Applicability

This test method is intended for use in determining the flammability and flame-propagation characteristics of thermal acoustic insulation materials when exposed to radiant heat and an open flame.

B2.2 Definitions

B2.2.1 Ignition Time

Ignition time is the length of time the burner flame is applied to the sample. The ignition time for this test is 15 seconds. In certain atypical cases the ignition time may be extended to 30 seconds (see section B2.2.5, After-Flame Time).

B2.2.2 Flame Profile (Pilot Burner)

The flame profile is an immediate “footprint” that occurs on a material at the start of a test as a result of pilot burner flame impingement.

B2.2.3 Zero Position

The zero position is the pilot burner application point on the test sample, which is level with the top surface of the sliding platform upper flange. The zero position coordinates are centerline (± 0.25 inches) with the sliding platform opening (front to back) and 4.5 ± 0.5 inches (114 ± 13 mm) from the inside right edge of the platform frame.

B2.2.4 Flame Propagation

Flame propagation is the leftmost spread of visible flame or flashing that occurs on a sample. It is referenced from the centerline of the pilot burner (zero position).

When the propane flame is brought into contact with certain materials, such as film/fiberglass assemblies, the pilot flame bores a round hole through the material approximately 1.5 inches (38 mm) in diameter. With materials such as foam and some rigid materials, the initial appearance of the flame on the sample surface is that of a “fanned out” flame profile. This is not flame propagation. This also applies to interface hook-and-loop and interface damping systems.

Melting or shrinking is not considered flame propagation. Materials that melt can alter the flame profile of the pilot burner if the material melts to the point that the pilot burner flame is directly contacting the backing board. Testing of such materials needs to be observed closely to determine whether the material is burning or simply melting. Material burning beyond the

allowable limit is considered flame propagation, regardless of the flame profile or the influence of the flame profile on the backing board.

Occasionally a material may exhibit “flashing” behavior. Flames appear on the test sample some distance away from the zero position (beyond the allowable limit). This is considered flame propagation.

B2.2.5 After-Flame Time

After-flame time is the time in seconds that any portion of the sample continues to burn or flash after the burner flame is removed. Glowing is not considered after-flame.

For after-flame time only, it is possible that certain materials with good propagation protection characteristics can show modest after-flame time beyond the limit. In some cases, after-flame can be attributed to the specific 15-second exposure time in the test. Because the exposure time was mainly derived from tests on thin film materials, extended exposure may be meaningful for other types of materials. If the after-flame time is above the allowable limit, but the material does not propagate, it is acceptable to apply the burner flame for 30 seconds. The same pass/fail criteria are applied, and if the material passes with a 30-second exposure, it can be used. The earlier tests with a 15-second exposure must be disregarded.

B2.2.6 Radiant Heat Source

The radiant heat source is an electric panel having six 3-inch (76.2 mm) wide emitter strips (see section B2.3.2 Electric Radiant Heat Source).

B2.2.7 Thermal/Acoustic Insulation

Thermal/acoustical insulation is a material or system of materials used to provide thermal/acoustic protection. Examples include fiberglass, foam, and other batting materials, which may be encapsulated by moisture barrier film covering.

B2.2.8 Refractory Board

A high-temperature, non-combustible, rigid insulation board with a maximum thermal conductivity of 0.694 Btu·in/hr·ft²·°F (0.10 W/m·K) at 500°F (260°C).

B2.2.9 Test Series

A series of tests conducted between chamber calibration and system recheck (see sections B2.5.2 Zero Position Calibration and B2.5.3 System Recheck Procedure).

B2.2.10 NIST

The National Institute of Standards and Technology (USA).

B2.2.11 NIST Traceability

A calibration entity using NIST traceable calibration instrumentation.

B.2.2.12 Heat-Flux

The intensity of the thermal environment to which the sample is exposed when burned. In this test method, the total heat flux is 1.5 BTU/ft²sec (1.7 W/cm²).

B2.3 Test Apparatus

B2.3.1 Test Chamber

Tests must be conducted in a radiant panel test chamber as shown in figure B2-1. The test chamber is 55 ± 1 inch (1397 ± 25.4 mm) wide, 20 ± 1 inch (508 ± 25.4 mm) deep (front to back), and 29 ± 1 inch (737 ± 25.4 mm) high from the top of the sliding platform to the top of the chamber frame. All dimensions are taken from the inside of the insulated walls.

The sides, back, and top of the chamber must be insulated with 0.5-inch-thick (12.7 mm), high-temperature refractory board. On the front side, a draft-free, high-temperature glass viewing window must be installed. The window is 9 ± 3 inches (229 ± 76 mm) high by 48 ± 4 inches (1219 ± 102 mm) long. The sliding platform drawer sits below the viewing window. Refer to Appendix M for more details on the test chamber.

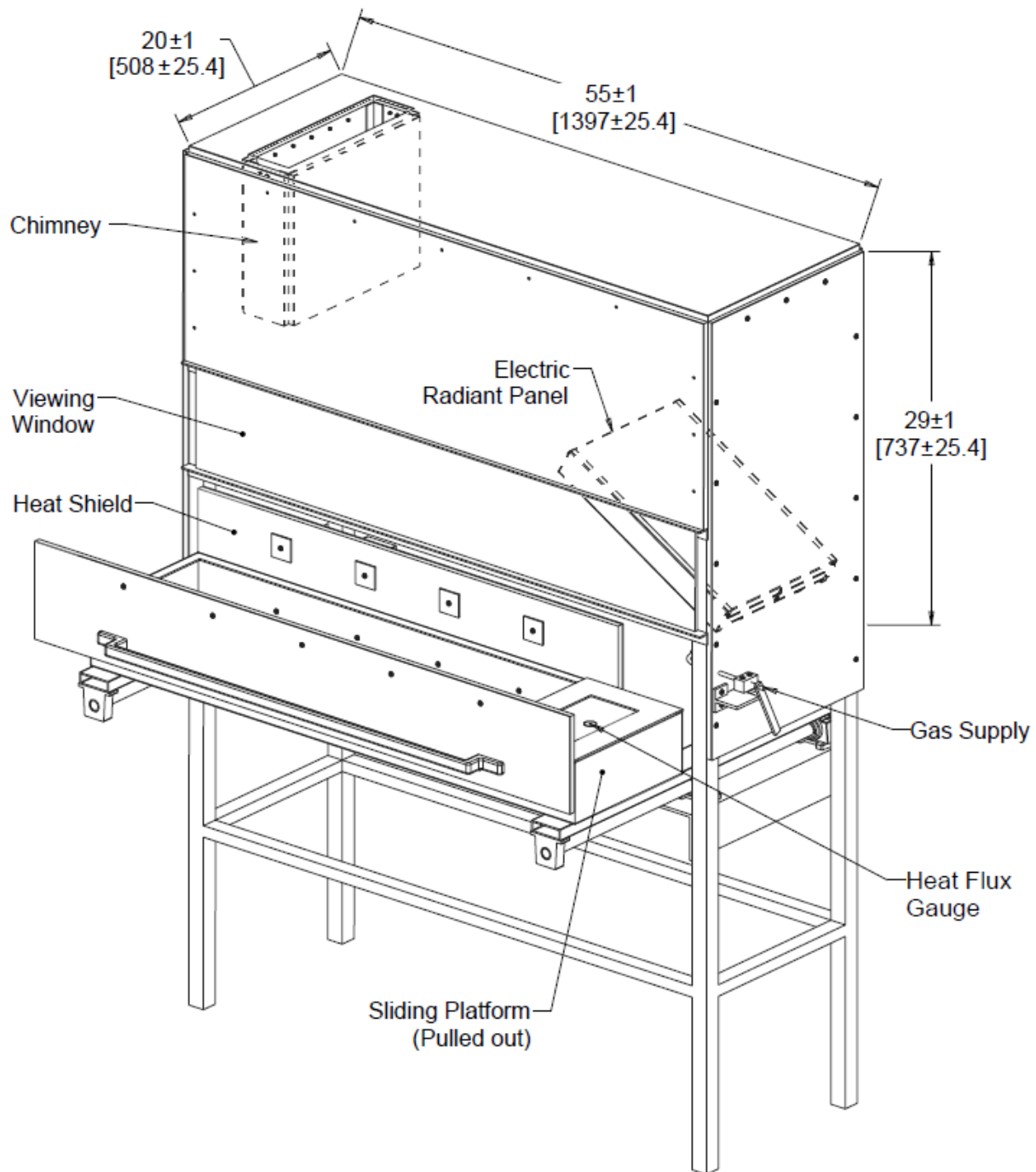
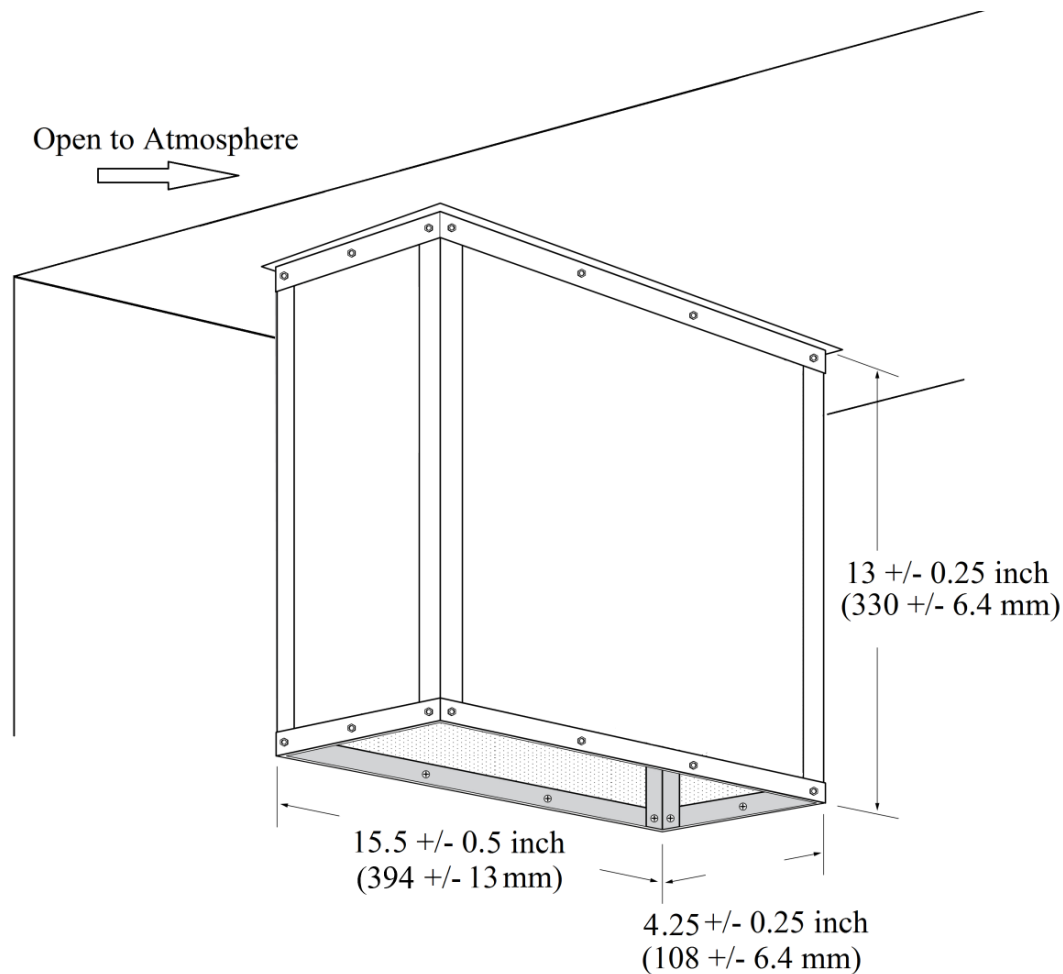


Figure B2-1. Test chamber

The chamber must have an internal chimney that extends to and terminates at the top of the chamber. The chimney is located at the opposite end of the chamber from the radiant heat source (see figure B2-2). Test results can be significantly influenced by the condition of the chimney in the test chamber, which must always be open and clear of obstruction. Refer to Appendix M for more details. The test chamber should be located under an exhaust hood to facilitate clearing exhaust smoke during each test.



0.125 inch (3.2 mm) Angle Iron (8 places)
 0.125 inch (3.2 mm) Flat Stock (4 places)
 0.5 inch (13 mm) Insulation Board (4 places)
 0.0625 inch (1.6 mm) Sheet Metal (4 places)

Figure B2-2. Interior view of internal chimney

B2.3.1.1 Draft Check

A draft check must be completed periodically if the test chamber is physically moved or if the exhaust system has been changed. Ensure that the chamber is draft free prior to turning on the power to the radiant heat source. To verify this, measure the airflow above the internal chimney with an anemometer device to ensure there is no airflow. Alternatively, an incense cone or other smoke-producing item can be placed on the sliding platform at the zero position with the platform drawer closed.

NOTE: the sliding platform must have refractory boards covering the entire length of the platform for either method of draft checking.

Observe the smoke behavior. If the smoke rises vertically without any drift, it can be regarded as draft-free. If testing is performed with an exhaust hood running, the airflow check must be performed with the exhaust hood on.

B2.3.2 Electric Radiant Heat Source

The electric panel must have six 3-inch (76.2-mm) wide emitter strips, as shown in figure B2-3. The emitter strips must be perpendicular to the length of the panel. The panel must have a radiation surface of 12.6 by 18.75 inches (321 by 476 mm) and be capable of operating continuously at the typical temperature range required to maintain the specified heat flux. The panel surface should be kept clean using a soft bristle brush or soft cloth. A plastic scraper can be used if any debris sticks to the surface. Never use anything metal, such as a wire brush, to clean the panel surface. Refer to Appendix M for more details on the electric radiant heat source.

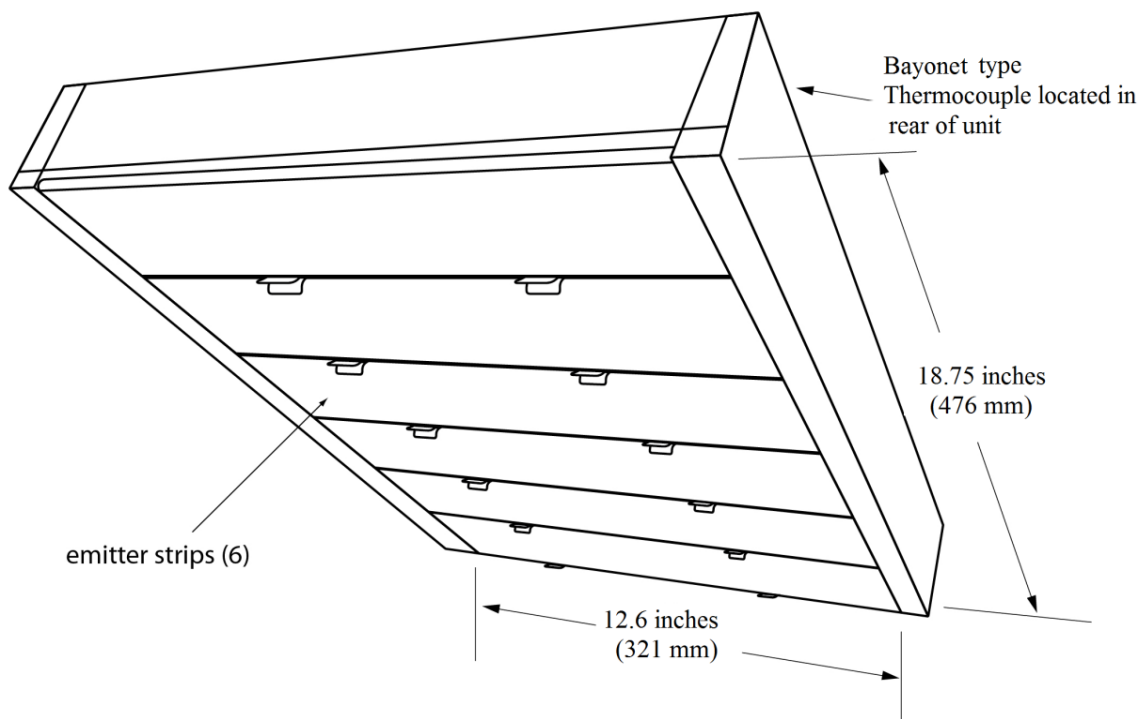


Figure B2-3. Electric radiant panel

B2.3.2.1 Electric Radiant Panel Placement

The electric panel must be mounted in the test chamber at $30 \pm 1^\circ$ to the horizontal sample plane and 7.5 ± 0.125 inches (191 ± 3 mm) above the zero position. Refer to Appendix M for proper positioning of the electric radiant panel.

B2.3.3 Sample Holding System

The drawer (also called the sliding platform) serves as the housing for test sample placement in a fixed and level position (see figure B2-4). The drawer must be at least 2 inches (51 mm) deep and may be up to 6 inches (152 mm) deep. It may be necessary to use shims or multiple sheets of refractory boards to obtain the correct height for a material to be level with the bottom surface of the sliding platform upper flange. The entire opening on the inside of the drawer must be covered during testing to prevent convective airflow. Refer to Appendix M for more details on the sample holding system.

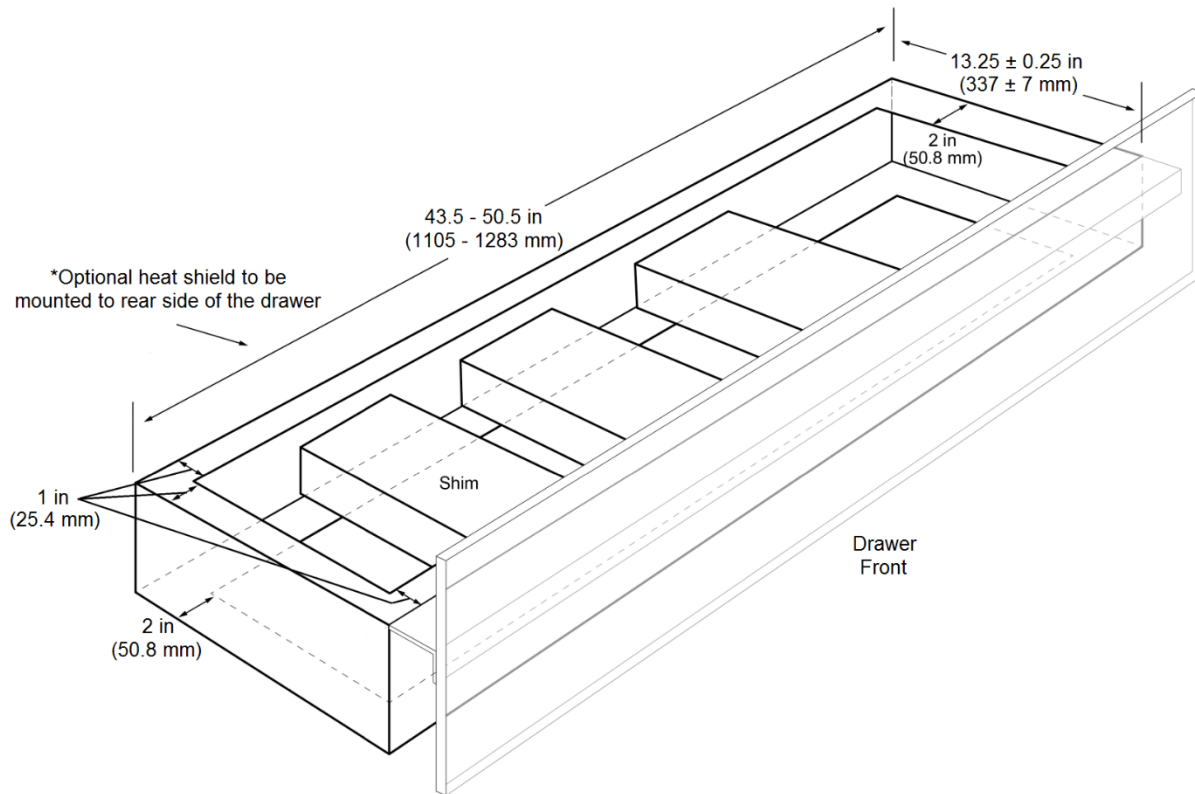


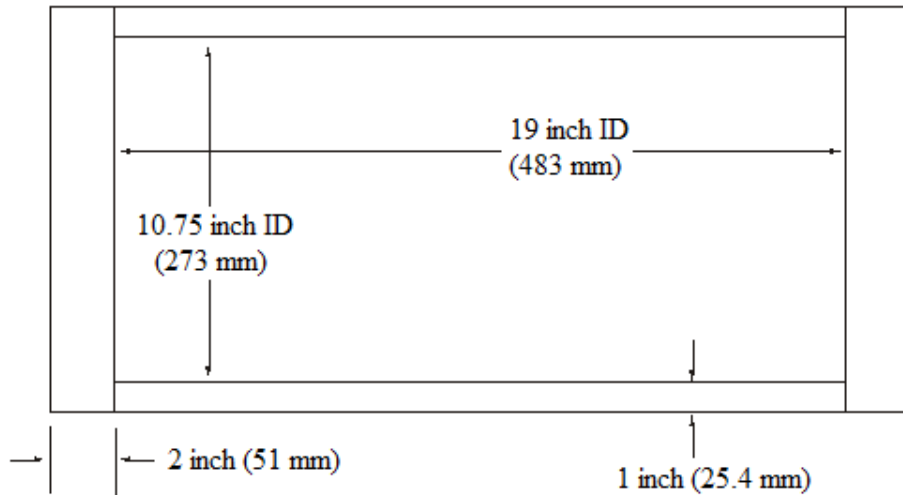
Figure B2-4. Sliding platform

B2.3.3.1 Standard Retaining Frame

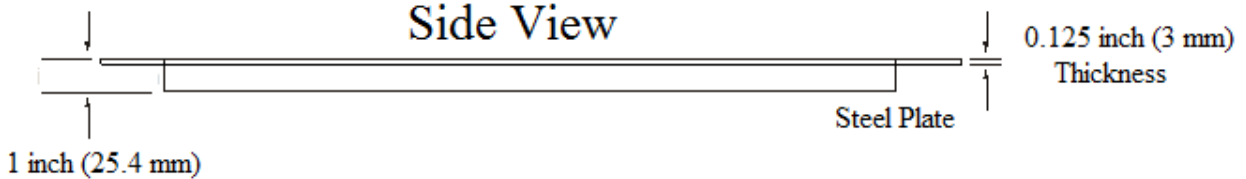
A retaining frame is required and must secure the sample in place during testing. The top flange of the frame (horizontal) sits on top of the sliding platform upper flange, and the bottom flange (vertical) compresses the film of the sample around the inside perimeter of the frame to help hold it in place (see figure B2-5). It may be necessary to adjust the sample up or down to maintain the 7.5 ± 0.125 -inch (191 ± 3 -mm) distance from the sample to the radiant panel at the zero position.

Foam samples tend to rise during testing, which can make flame propagation difficult to determine. It is acceptable to hold the foam sample in place with safety wire if the wire is positioned away from the propane igniter and does not affect the flame propagation.

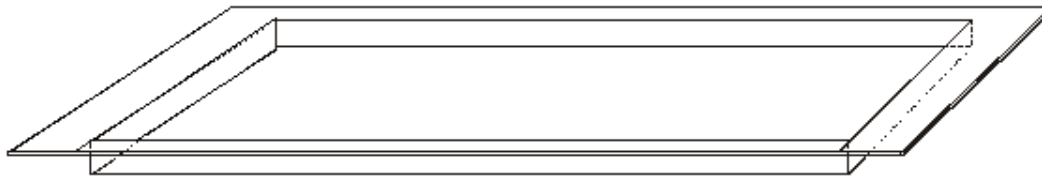
Top View



Side View



Three Dimensional View



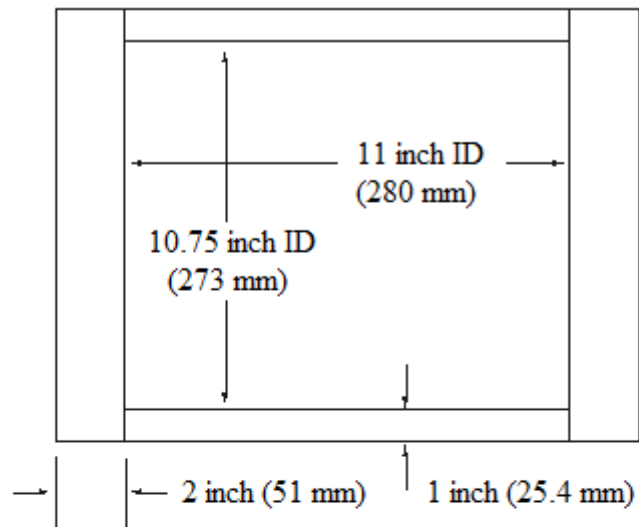
* All Dimensions are Nominal

Figure B2-5. Standard retaining frame

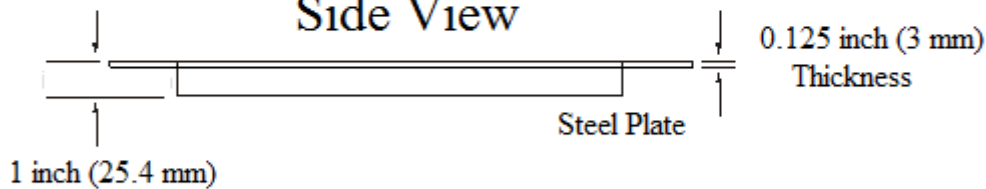
B2.3.3.2 Hook-and-Loop Retainer Frame

When testing hook-and-loop materials, a smaller retaining frame must be constructed to keep the sample in place. The frame is fabricated of mild steel with a thickness of 1/8 inches (3.2 mm) (see figure B2-6).

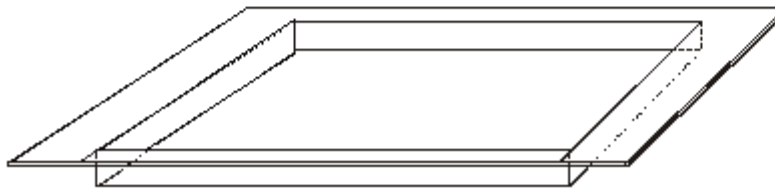
Top View



Side View



Three Dimensional View



* All Dimensions are Nominal

Figure B2-6. Hook-and-loop retainer frame

B2.3.4 Pilot Burner

The pilot burner used to ignite the sample must be a commercial propane Venturi torch with an axially symmetric burner tip and a propane supply tube having an orifice diameter of 0.006 inches (0.15 mm) (see figure B2-7). The length of the burner tube must be 2.875 inches (73 mm). The propane flow must be adjusted via gas pressure through an inline regulator to produce a blue inner cone length of 0.75 inches (19 mm). A removable 0.75-inch (19 mm)

guide, such as a thin strip of metal, may be connected to the top of the burner to aid in setting the flame length. The overall flame length must be approximately 5 inches long (127 mm) (see figure B2-7). An optional high-temperature glass viewing window located on the left wall of the chamber is permitted to ensure proper flame length if it is no larger than 6 inches by 6 inches (152 by 152 mm).

Provisions must be made to move the burner from the test position so the flame is horizontal and at least 2 inches (50.8 mm) above the sample plane (standby position). Do not allow the flame to impinge on the radiant panel. Refer to Appendix M for more details on the pilot burner.

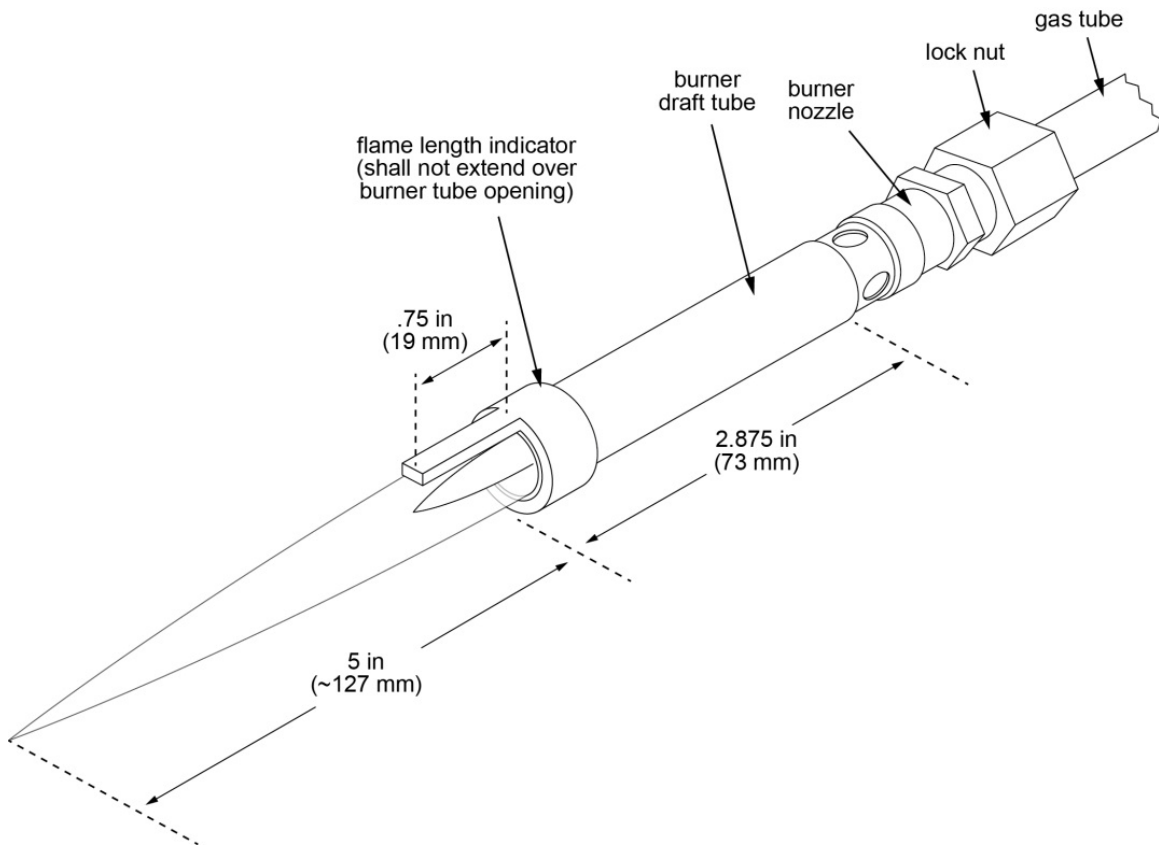


Figure B2-7. Propane venturi torch (pilot burner)

B2.3.5 Chamber Temperature Thermocouple

A chamber temperature thermocouple is recommended as a third point of reference for overall system health monitoring. It is used in conjunction with the heat-flux measurement and power-controller setpoint. The thermocouple must be a 0.0625-inch (1.59 mm) diameter, stainless-steel, jacketed Type K (Chromel-Alumel) thermocouple, located inside the chamber through a small hole drilled through the back wall. See Appendix M for more details on the location of the chamber thermocouple.

Once heat flux is determined and the system is calibrated and ready for testing, the nominal operating range is typically $450 \pm 100^{\circ}\text{F}$ ($232 \pm 55^{\circ}\text{C}$). This temperature should remain consistent ($\pm 5\%$) in day-to-day testing for an individual machine, but may vary much more across different machines.

B2.3.6 Calibration Assembly

B2.3.6.1 Heat-Flux Gauge

A water-cooled, Gardon-type heat-flux gauge (HFG) must be used to determine the total heat-flux at three positions within the chamber. The HFG cooling water temperature, pressure, and flow shall be maintained within the manufacturer's recommendations. Ensure no condensation occurs on the gauge surface at any time (often caused by cooling water being too cold).

The HFG must have a thin, full-faced, opaque coating of high-temperature, high-emissivity, ultra-flat black paint. The sensitivity of the gauge is a function of the surface condition. Changes in the coating may cause drift in the overall characteristics of the gauge. Regularly inspect the measuring surface for physical damage or dust particles that may have accumulated. Cleaning can be accomplished by gently wiping a soft, water-dampened sponge across the sensor face. Damage done to the coating during the cleaning process will affect the measurement accuracy of the sensor. To maintain accuracy, the measuring surface must be recoated at regular intervals, followed by annual recalibration. See Appendix H for full details on the HFG and its required calibration.

B2.3.6.2 HFG Calibration Fixture

The center of an HFG must be mounted in the zero position, as defined in B2.2.3, to determine total heat-flux on test samples. The HFG must be mounted in a supporting device protruding through 0.5-inch-thick (12.7 mm) rigid refractory board. Alignment features may be added to help secure the fixture in the correct position. The holder must be constructed so it can be easily moved from one position to the next when conducting a three-position check, or it must be able to measure all three positions at the same time (see section B.2.5.4 3 Position Check). Refer to Appendix M for more details.

B2.3.7 Instrumentation and Equipment

B2.3.7.1 Data Acquisition

A computerized data-acquisition system must be used to record the output of the HFG and the chamber thermocouple. The data-acquisition system must be capable of recording the HFG output every second during calibration and calculating a 5-minute average of the data. An acceptable data-acquisition system is a 22-bit, analogue-to-digital converter with an accuracy of 0.02% of the reading. The data-acquisition system must be calibrated annually to NIST traceability.

B2.3.7.2 Timing Device

A stopwatch or other device, accurate to ± 1 second per 8 hours (± 3 sec/day), must be used to measure the time of flame application (ignition time) and after-flame. It is acceptable to use an automatic timer for moving the pilot burner in and out of test position. The timing device must be calibrated annually to NIST traceability.

B2.3.7.3 Ruler

A ruler or scale graduated to the nearest 0.1 inches (2.5 mm) must be provided to measure the flame propagation length.

B2.4 Test Samples

B2.4.1 Number of Samples

A minimum of three samples must be tested.

B2.4.2 Sample Conditioning

Condition test samples at $70 \pm 5^\circ \text{F}$ ($21 \pm 2^\circ \text{C}$) and $55 \pm 10\%$ relative humidity for a minimum of 24 hours prior to testing. It is permissible to remove more than one sample at a time from the conditioning chamber if the samples are placed in a closed container (a plastic bag is acceptable). The samples must be protected from contamination until tested.

B2.4.3 Sample Construction

Test samples must include all materials used in construction of the insulation, including batting, film, scrim, and tape. Thermal/acoustic insulation typically consists of a thin film moisture barrier encapsulating a batting material. There are also foam insulation materials that may or may not use a separate moisture barrier. There are frequently detail materials that need to be accounted for in addition to the basic materials that make up the insulation. These detail materials include thread, tapes, and hook-and-loop fasteners. With the exception of “small parts,” detail materials such as these are considered part of the construction of the material and have been shown to have an influence on whether the material will propagate a fire. Because these detail features of the construction are not uniformly applied and may be used with several different basic materials, fabrication of test samples requires special consideration of these detail materials, in addition to that of the basic materials.

B2.4.3.1 Rigid/Nonrigid Materials (Mated)

This section describes testing of materials, such as film/fiberglass assemblies, quilted blankets, thread, and foam, and auxiliary materials, such as felt and coated fabric (used in addition to batting and cover material). Use of the standard retainer frame is required when testing these materials (see section B2.3.3.1).

For oriented film cover material, the term “fill” is typically used for transverse direction and “warp” is used for machine direction. If there are sufficient data available that show

there is no difference in test results between the warp and fill direction, then it is acceptable to test just the fill direction. If a new material is tested, and there is no history on this material, then both warp and fill directions must be tested.

Cut a piece of core material, such as foam or fiberglass, and cut a piece of film cover material (if used) large enough to cover the core material. Heat sealing is the preferred method of preparing fiberglass samples because they can be made without compressing the fiberglass. Cover materials that are not heat sealable may be stapled, sewn, or taped if there is enough cover material to be drawn down the sides without compressing the core material. The fastening means must be as continuous as possible along the length of the seams or enough to prevent the cover from moving once the frame secures the sample. The sample thickness must be of the same thickness as installed in the aircraft.

To facilitate proper placement of samples in the sliding platform housing, cut nonrigid core materials (such as fiberglass) 12.5 inches (318 mm) wide by 23 inches (584 mm) long. Rigid materials may be more difficult to fit beneath the sliding platform upper flanges, so the width can be reduced. Cut rigid materials (such as foam or silicon assemblies) 11.5 ± 0.25 inches (292 ± 6 mm) wide by 23 inches (584 mm) long to fit properly in the sliding platform housing and provide a flat, exposed surface.

B2.4.3.2 Tape

Tapes are used both during initial production and in the process of making repairs or facilitating material replacements on airplanes in service. It is not practical to test each possible configuration of tape and film/batting material. To simplify this process, the following procedure has been developed to show compliance for the use of tape. It is also acceptable to test the tape in its installed configuration, which will qualify that configuration only.

Each type of tape requires qualification on each material on which it is used. It is acceptable, however, to use a standard batting material for all tape/film combinations.

Four strips of 2-inch-wide (51 mm) tape (as supplied by the manufacturer) must be placed on the test sample. The tape strips must be cut long enough to cover the sample from front to back. The first strip of tape is applied at the right side of the sample and each strip of tape overlaps the preceding strip by 0.5 ± 0.125 inches (12.7 ± 3 mm) in the right-to-left direction. The tape must be arranged so that the centerline of the pilot burner igniter flame contacts the seam of the first overlap. Figure B2-8 shows the general arrangement. It will be necessary to make a template to determine how far from the right edge of the sample to place the first strip of tape. This is necessary to ensure that the burner flame contacts properly.

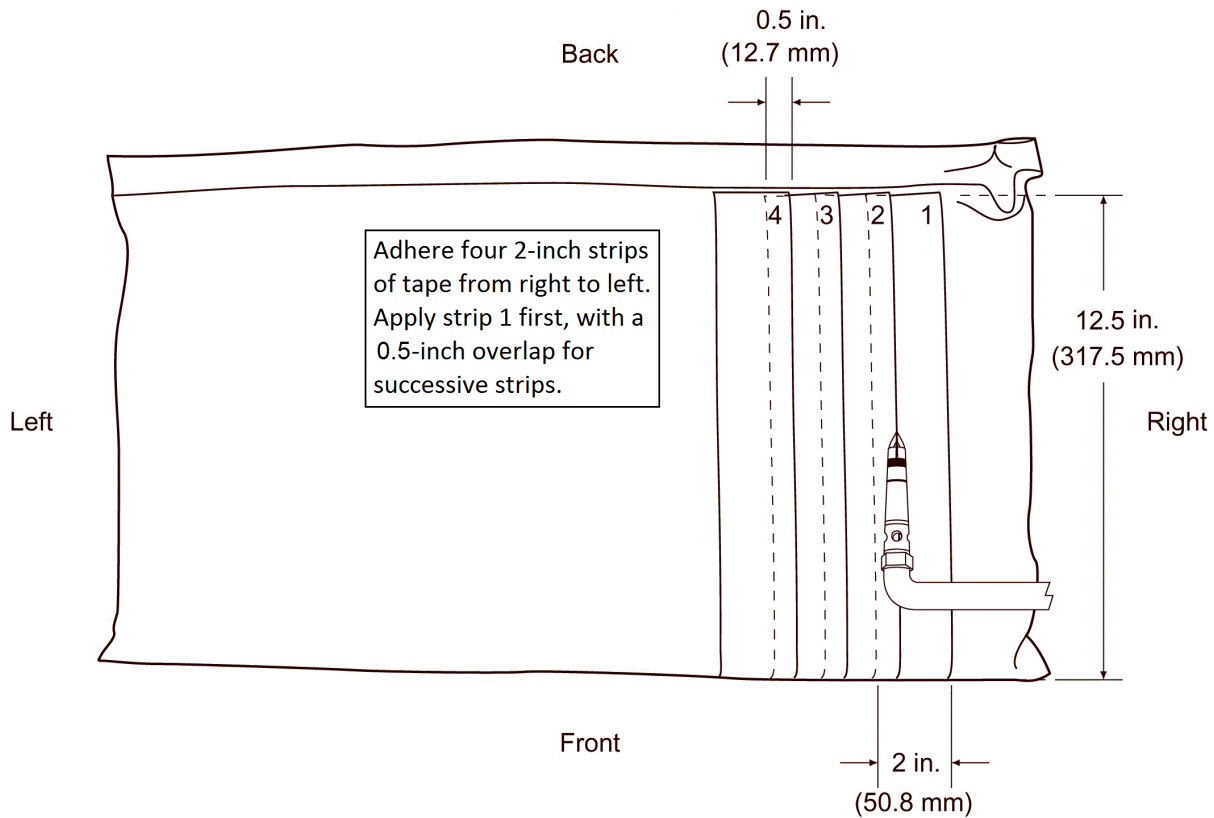


Figure B2-8. Tape configuration (top view)

If the tape is not supplied in 2 inch (51 mm) widths, but only in wider sizes, cut the tape down to 2 inches (51 mm). If it is narrower than 2 inches (50 mm), use the actual width. Use of the standard retaining frame is required when testing tapes (see section B2.3.3.1).

B2.4.3.3 Hook-and-Loop

Separate insulation blankets are often connected using hook-and-loop fastening systems. Depending on the installation, hook-and-loop fasteners could also be used to attach the insulation to the airplane structure. As with tape, there are many possible combinations and orientations of fastener and film/batting, so testing each one could be impractical. However, the influence of the hook-and-loop on fire safety is potentially significant and must be addressed in testing. A test procedure has been developed to simplify the certification process. Samples are tested as mated components to address the different uses of hook-and-loop materials. Whereas hook-and-loop material is not always mated when installed (e.g., there may be small segments of unmated material), testing indicates that materials that pass when mated are satisfactory.

Tests conducted on 1-inch-thick (25.4 mm) batting material are used to substantiate the hook-and-loop on all other thicknesses and densities of that material. This thickness will keep the upper surface at the standard height below the radiant panel and allow the pilot burner flame to impinge on the interface of the hook-and-loop. Because each core/outer

material combination will require substantiation in the standard configuration, the hook-and-loop test may be conducted with any acceptable core material.

Encapsulated material samples are constructed by folding the material with the mated edge around the core material and then stapling the sample along the non-mated edges. Figure B2-9 shows an example of the configuration for mated samples. Note that in this case, the sample size and orientation relative to the pilot burner are different than for a typical test sample. Hook-and-loop strips 1 inch (25.4 mm) wide must be attached within 0.25 inches (6 mm) of the sample edge.

The sample must be 12 inches (305 mm) long and 4 inches (102 mm) wide, and placed so that it touches the back and right vertical surface of the sliding platform drawer level with the bottom surface of the sliding platform upper flange. Adjusting the height of the sample may be necessary to ensure that the relationship to the pilot burner is maintained to keep the junction or interface of the hook-and-loop exposed to the tip of the burner flame. Use of the hook-and-loop retaining frame is required when testing these materials (see section B2.3.3.2). Figure B2-10 shows the sample with the retaining frame in place.

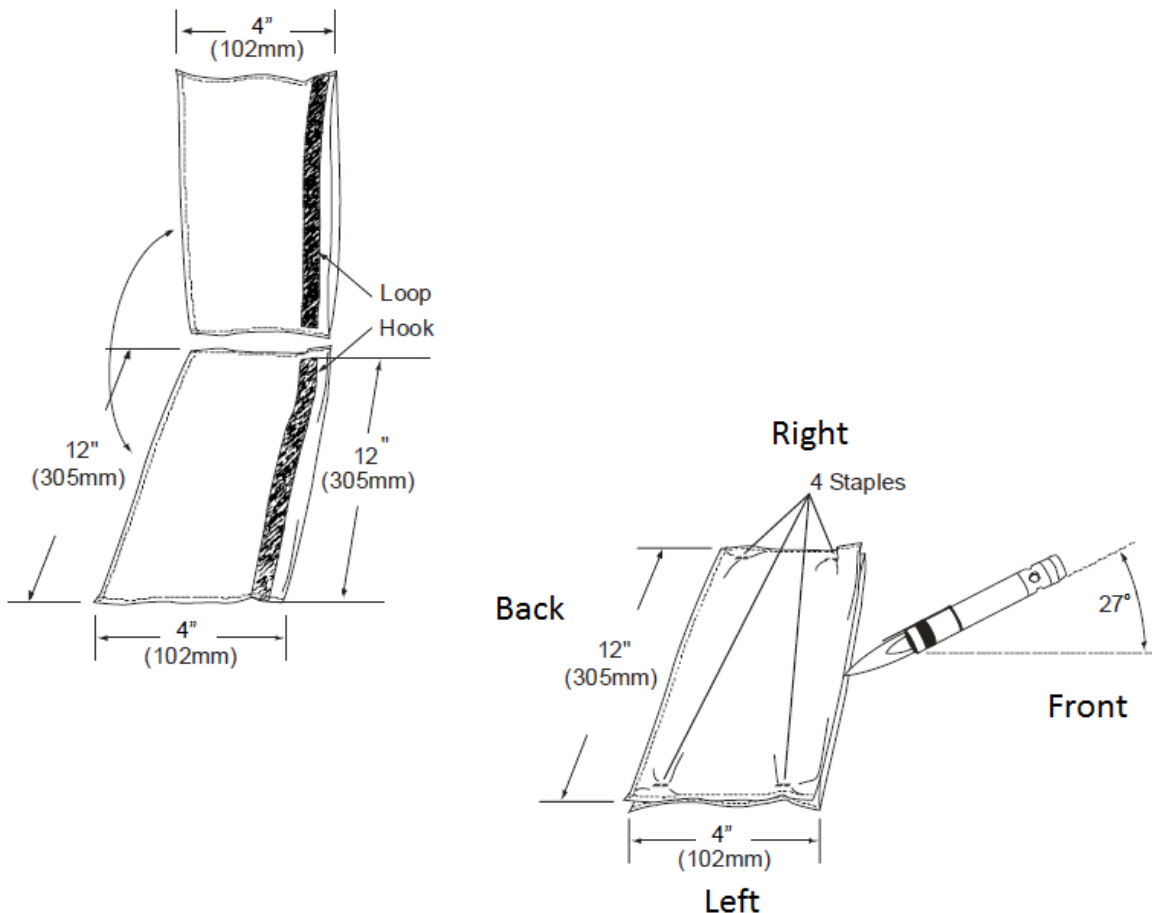


Figure B2-9. Hook-and-loop configuration

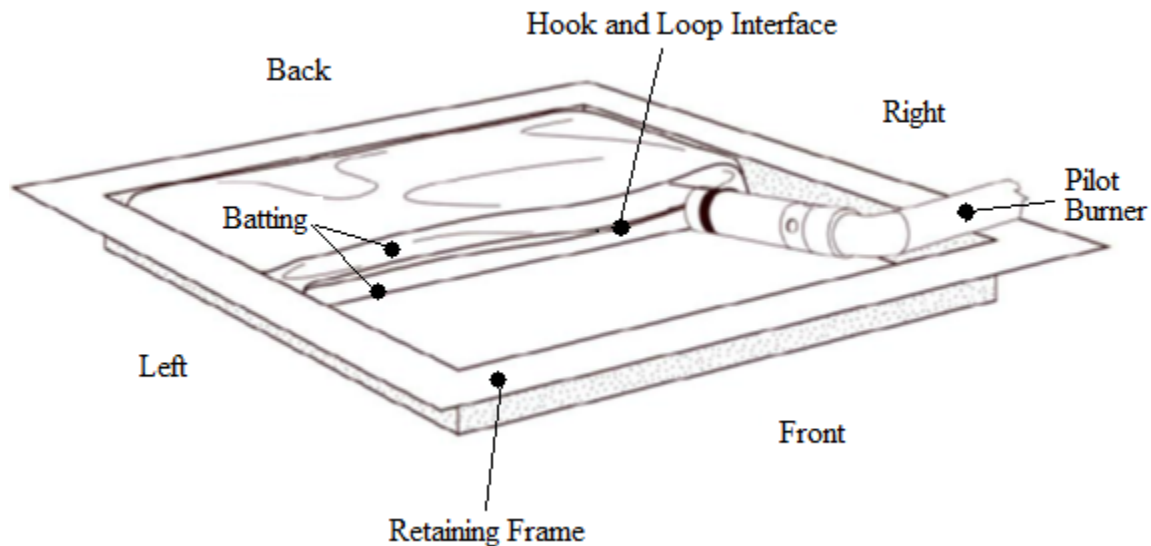


Figure B2-10. Hook-and-loop retainer frame securing material

Three tests are conducted with each combination of mated samples using the same pass/fail criteria as specified in section B2.8. Once this combination of materials (hook-and-loop, whatever material it is attached to, and any other insulation materials contained in the sample) have been substantiated, that combination of materials may be mated to any other substantiated combination of materials without further test.

B2.4.3.4 Damping Systems

Structural damping materials may be considered thermal/acoustic insulation, depending on their specific configuration and use. These materials are often a soft aluminum sheet bonded to the airplane structure. The aluminum sheet itself is not susceptible to flame propagation and is not itself insulation. Small aluminum sheets bonded directly to the airplane skin with a layer of adhesive would not be considered thermal/acoustic insulation. Damping materials that include a layer of foam or other material would be treated as thermal/acoustic insulation, and therefore must be tested for flame-propagation characteristics.

The sample must be 12 inches long and 4 inches wide, and must be placed so that it is level with the top surface of the sliding platform upper flange (see figure B2-11). When testing at the interface of the insulating material and substrate, some adaptation is necessary to precisely position the test sample. To determine the correct placement (front to back) for the test sample, place a piece of damping system (material) bonded to a 0.060 ± 0.010 -inch-thick (1.5 ± 0.25 mm) piece of aluminum sheet in the radiant panel test apparatus sliding platform.

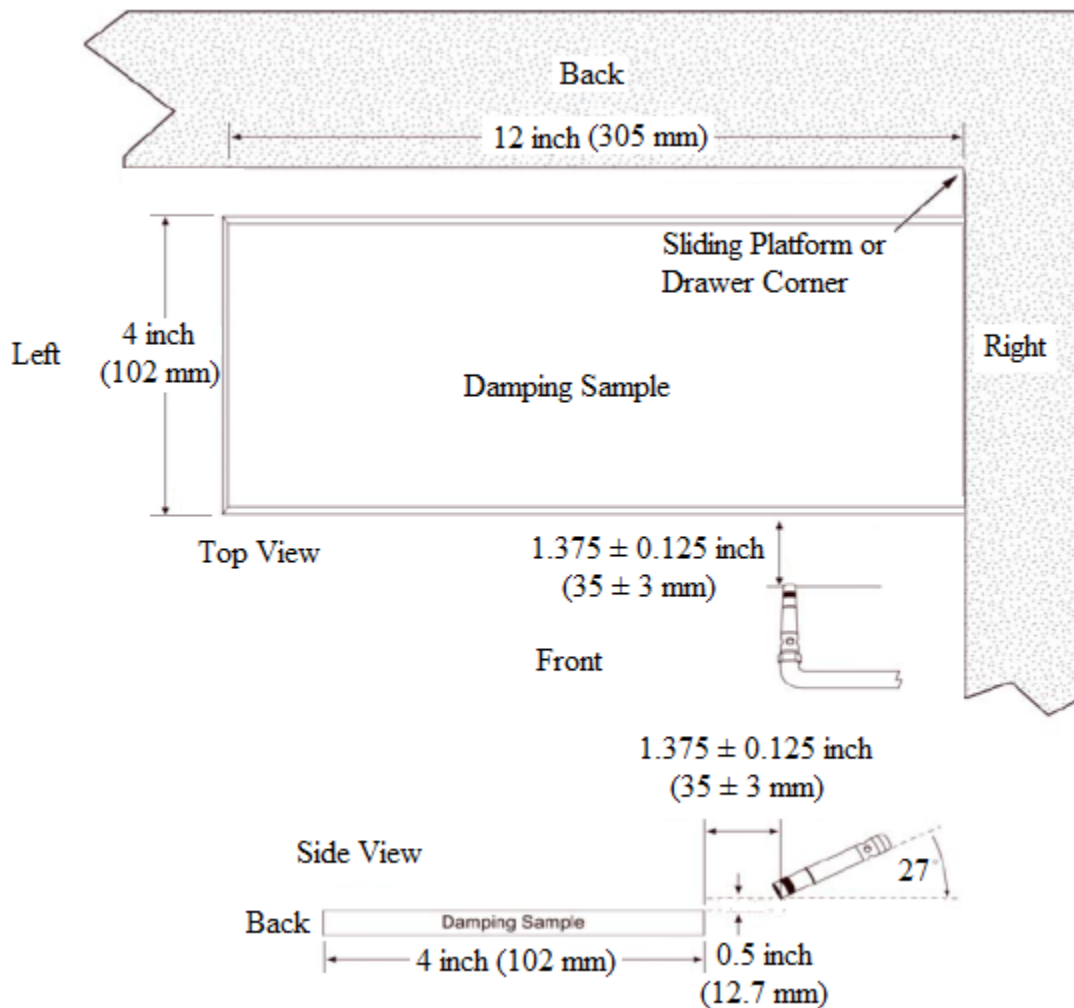


Figure B2-11. Damping material configuration

With the pilot burner in the down position and the burner guide removed, the distance from the bottom of the burner to the front edge of the sample must be 1.375 ± 0.125 inches (35 ± 3 mm). A metal shim can then be made and sized accordingly to be placed behind the sample so that the 4-inch-wide sample is placed in the correct position for each test. This measurement and shim-size determination are needed for each lab because slight variations may exist from one apparatus to another. The sample must be placed against the right side of the upper flange on the drawer. Figure B2-11 shows the position of the sample and burner. The top of the sample must be at the proper height (see section B2.2.3 Zero Position). Because the igniter angle is 27 degrees, the flame then impinges the interface of the sample and the aluminum sheet. No sample retaining frame is required when testing these materials.

B2.5 Preparation of Apparatus

B2.5.1 General Information

Prior to daily testing, a “Zero Position Calibration” (section B2.5.2) and “System Upset Check” (section B2.5.3) must be conducted. A “Recheck” must be conducted immediately following the completion of a test series to ensure data are valid. If the recheck heat-flux value is not within range, the test data are considered to be invalid (section B2.6.4). Once a recheck is conducted, material testing must be continued within 30 minutes, or the equipment must be allowed to cool to ambient conditions (approximately 1 hr) if testing has been completed. Heat flux must be calculated using a 5-minute rolling average.

Calibration of the test apparatus must be completed no sooner than 25 minutes and no later than 90 minutes after turning the radiant panel on. If calibration is not able to be completed within 90 minutes, it could indicate a problem with the machine and the equipment must be allowed to cool to ambient conditions (approximately 1 hr) before repeating the “Zero Position Calibration” and “System Upset Check” procedure.

NOTE: The actual heat flux generated by the radiant panel has a direct influence on test results. Experiments suggest that variations in heat flux from the ranges specified can influence both after-flame time (after removal of the pilot burner flame) and propagation length, although not necessarily in the same way. A slightly higher heat flux might be critical for one parameter, whereas a slightly lower heat flux might be critical for the other parameter. It is essential that heat flux be maintained as specified in table B2-1.

Table B2-1. Heat-flux ranges for thermal/acoustical insulation test

	W/cm ²			
Range	Zero Position	#1 Position	#2 Position	Recheck
High	1.72	1.73	1.67	1.75
Nominal	1.70	1.70	1.64	1.70
Low	1.69	1.66	1.57	1.64
	BTU/ft ² *sec			
Range	Zero Position	#1 Position	#2 Position	Recheck
High	1.51	1.52	1.47	1.54
Nominal	1.50	1.50	1.44	1.50
Low	1.49	1.46	1.38	1.44

B2.5.2 Zero-Position Calibration Procedure

B2.5.2.1 Install the HFG calibration fixture at the zero position. Place a sheet of noncombustible material on top of the sliding platform adjacent to the calorimeter fixture (to the left) to prevent heat loss during calibration. The entire opening of the inside of the drawer must be covered.

B2.5.2.2 Ensure the HFG surface is clean, properly aligned, and cooling water is flowing. Close the sliding platform.

B2.5.2.3 The pilot burner must be off and in the down position (test position).

B2.5.2.4 Begin heating and allow a minimum time period of 25 minutes for equipment to stabilize. The temperature of the radiant panel must reach its set point.

B2.5.2.5 Calculate the zero position heat flux using the HFG millivolt signal and its calibration constant, and begin observing a 5-minute rolling average.

B2.5.2.6 Once a stable heat flux is determined, adjust the temperature setting as necessary, and restart the 5-minute rolling average. Repeat this process until the zero-position heat flux is within the appropriate range (table B2-1).

B2.5.3 System Upset Check

Prior to testing, a system upset check must be completed once the zero-position heat flux is determined to be stable and within tolerance. The heat flux must return to the zero-position range, as specified in table B2-1 during this check.

B2.5.3.1 Raise the pilot burner to the standby position.

B2.5.3.2 Pull the sliding platform out to its stop and hold open for 30 seconds (simulated material load time).

B2.5.3.3 After 30 seconds, close the sliding platform completely.

B2.5.3.4 Lower the pilot burner into the test position.

B2.5.3.5 Allow the process-controller temperature to return to its original setpoint ($\pm 1^{\circ}\text{F}$).

B2.5.3.6 Begin the 5-minute heat flux rolling average calculation.

B2.5.3.7 After the 5-minute average heat flux is determined to be correct (zero position), proceed to the next step, or make adjusts as necessary and repeat (refer to table B2-1).

B2.5.3.8 Raise the pilot burner to the standby position, then, using caution because it may be very hot, open the drawer and remove the HFG calibration assembly.

NOTE: It is acceptable to leave the assembly at the left end of the chamber during material testing if the HFG is protected and cooling water is flowing to prevent damage to the sensor.

B2.5.4 Three-Position Check

A three-position heat-flux check is required whenever the radiant panel is replaced or whenever the HFG has been recalibrated or replaced. To ensure the panel is operating correctly, there must be a drop in observed heat flux as the distance from the zero position increases (position #2). Allow the HFG to reach steady state at each position before recording the heat flux. The distance between the centerlines of each of the three positions is 2 ± 0.0625 inches (50.8 ± 1.6 mm). As the holder is being moved, make sure to place high-temperature boards to the right of the holder to prevent heat loss. For daily testing, a heat flux check in the zero position is sufficient.

B2.5.4.1 Conduct “Zero Position Calibration” (see section B2.5.2)

B2.5.4.2 Conduct “System Upset Check” (see section B2.5.3)

B2.5.4.3 Raise the pilot burner to the standby position, open the drawer, and move the calibration assembly to position #1. Move refractory boards to the left. Cover any gap that opened to the right side of the calibration assembly.

B2.5.4.4 Close the drawer and lower the pilot burner into test position. Calculate the 5-minute heat-flux rolling average to confirm heat flux is within range for position #1 (refer to table B2-1).

B2.5.4.5 Raise the pilot burner to the standby position, open the drawer, and move the calibration assembly to position #2 (refer to table B2-1). Move refractory boards to the left. Cover any gap that opened to the right side of the calibration assembly.

B2.5.4.6 Close the drawer and lower the pilot burner into test position. Calculate the 5-minute heat-flux rolling average to confirm heat flux is within range for position #2.

B2.6 Test Procedure

B2.6.1 General Information

Once calibration is verified, testing can begin. If testing is not conducted for a period of time exceeding 30 minutes, the HFG calibration assembly must be installed and allowed to stabilize for a minimum of 5 minutes, followed by a “System Upset Check” (section B2.5.3). The heat flux must return to the zero-position range, as specified in table B2-1, during this check.

It is extremely important that each test must be carefully observed to determine flame propagation and after-flame accurately. Flame propagation is not a determination of burn length made after the test. Flame propagation can occur and not leave any trace of sample damage.

NOTE: Flame propagation is a measurement of distance, whereas after-flame is a measurement of time. Generally speaking, after-flame may have some flame propagation characteristics.

The farthest flame-propagation distance to the left of the centerline of the pilot burner must be identified considering the following criteria:

1. Flame propagation left of the centerline of the pilot burner while the burner is in the test position
2. Flashing on the sample that occurs left of the centerline of the pilot burner while the burner is in the test position
3. Flame propagation or flashing on the sample that occurs left of the centerline of the pilot burner once the burner is raised to the standby position

B2.6.2 Sample Ventilation Slit

With all film coverings, make a slit on the top surface of the film cover approximately 2.5 ± 0.5 inches (64 ± 13 mm) long, front to back relative to test chamber, and centered approximately 4 ± 0.5 inches (102 ± 13 mm) from the left flange of the retaining frame. The slit is for test purposes only to allow ventilation of gases during testing. This is not a requirement for the installed insulation.

B2.6.3 Test Sequence

B2.6.3.1 Conduct “Zero Position Calibration” (see section B2.5.2)

B2.6.3.2 Conduct “System Upset Check” (see section B2.5.3)

B2.6.3.3 Stack up refractory boards inside the drawer so the top surface of the test sample will be level with the bottom surface of the drawer upper flange when placed inside. The rest of the inside of the drawer should be completely covered with refractory boards so no convective airflow can pass through.

B2.6.3.4 Ignite the pilot burner and keep it in the standby position. Verify that the flame is the correct length.

B2.6.3.5 Open the drawer and place the test sample in the sliding platform. Place the retaining frame over the test sample, if required (see figure B2-5).

B2.6.3.6 Immediately push the sliding platform into the chamber (within 3 seconds or less).

B2.6.3.7 Within 1 second or less, bring the pilot burner flame into contact with the center of the sample at the zero position, and simultaneously start the timer.

B2.6.3.8 After an ignition time of 15 seconds or, in some cases, 30 seconds, quickly lift the burner flame to the standby position within 1 second or less.

B2.6.3.9 Open the drawer, take measurements, and record data, then remove the test sample. Continue testing as necessary. To avoid excessive heat loss, keep the drawer closed when not loading, measuring, or unloading samples.

B2.6.3.10 When test series is complete, conduct system “Recheck” to verify posttest heat flux is within range. If not within range, previous test data are invalid (refer to table B2-1).

B2.6.4 System Recheck Procedure

B2.6.4.1 Install the HFG fixture at the zero position. Place a sheet of noncombustible material on top of the sliding platform adjacent to the calorimeter fixture (to the left) to prevent heat loss during calibration. All gaps within the drawer opening that could allow air to flow through must be covered.

B2.6.4.2 Ensure the HFG surface is clean, properly aligned, and that cooling water is flowing. Close the sliding platform.

B2.6.4.3 The pilot burner must be off and in the down position (test position).

B2.6.4.4 Allow the system to stabilize for 25 minutes.

B2.6.4.5 After 25 minutes, calculate the zero-position “Recheck” heat flux using the HFG millivolt signal and its calibration constant, and begin a 5-minute rolling average.

B2.6.4.6 After 5 minutes (no adjustments permitted), verify heat flux is within the “Recheck” range (table B2-1).

B2.6.4.7 You may continue material testing after a “Recheck,” or shut down the system and allow the apparatus to cool to ambient conditions if testing has been completed.

B2.7 Report

B2.7.1 Setpoint Temperature

Record the temperature set point for the radiant panel power controller.

B2.7.2 Zero Position Calibration

Record the 5-minute average heat-flux value (BTU/ft²-sec or W/cm²).

B2.7.3 Chamber Temperature

Report the pretest chamber temperature after calibration.

B2.7.4 System Recheck

Record the 5-minute average heat-flux value (BTU/ft²*sec).

B2.7.5 Material Identification

Fully identify and describe the test sample (e.g., width, length, thickness).

B2.7.6 Ignition Time

Report the ignition time in seconds for each sample tested (15 or 30 seconds).

B2.7.7 After-Flame

Report the after-flame time in seconds for each sample tested.

B2.7.8 Flame Propagation

Report the flame propagation length for each sample tested.

B2.7.9 Notes/Comments

Report any occurrences of shrinkage, melting, glowing, swelling, flashing, or char.

B2.7.10 Pass/Fail

Report the total number of materials tested and total number of materials that passed.

B2.8 Requirements

B2.8.1 Quantity of Samples

A minimum of three samples must be tested and 80% or greater must pass both criteria specified in B2.8.2 and B2.8.3. An example is shown in table B2-2.

Table B2-2. Quantity of samples that must pass for a given number tested

Total Samples Tested	Must Pass	%
3	3	100%
4	4	100%
5	4	80%
6	5	83%
7	6	86%
8	7	88%
9	8	89%
10	8	80%
11	9	82%
12	10	83%

B2.8.2 After-Flame

The after-flame time, after removal of the pilot burner flame, must not exceed 3 seconds.

B2.8.3 Flame Propagation

There must be no flame propagation or flashing beyond 2 inches (50.8 mm) measured to the left of the centerline of the pilot burner.