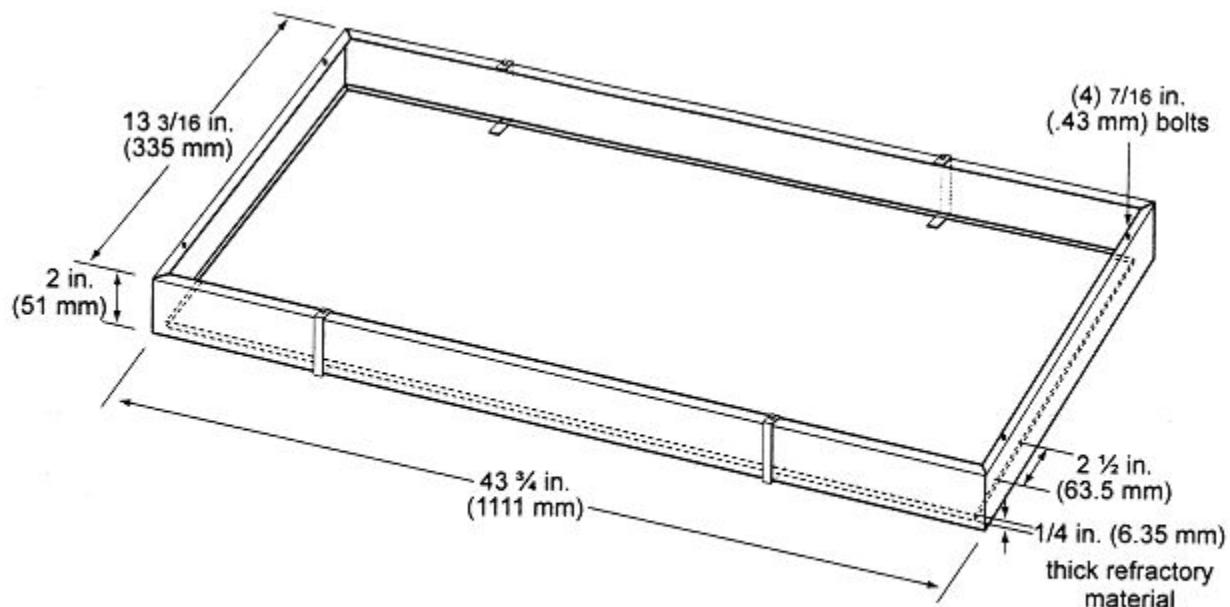


multiple sheets of material based on the thickness of the test specimen (to meet the sample height requirement). Typically, these non-combustible sheets of material are available in 6 mm ( $\frac{1}{4}$  inch) thicknesses. See figure 4. A sliding platform that is deeper than the 50.8 mm (2-inch) platform shown in figure 4 is also acceptable as long as the sample height requirement is met.



**Figure 4 - Sliding Platform**

- (ii) Attach a 13 mm ( $\frac{1}{2}$  inch) piece of Kaowool MTM board or other high temperature material measuring 1054 by 210 mm (41 $\frac{1}{2}$  by 8 $\frac{1}{4}$  inches) to the back of the platform. This board serves as a heat retainer and protects the test specimen from excessive preheating. The height of this board must not impede the sliding platform movement (in and out of the test chamber). If the platform has been fabricated such that the back side of the platform is high enough to prevent excess preheating of the specimen when the sliding platform is out, a retainer board is not necessary.
- (iii) Place the test specimen horizontally on the non-combustible board(s). Place a steel retaining/securing frame fabricated of mild steel, having a thickness of 3.2 mm ( $\frac{1}{8}$  inch) and overall dimensions of 584 by 333 mm (23 by 13 $\frac{1}{8}$  inches) with a specimen opening of 483 by 273 mm (19 by 10 $\frac{3}{4}$  inches) over the test specimen. The front, back, and right portions of the top flange of the frame must rest on the top of the sliding platform, and the bottom flanges must pinch all 4 sides of the test specimen. The right bottom flange must be flush with the sliding platform. See figure 5.

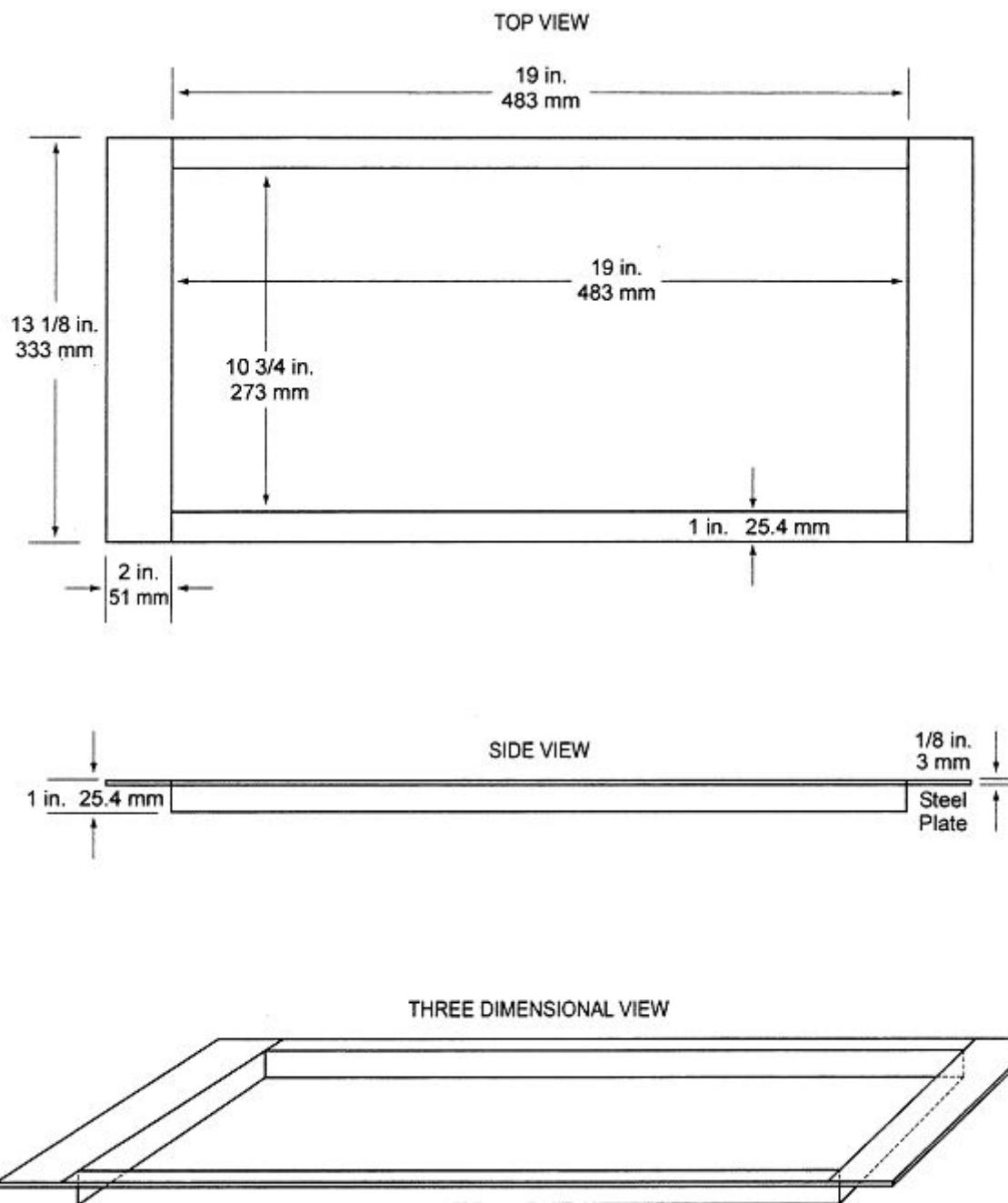
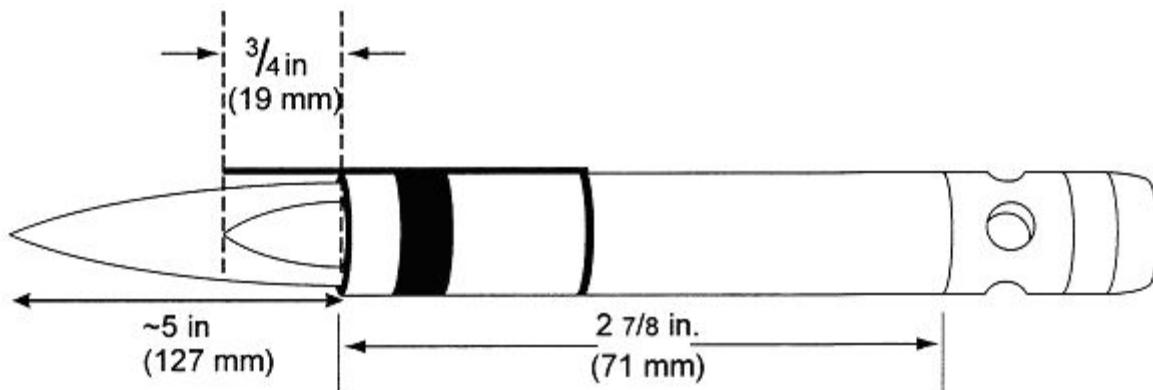


Figure 5: 3 views

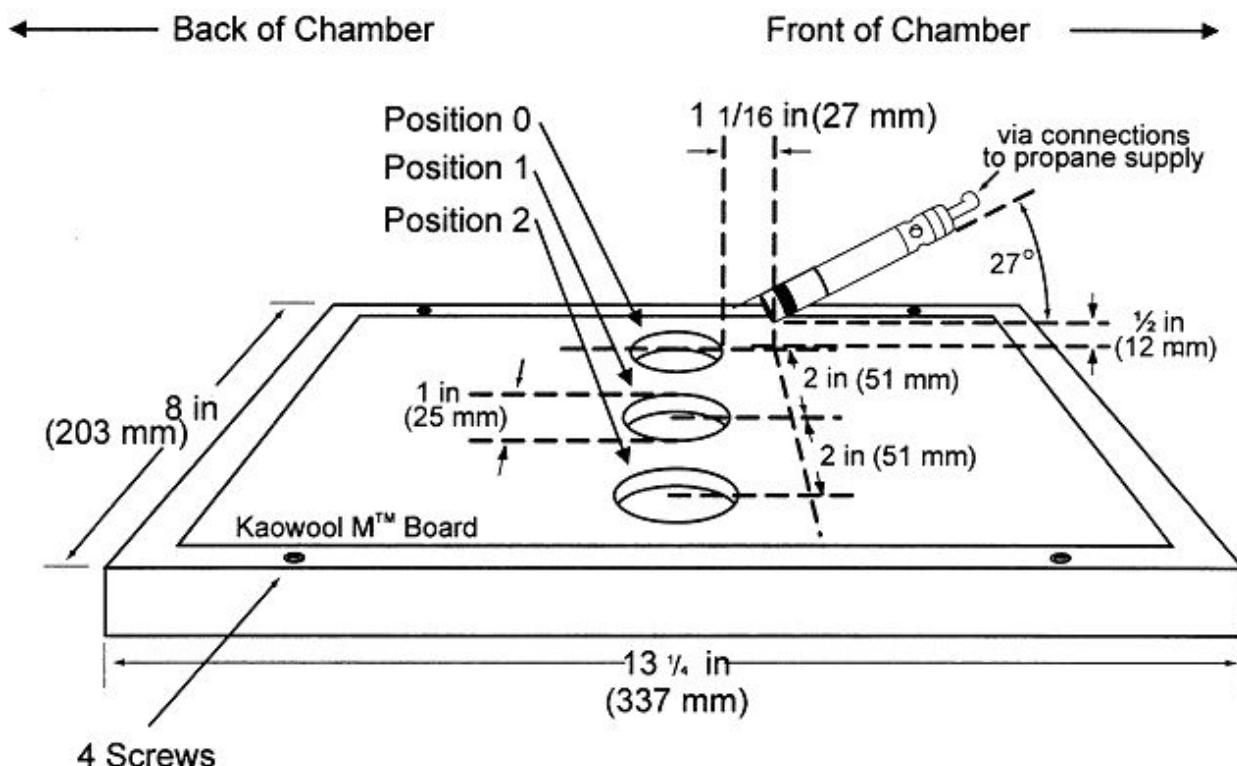
- (4) Pilot Burner. The pilot burner used to ignite the specimen must be a Bernzomatic™ (or equivalent) commercial propane venturi torch with an axially symmetric burner tip and a propane supply tube with an orifice diameter of 0.15 mm (0.006 inches). The length of the burner tube must be 71 mm (2 1/8 inches). The propane flow must be adjusted via gas pressure through an in-line regulator to produce a blue inner cone length of 19 mm (3/4 inch). A 19 mm (3/4 inch) guide (such as a thin strip of metal) may be soldered to the top of the burner to aid in setting the flame height. The overall flame length must be approximately 127 mm (5 inches) long. Provide a way to move the burner out of the ignition position so that the flame is horizontal and at least 50 mm (2 inches) above the specimen plane. See figure 6.



**Figure 6 – Propane Pilot Burner**

- (5) Thermocouples. Install a 24 American Wire Gauge (AWG) Type K (Chromel-Alumel) thermocouple in the test chamber for temperature monitoring. Insert it into the chamber through a small hole drilled through the back of the chamber. Place the thermocouple so that it extends 279 mm (11 inches) out from the back of the chamber wall, 292 mm (11½ inches) from the right side of the chamber wall, and is 51 mm (2 inches) below the radiant panel. The use of other thermocouples is optional.
- (6) Calorimeter. The calorimeter must be a one-inch cylindrical water-cooled, total heat flux density, foil type Gardon Gage that has a range of 0 to 5.7 Watts/cm<sup>2</sup> (0 to 5 BTU/ft<sup>2</sup> sec).
- (7) Calorimeter calibration specification and procedure.
  - (i) Calorimeter specification.
    - (A) Foil diameter must be  $6.35 \pm 0.13$  mm ( $0.25 \pm 0.005$  inches).
    - (B) Foil thickness must be  $0.013 \pm 0.0025$  mm ( $0.0005 \pm 0.0001$  inches).
    - (C) Foil material must be thermocouple grade Constantan.
    - (D) Temperature measurement must be a Copper Constantan thermocouple.
    - (E) The copper center wire diameter must be 0.013 mm (0.0005 inches).
    - (F) The entire face of the calorimeter must be lightly coated with "Black Velvet" paint having an emissivity of 96 or greater.
  - (ii) Calorimeter calibration.
    - (A) The calibration method must be by comparison to a like standardized transducer.
    - (B) The standardized transducer must meet the specifications given in paragraph (b)(6) of Part VI of this Appendix.
    - (C) Calibrate the standard transducer against a primary standard traceable to the National Institute of Standards and Technology (NIST).
    - (D) The method of transfer must be a heated graphite plate.
    - (E) The graphite plate must be electrically heated, have a clear surface area on each side of the plate of at least 51 by 51 mm (2 by 2 inches), and be  $3.2 \pm 1.6$  mm ( $\frac{1}{8} \pm \frac{1}{16}$  inch) thick.

- (F) enter the 2 transducers on opposite sides of the plates at equal distances from the plate.
  - (G) The distance of the calorimeter to the plate must be no less than 1.6 mm (0.0625 inches), nor greater than 9.5 mm (0.375 inches).
  - (H) The range used in calibration must be at least 0–3.9 Watts/cm<sup>2</sup> (0–3.5 BTUs/ft<sup>2</sup> sec) and no greater than 0–6.4 Watts/cm<sup>2</sup> (0–5.7 BTUs/ft<sup>2</sup> sec).
  - (I) The recording device used must record the 2 transducers simultaneously or at least within 1/10 of each other.
- (8) Calorimeter fixture. With the sliding platform pulled out of the chamber, install the calorimeter holding frame and place a sheet of non-combustible material in the bottom of the sliding platform adjacent to the holding frame. This will prevent heat losses during calibration. The frame must be 333 mm (13½ inches) deep (front to back) by 203 mm (8 inches) wide and must rest on the top of the sliding platform. It must be fabricated of 3.2 mm (⅛ inch) flat stock steel and have an opening that accommodates a 12.7 mm (½ inch) thick piece of refractory board, which is level with the top of the sliding platform. The board must have three 25.4 mm (1 inch) diameter holes drilled through the board for calorimeter insertion. The distance to the radiant panel surface from the centreline of the first hole (“zero” position) must be 191 ± 3 mm (7½ ± ¼ inches). The distance between the centreline of the first hole to the centreline of the second hole must be 51 mm (2 inches). It must also be the same distance from the centreline of the second hole to the centreline of the third hole. See figure 7. A calorimeter holding frame that differs in construction is acceptable as long as the height from the centreline of the first hole to the radiant panel and the distance between holes is the same as described in this paragraph.



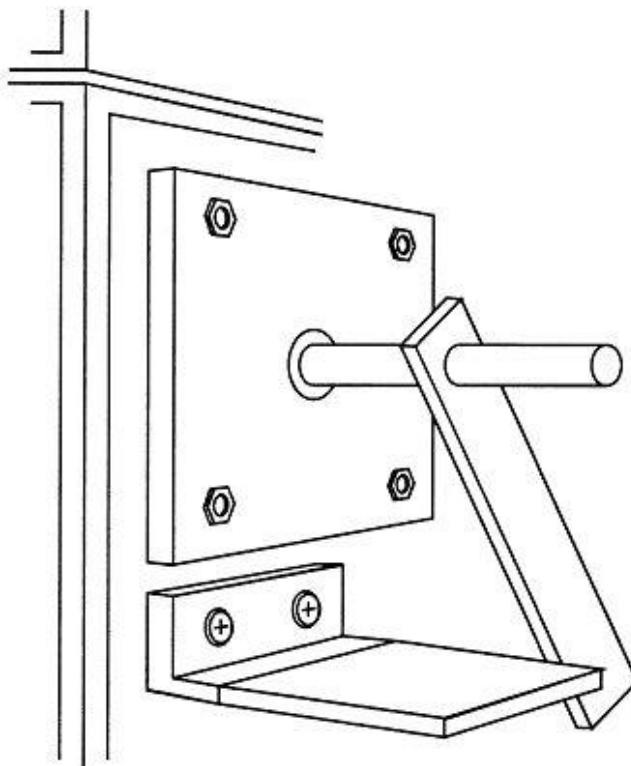
**Figure 7 - Calorimeter Holding Frame**

- (9) Instrumentation. Provide a calibrated recording device with an appropriate range or a computerized data acquisition system to measure and record the outputs of the calorimeter and the thermocouple. The data acquisition system must be capable of recording the calorimeter output every second during calibration.
- (10) Timing device. Provide a stopwatch or other device, accurate to  $\pm 1$  second/hour, to measure the time of application of the pilot burner flame.
- (c) Test specimens.
- (1) Specimen preparation. Prepare and test a minimum of three test specimens. If an oriented film cover material is used, prepare and test both the warp and fill directions.
- (2) Construction. Test specimens must include all materials used in construction of the insulation (including batting, film, scrim, tape etc.). 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, since they can be made without compressing the fiberglass ("box sample"). Cover materials that are not heat sealable may be stapled, sewn, or taped as long as the cover material is over-cut enough to be drawn down the sides without compressing the core material. The fastening means should be as continuous as possible along the length of the seams. The specimen thickness must be of the same thickness as installed in the airplane.
- (3) Specimen Dimensions. To facilitate proper placement of specimens in the sliding platform housing, cut non-rigid core materials, such as fibreglass, 318 mm (12½ inches) wide by 584 mm (23 inches) long. Cut rigid materials, such as foam,  $292 \pm 6$  mm (11½  $\pm \frac{1}{4}$  inches) wide by 584 mm (23 inches) long in order to fit properly in the sliding platform housing and provide a flat, exposed surface equal to the opening in the housing.
- (d) Specimen conditioning. Condition the test specimens at  $21 \pm 2^\circ\text{C}$  ( $70 \pm 5^\circ\text{F}$ ) and  $55\% \pm 10\%$  relative humidity, for a minimum of 24 hours prior to testing.
- (e) Apparatus Calibration.
- (1) With the sliding platform out of the chamber, install the calorimeter holding frame. Push the platform back into the chamber and insert the calorimeter into the first hole ("zero" position). See figure 7. Close the bottom door located below the sliding platform. The distance from the centerline of the calorimeter to the radiant panel surface at this point must be  $191 \pm 3$  mm ( $7\frac{1}{2} \pm \frac{1}{8}$  inches). Prior to igniting the radiant panel, ensure that the calorimeter face is clean and that there is water running through the calorimeter.
- (2) Ignite the panel. Adjust the fuel/air mixture to achieve  $1.7 \text{ Watts/cm}^2 \pm 5\%$  ( $1.5 \text{ BTUs/ft}^2 \text{ sec} \pm 5\%$ ) at the "zero" position. If using an electric panel, set the power controller to achieve the proper heat flux. Allow the unit to reach steady state (this may take up to 1 hour). The pilot burner must be off and in the down position during this time.
- (3) After steady-state conditions have been reached, move the calorimeter 51 mm (2 inches) from the "zero" position (first hole) to position 1 and record the heat flux. Move the calorimeter to position 2 and record the heat flux. Allow enough time at each position for the calorimeter to stabilize. Table 1 depicts typical calibration values at the three positions.

**TABLE 1.—CALIBRATION TABLE**

Position	BTU's/ft <sup>2</sup> sec	Watts/cm <sup>2</sup>
“Zero” Position.	1.5	1.7
Position 1	1.51–1.50–1.49	1.71–1.70–1.69
Position 2	1.43–1.44	1.62–1.63

- (4) Open the bottom door. Remove the calorimeter and holder fixture. Use caution as the fixture is very hot.
- (f) Test Procedure.
- (1) Ignite the pilot burner. Ensure that it is at least 51 mm (2 inches) above the top of the platform. The burner must not contact the specimen until the test begins.
  - (2) Place the test specimen in the sliding platform holder. Ensure that the test sample surface is level with the top of the platform. At “zero” point, the specimen surface must be  $191 \pm 3$  mm ( $7\frac{1}{2} \pm \frac{1}{8}$  inches) below the radiant panel.
  - (3) Place the retaining/securing frame over the test specimen. It may be necessary (due to compression) to adjust the sample (up or down) in order to maintain the distance from the sample to the radiant panel  $191 \pm 3$  mm ( $7\frac{1}{2} \pm \frac{1}{8}$  inches) at “zero” position). With film/fiberglass assemblies, it is critical to make a slit in the film cover to purge any air inside. This allows the operator to maintain the proper test specimen position (level with the top of the platform) and to allow ventilation of gases during testing. A longitudinal slit, approximately 2 inches (51 mm) in length, must be centered  $76 \pm 13$  mm ( $3 \pm \frac{1}{2}$  inches) from the left flange of the securing frame. A utility knife is acceptable for slitting the film cover.
  - (4) Immediately push the sliding platform into the chamber and close the bottom door.
  - (5) Bring the pilot burner flame into contact with the center of the specimen at the “zero” point and simultaneously start the timer. The pilot burner must be at a  $27^\circ$  angle with the sample and be approximately  $\frac{1}{2}$  inch (12 mm) above the sample. See figure 7. A stop, as shown in figure 8, allows the operator to position the burner correctly each time.



**Figure 8 - Propane Burner Stop**

- (6) Leave the burner in position for 15 seconds and then remove to a position at least 51 mm (2 inches) above the specimen.

(g) Report.

- (1) Identify and describe the test specimen.
- (2) Report any shrinkage or melting of the test specimen.
- (3) Report the flame propagation distance. If this distance is less than 51 mm (2 inches), report this as a pass (no measurement required).
- (4) Report the after-flame time.

(h) Requirements.

- (1) There must be no flame propagation beyond 51 mm (2 inches) to the left of the centerline of the pilot flame application.
- (2) The flame time after removal of the pilot burner may not exceed 3 seconds on any specimen.

[Amdt 25/6]

## Part VII – Test Method to Determine the Burnthrough Resistance of Thermal/Acoustic Insulation Materials

*ED Decision 2009/010/R*

Use the following test method to evaluate the burnthrough resistance characteristics of aircraft thermal/acoustic insulation materials when exposed to a high intensity open flame.

(a) Definitions.

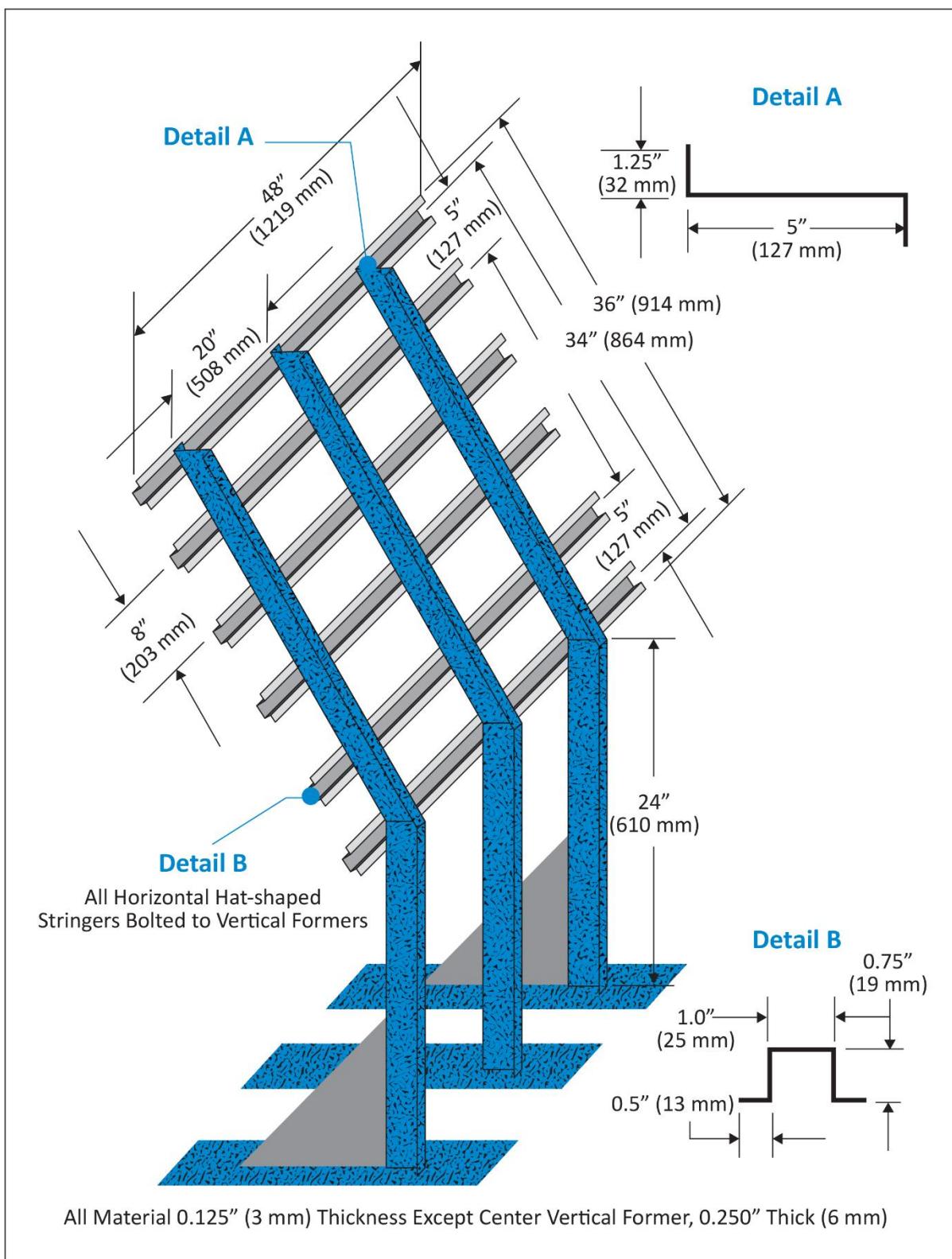
Burnthrough time means the time, in seconds, for the burner flame to penetrate the test specimen, and/or the time required for the heat flux to reach  $2.27 \text{ W/cm}^2$  ( $2.0 \text{ Btu/ft}^2 \text{ sec}$ ) on the inboard side, at a distance of 30.5 cm (12 inches) from the front surface of the insulation blanket test frame, whichever is sooner. The burnthrough time is measured at the inboard side of each of the insulation blanket specimens.

Insulation blanket specimen means one of two specimens positioned in either side of the test rig, at an angle of  $30^\circ$  with respect to vertical.

Specimen set means two insulation blanket specimens. Both specimens must represent the same production insulation blanket construction and materials, proportioned to correspond to the specimen size.

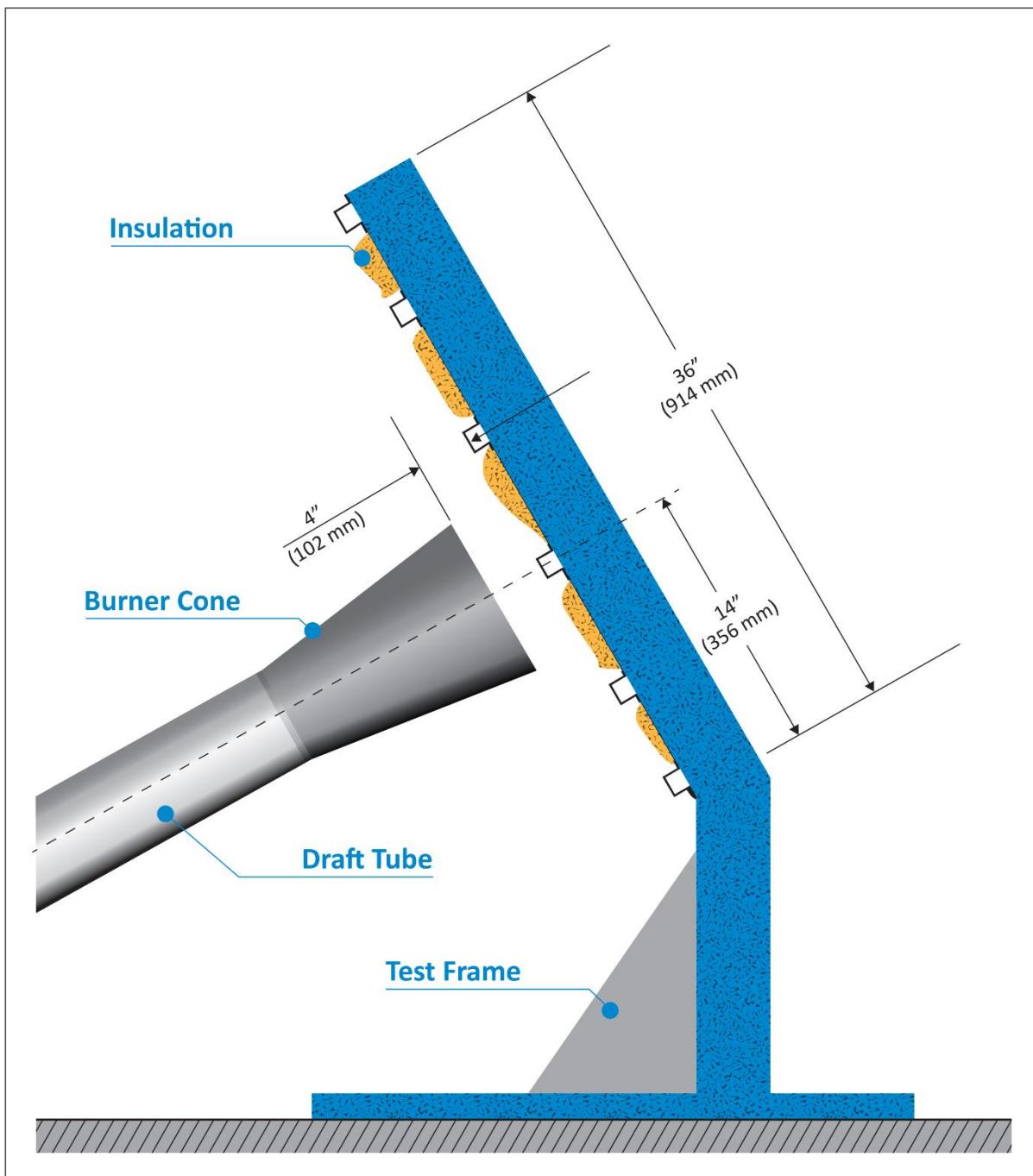
(b) Apparatus.

- (1) The arrangement of the test apparatus is shown in figures 1 and 2 and must include the capability of swinging the burner away from the test specimen during warm-up.



**Figure 1 – Burnthrough Test Apparatus Specimen Holder**

- (2) Test burner. The test burner must be a modified gun-type such as the Park Model DPL 3400 or equivalent. Flame characteristics are highly dependent on actual burner setup. Parameters such as fuel pressure, nozzle depth, stator position, and intake airflow must be properly adjusted to achieve the correct flame output.



**Figure 2 – Burnthrough Test Apparatus**

- (i) Nozzle. A nozzle must maintain the fuel pressure to yield a nominal 0.378 l/min (6.0 gal/hr) fuel flow. A Monarch-manufactured 80° PL (hollow cone) nozzle nominally rated at 6.0 gal/hr at 100 lb/in<sup>2</sup> (0.71 MPa) delivers a proper spray pattern.
- (ii) Fuel Rail. The fuel rail must be adjusted to position the fuel nozzle at a depth of 8 mm (0.3125 inch) from the end plane of the exit stator, which must be mounted in the end of the draft tube.