



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, DC

TSO-C152

Effective Date:

Proposed Technical Standard Order

Subject: FLAMMABILITY TEST METHOD FOR AIRCRAFT BLANKETS

1. **PURPOSE.** This technical standard order (TSO) prescribes the minimum performance standards (MPS) for flammability that blankets to be used for passenger comfort in aircraft cabins must meet to be identified with the applicable TSO marking.
2. **APPLICABILITY.** This TSO is effective for new applications submitted after the effective date of this TSO.
3. **REQUIREMENTS.** Aircraft blankets that are to be so identified and that are manufactured on or after the effective date of this TSO must meet the flammability test set forth in Appendix 1, " Procedure for the 4-ply Horizontal Flammability Test for Aircraft Blankets."
 - a. **Functionality.** The standards of this TSO apply to blankets intended to provide comfort and warmth for aircraft occupants.
 - b. **Deviations.** The Federal Aviation Administration has provisions for using alternative or equivalent means of compliance to the criteria set forth in the MPS of this TSO. Applicants invoking these provisions shall demonstrate that an equivalent level of safety is maintained and shall apply for a deviation in accordance with 14 CFR § 21.609.
4. **MARKING.** In accordance with 14 CFR § 21.607(d), articles manufactured under this TSO must be marked as follows:

At least one major component must be permanently and legibly marked with all of the information listed in 14 CFR § 21.607(d), except for the option provided in 14 CFR § 21.607(d)(3), where the date of manufacture must be used in lieu of the optional serial number.

5. **DATA REQUIREMENTS.**

- a. **Application Data.** In accordance with 14 CFR § 21.605(a)(2), the manufacturer must

furnish the Manager, Aircraft Certification Office (ACO), Federal Aviation Administration (FAA), having purview of the manufacturer's facilities, one copy each of the following technical data to support the FAA design and production approval:

- (1) Operating or user instructions and article limitations. The limitations shall be sufficient to describe the operational capability of the equipment.
- (2) Instructions for periodic cleaning and recommended inspection intervals and service life.
- (3) The quality control functional test specification to be used to test each production article to ensure compliance with this TSO, as required by 14 CFR § 21.605(a)(3) and § 21.143(a).
- (4) Manufacturer's TSO qualification test report.
- (5) Nameplate drawing providing the information required by paragraph 4. MARKING.
- (6) A drawing list enumerating all of the drawings and processes that are necessary to define the article's design.

b. Manufacturer Data. In addition to the data that are to be furnished directly to the FAA, each manufacturer must have available for review by the manager of the ACO having purview of the manufacturer's facilities, the following technical data:

- (1) The functional qualification specifications to be used to qualify each production article to ensure compliance with this TSO.
- (2) Equipment calibration procedures.
- (3) Corrective maintenance procedures within 12 months after TSO authorization.
- (4) Schematic drawings.
- (5) Material and process specifications.

c. Furnished Data. One copy of the technical data and information specified in paragraphs 5a(1) through (6) of this TSO and any other data or information that are necessary for the proper certification and use and/or for continued airworthiness of the aircraft blanket must be furnished to the holder of the Type Certificate or Supplemental Type Certificate for installing each article manufactured under this TSO on an airplane.

6. AVAILABILITY OF REFERENCED DOCUMENTS.

a. Appendix 1, "Procedure for the 4-ply Horizontal Flammability Test for Aircraft Blankets," of this TSO was originally included in DOT/FAA/AR-96-15, "The Development of a

Flammability Test Method for Aircraft Blankets" as Appendices A and B. The information contained in those appendices has been modified to accommodate the format of this TSO but the original report from which it was extracted may be downloaded from the FAA Technical Center's website at www.tc.faa.gov.

b. Federal Aviation Regulations 14 CFR part 21, Subpart O, 14 CFR part 25 and 49 CFR part 178 may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402-9325. Advisory Circular 20-115 "Radio Technical Commission for Aeronautics, Inc, Document RTCA/DO-178", Advisory Circular 25-17 "Transport Airplane Cabin Interiors Crashworthiness Handbook", and "Aircraft Materials Fire Test Handbook," DOT/FAA/CT-89/15 may be obtained from the U.S. Department of Transportation, Utilization and Storage Section, SVC-121.23, Washington, D.C. 20590.

c. Department of Transportation (DOT) Specifications may be purchased from the U.S. Department of Transportation Records Center, 400 7th Street S.W., Washington, D.C. 20590.

James C. Jones
Manager, Aircraft Engineering Division
Aircraft Certification Service

APPENDIX 1. PROCEDURE FOR THE 4-PLY HORIZONTAL FLAMMABILITY TEST FOR AIRCRAFT BLANKETS

1. Purpose. This standard provides the minimum performance standards for flammability requirements for aircraft blankets.
2. Scope. This test method is intended for use in determining the resistance of blankets to flame when tested in the horizontal position and exposed to the Bunsen burner for 12 seconds.

3. Definitions.

- 3.1 Ignition Time. Ignition time is the length of time the burner flame is applied to the specimen, 12 seconds for this test.

- 3.2 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. Surface burning that results in a glow but not in a flame is not included.

- 3.3 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.

4. Test Apparatus.

- 4.1 Test Cabinet. The test will be conducted in a draft-free cabinet fabricated in accordance with figures B-1, B-2, and B-3, or other equivalent enclosures acceptable to the FAA. A hole may be drilled into a wall to accommodate the test fixture. 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 0.040 inch (1 mm) thick should be used for the bottom surface of the chamber.

- 4.2 Test Fixture. The test fixture will be fabricated of corrosion resistant metal as shown in figure B-4, with its drawings in figure B-7. This is the same test fixture used for the forty-five-degree test specified in FAR 25.855.

- 4.3 Burner. The burner was a Bunsen or Tirrill type with a 3/8-inch (10-mm) inside diameter barrel and 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. There should also be a way to move the burner into and out of the test position when the cabinet door is closed.

- 4.4 Burner Fuel. Methane gas (99% minimum purity) or other burner fuel acceptable to the FAA should be used. Methane is the preferred fuel. It can be used without adding air through the

aspirating holes at the bottom of the burner flame barrel; i.e., a pure diffusion flame.

4.5 Plumbing for Gas Supply. The necessary gas connections and the applicable plumbing were essentially those as shown in figure B-5. A control valve system with a delivery rate designed to furnish gas to the burner under pressure of $2\ 1/2 \pm 1/4$ psi (17 ± 2 kPa) at the burner inlet was installed between the gas supply and the burner.

4.6 Flame Height Indicator. A removable height indicator was 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 and spaced 1 inch (25 mm) away from the burner barrel as shown in figure B-5. 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 when the height of the inner flame is 1 1/2 inches (38 mm) long, the proper flame profile is achieved.

4.7 Timer. A stopwatch or other device calibrated to the nearest 0.1 second was used to measure the time of application of the burner flame, the flame time, and the drip flame time.

5. Test Specimens.

5.1 Specimen Selection. Specimens tested were cut from new aircraft blankets.

5.2 Specimen Number. At least three specimens should be prepared and tested.

5.3 Specimen Size. An 8- by 8-inch specimen is the exposed sample size; however, an 11- by 11-inch specimen should be cut in order to pull the specimen taut once secured in the test fixture. The excess material may be trimmed off.

5.4 Specimen Thickness. The specimen shall be of 4-ply configuration. This may be accomplished by folding the blanket in half and then folding it again or by stacking four individual blanket specimens cut to size.

6. Procedure.

6.1 Burner Adjustment.

6.1.1 If using methane as the burner fuel, ensure that the air supply to the burner is shut off.

6.1.2 Open the stopcock in the gas line fully and light the burner.

6.1.3 Adjust the needle valve on the burner to give the proper 1 1/2-inch (38 mm) flame height and then remove the flame height indicator.

6.2 Test Procedure.

6.2.1 Insert the test fixture with specimen in place into the test cabinet. The bottom of the specimen should be 3/4 inch above the level at the top of the burner.

6.2.2 Close the cabinet door and keep it closed during the test.

6.2.3 The timer must be started immediately upon positioning the burner. Position the burner such that it is directly under the geometric center of the test specimen. This is shown in figure B-6.

6.2.4 Apply the flame for 12 seconds and then withdraw it by moving the burner at least 3 inches (76 mm) away from the specimen or by turning the gas off. If the flame extinguishes during the ignition time for any reason, the test shall be rerun.

6.2.5 If flaming material falls from the test specimen, determine the drip flame time for the specimen.

6.2.6 Determine the flame time for the specimen.

6.2.7 After all flaming ceases, the cabinet door should be opened slowly to clear the test cabinet of fumes and smoke. The exhaust fan may be turned on to facilitate clearing the smoke and fumes.

6.2.8 Remove any material that fell from the specimen to the bottom of the cabinet. If necessary, clean the test cabinet window prior to testing the next specimen.

7. Report.

7.1 Material Identification. Fully identify the material tested.

8. Test Results.

8.1 Ignition Time. Report the ignition time.

8.2 Flame Time. Report the flame time for each specimen tested. Determine and record the average value for flame time.

8.3 Drip Flame Time. Report the drip flame time for each specimen tested. Determine and record the average value for drip flame time. For specimens that have no drips, record "0" for the drip flame time and also record "No Drips."

9. Requirements.

9.1 Flame Time. The average flame time for all of the specimens tested should not exceed 15 seconds.

9.2 Drip Flame Time. The average drip extinguishing time for all of the specimens tested should not exceed 5 seconds.

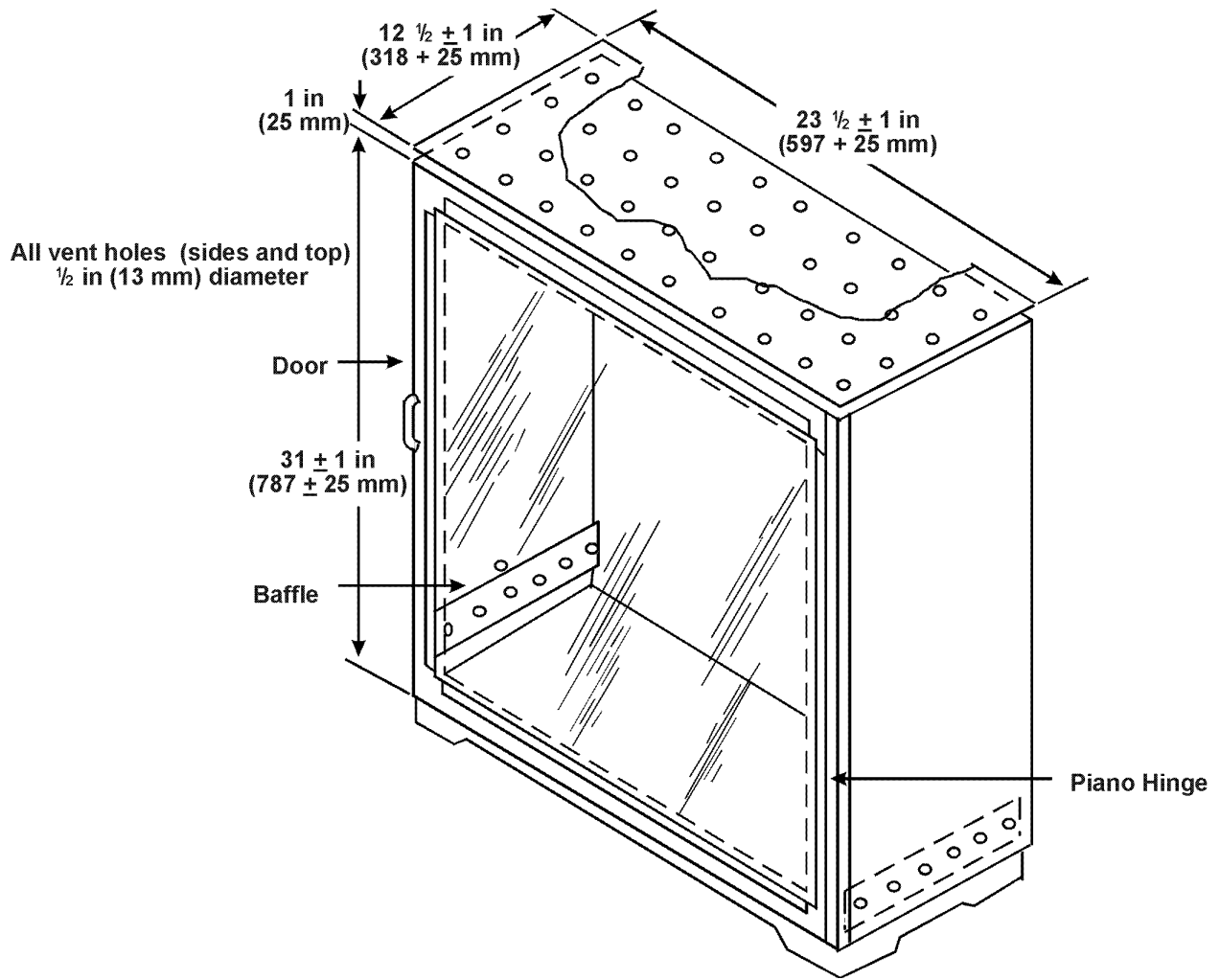


Figure 1. Sketch of Bunsen Burner Test Cabinet

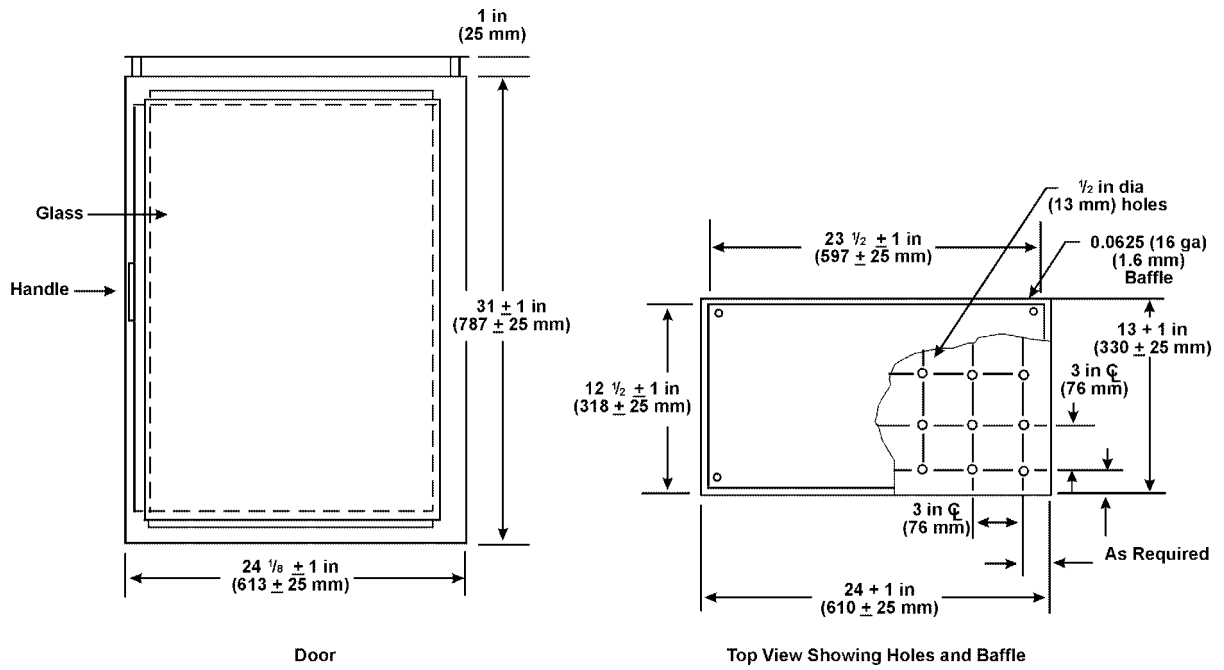


Figure 2. Front and Top View of Bunsen Burner Test Cabinet

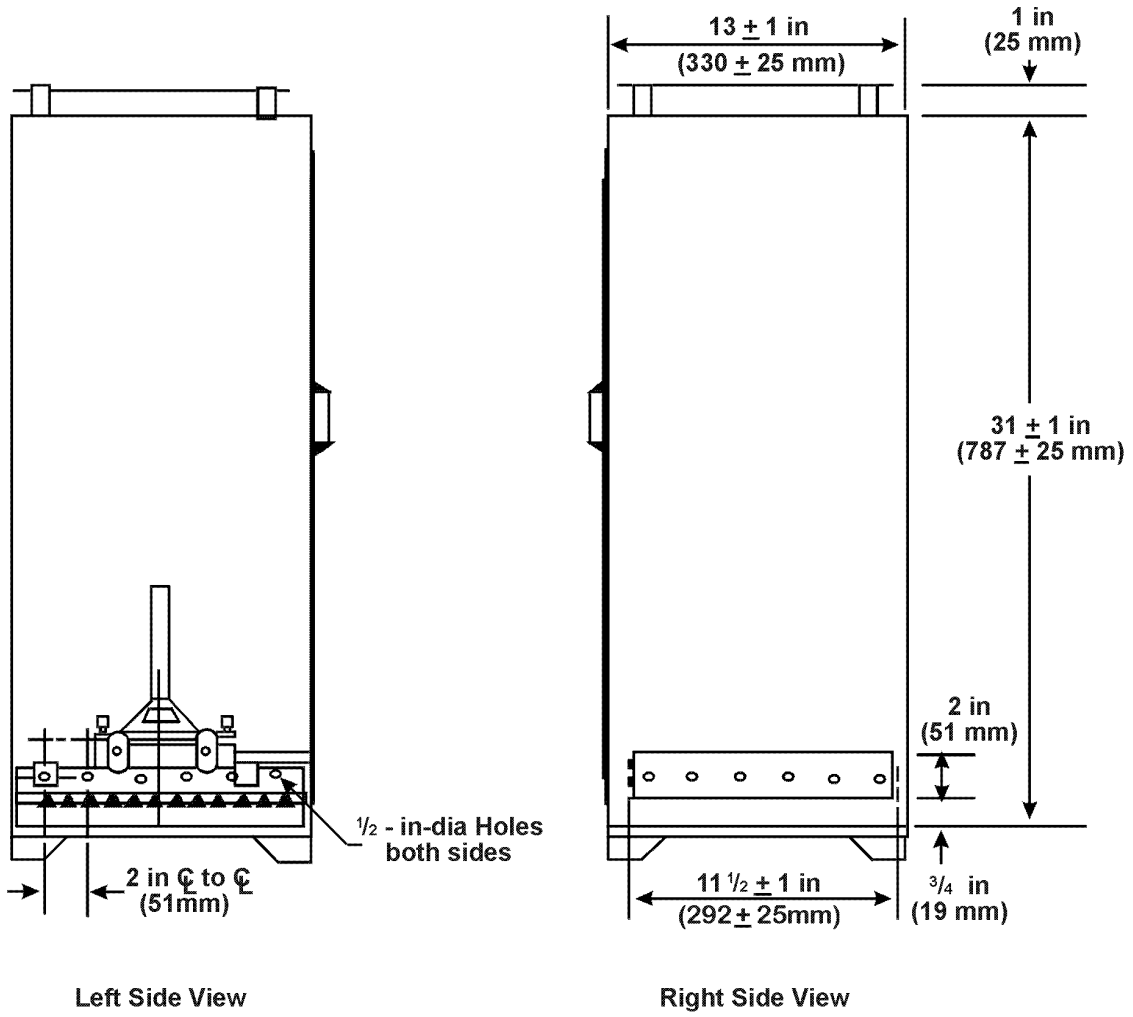


Figure 3. Side Views of Bunsen Burner Test Cabinet

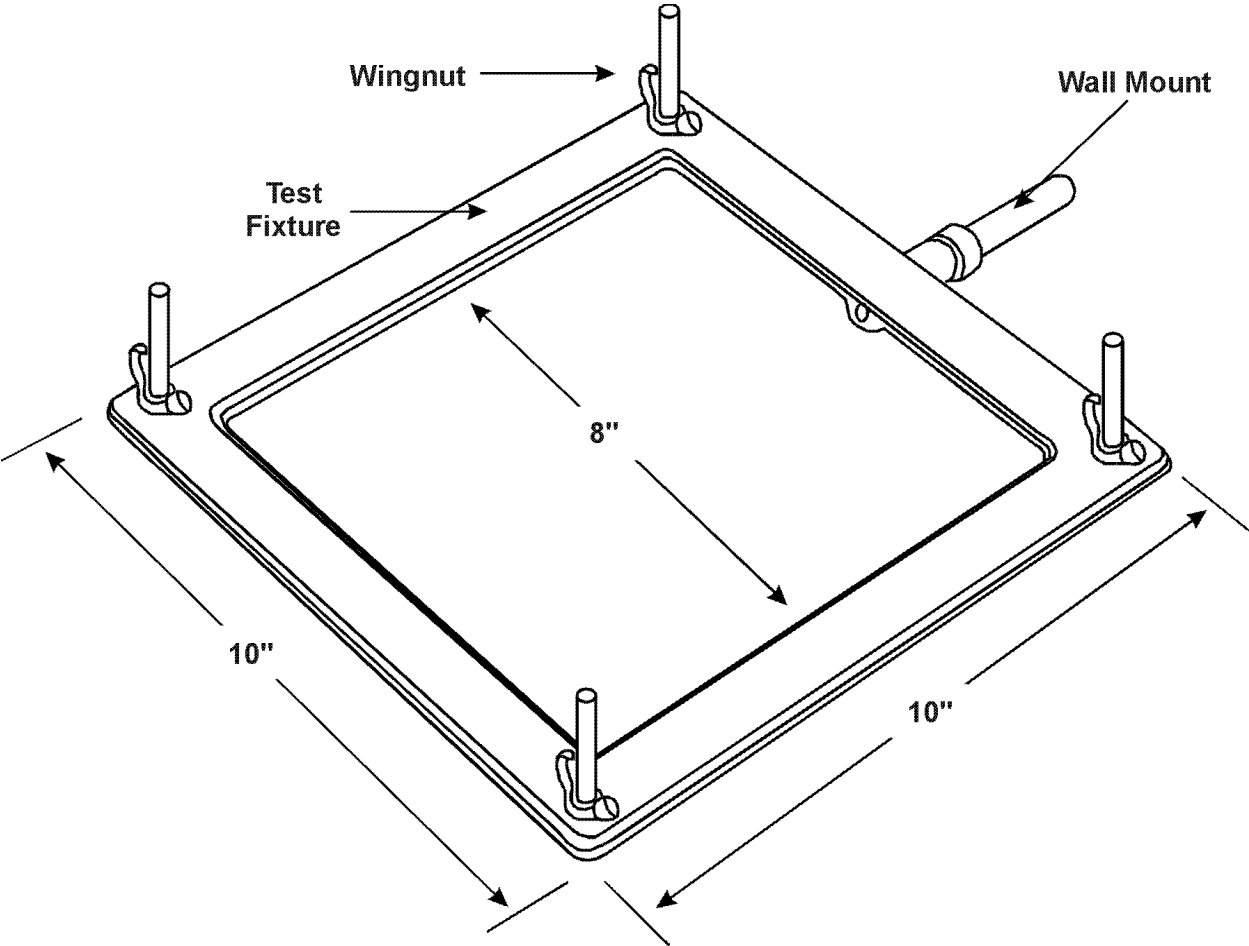


Figure 4. Horizontal Test Fixture

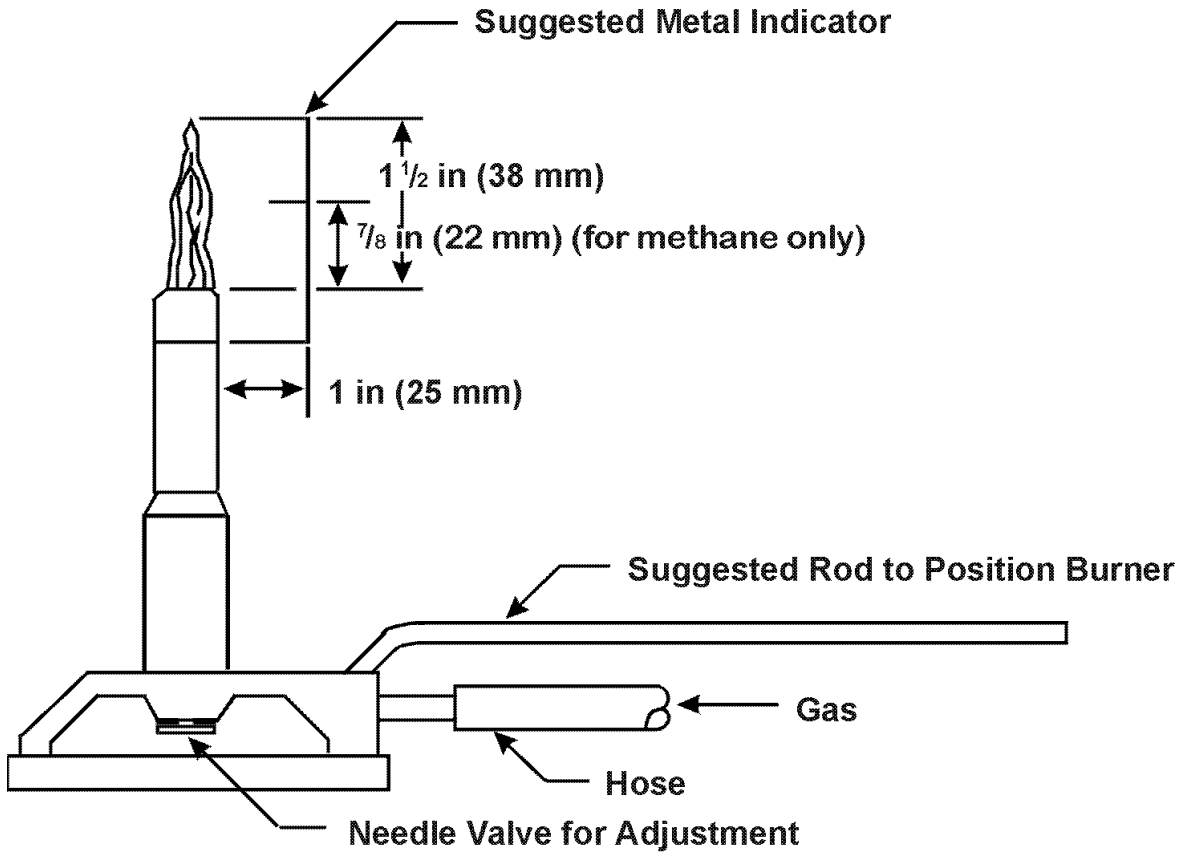


Figure 5. Burner Plumbing and Burner Flame Height Indicator

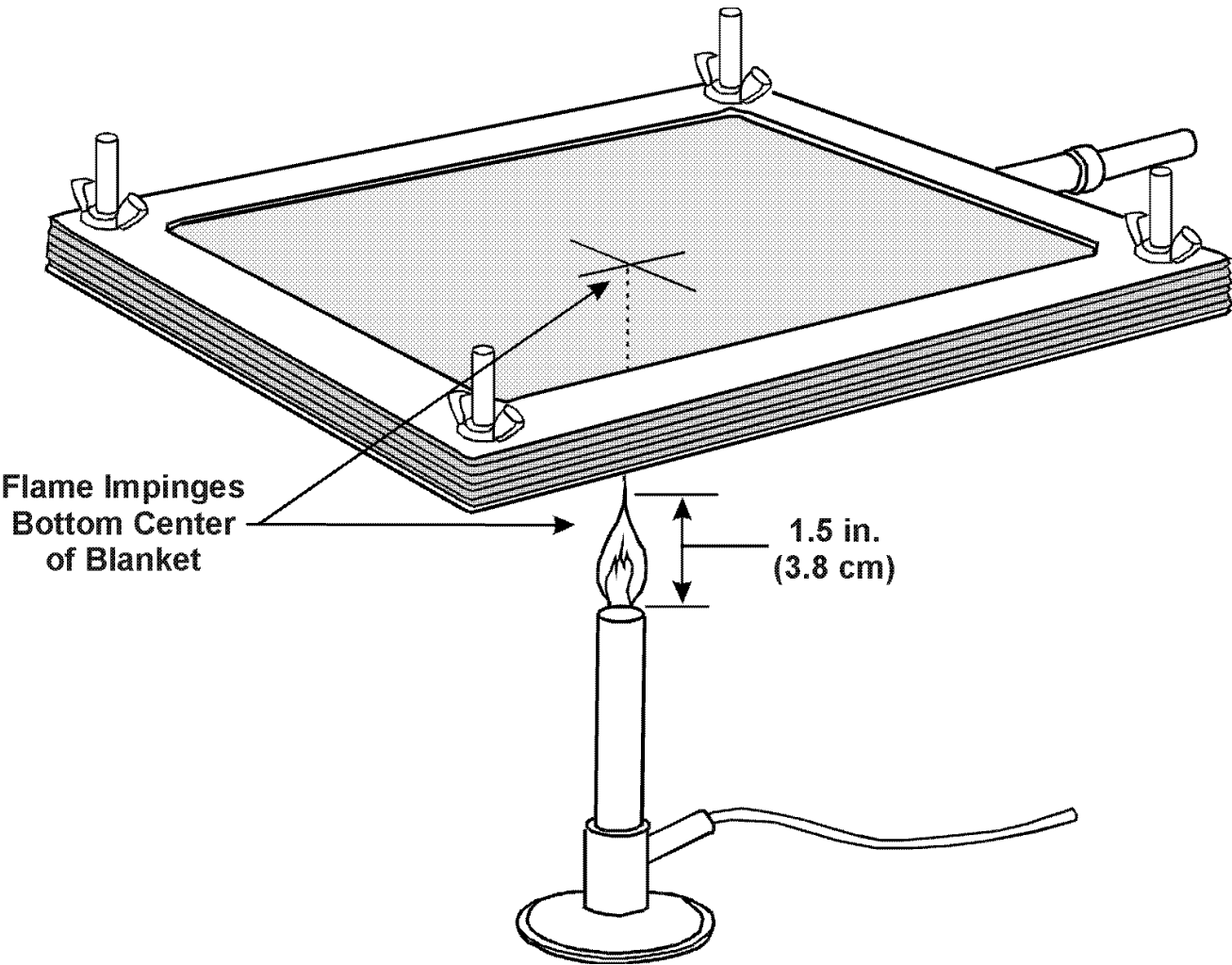
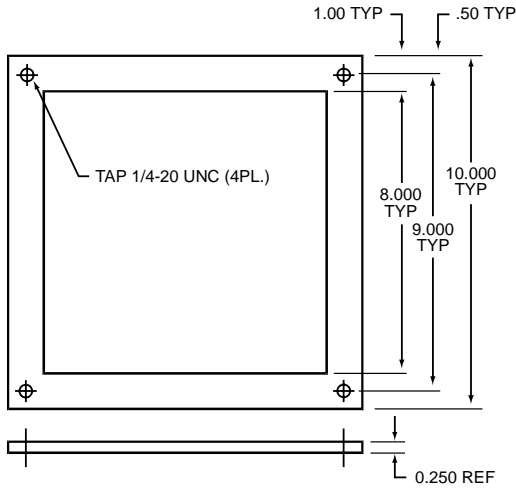
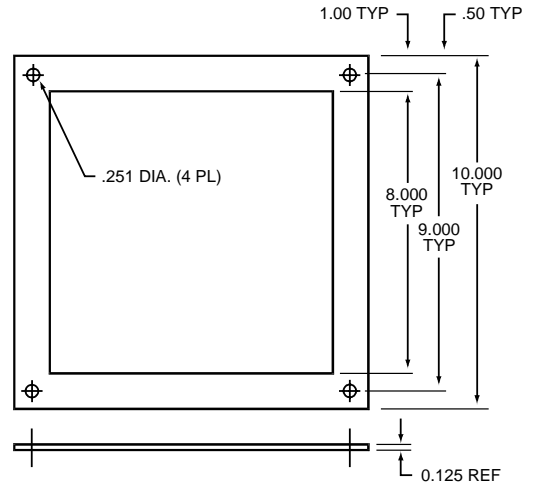


Figure 6. Horizontal Test Fixture with Four-Ply Blanket Sample



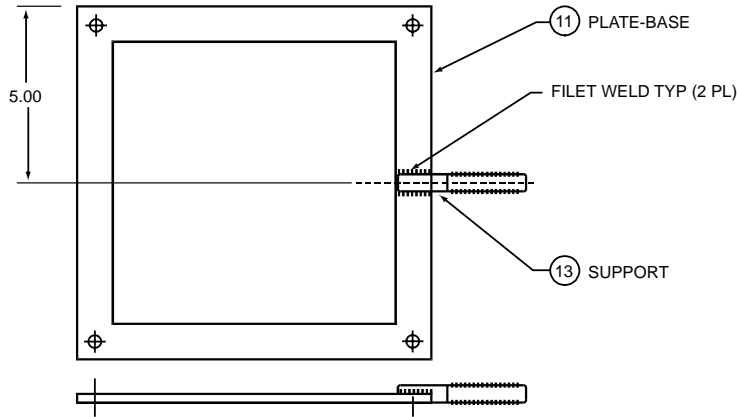
11 PLATE BASE

MATL: ALALY. PL. .250 THICK
QNTY: 1 REQ'D PER ASS'Y
FINISH: VIBRATORY SAND & CAUSTIC DIP



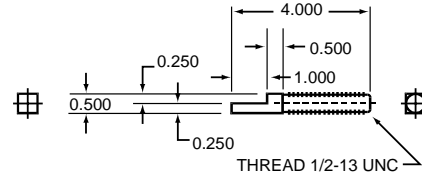
2 PLATE COVER

MATL: ALALY. PL. .125 THICK
QNTY: 1 REQ'D PER ASS'Y
FINISH: VIBRATORY SAND & CAUSTIC DIP



1 PLATE ASS'Y

MATL: MAKE FROM PARTS NOTED
QNTY: 1 REQ'D PER ASS'Y
FINISH: VIBRATORY SAND & CAUSTIC DIP



13 SUPPORT

MATL: ALALY. BAR. .5 SQUARE
QNTY: 1 REQ'D PER ASS'Y
FINISH: VIBRATORY SAND & CAUSTIC DIP

TOLERANCES (EXCEPT AS NOTED)	
1 PLACE	1.830
2 PLACE	1.813
3 PLACE	1.806
ANGULAR	1 1/2

Figure 7. Test Fixture

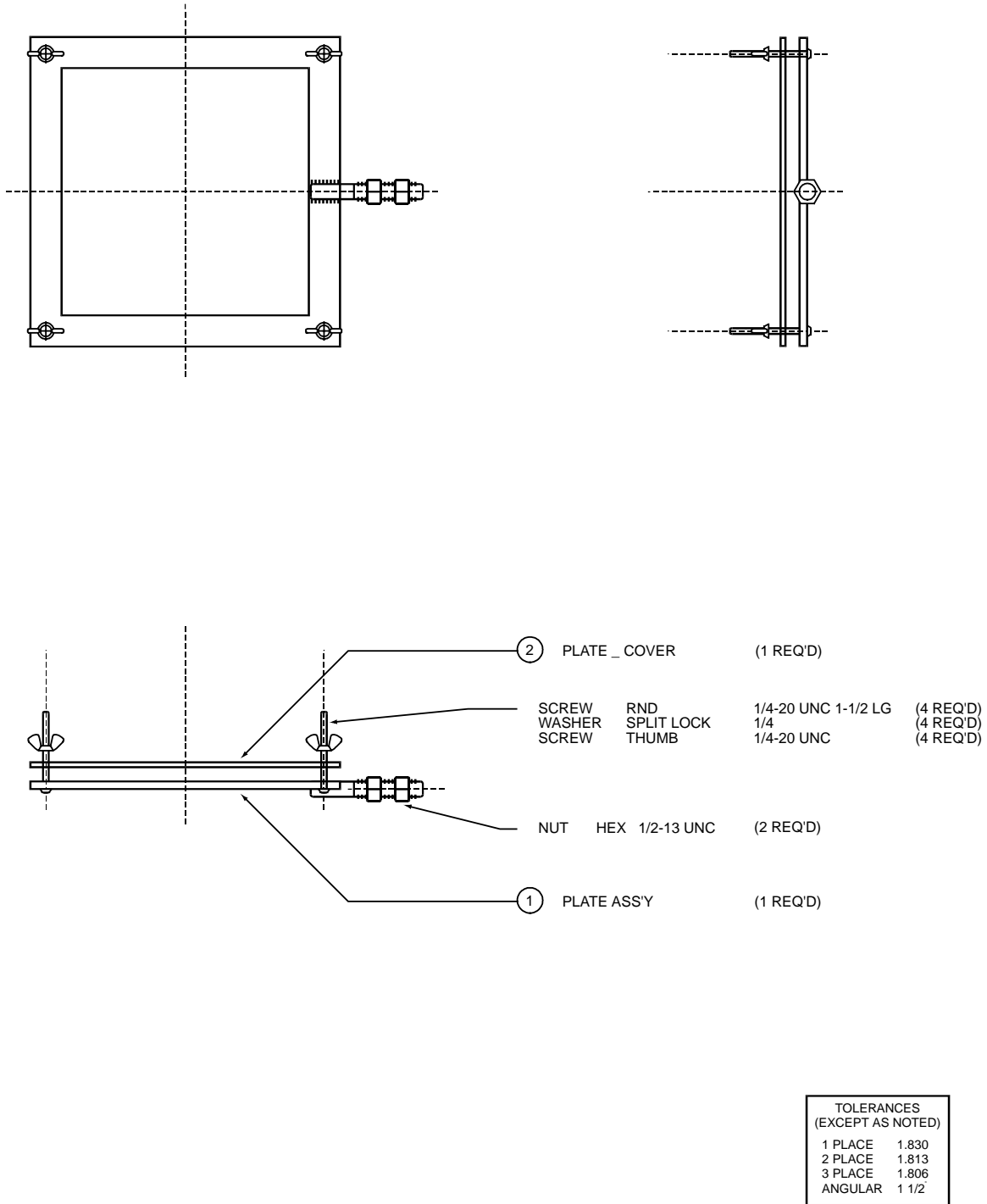


Figure 8. Test Fixture (continued)