

Chapter A3

Oil Burner Flammability Test for Seat Cushions

A3.1 Scope

A3.1.1 Applicability

This test method evaluates the burn resistance and weight-loss characteristics of aircraft seat cushions when exposed to a high-intensity open flame to show compliance to the requirements of 14 CFR 25.853.

A3.2 Definitions

A3.2.1 Vertical Assembly

The vertical assembly is the back cushion located in the vertical orientation. The vertical assembly may be representative of the production seat back, seat bottom, or both if the production articles have the same construction.

A3.2.2 Horizontal Assembly

The horizontal assembly is the bottom cushion in the horizontal orientation. The horizontal assembly may be representative of the production seat back, seat bottom, or both if the production articles have the same construction.

A3.2.3 Seat Test Sample

A seat test sample consists of one vertical assembly and one horizontal assembly. Both assemblies represent the same production cushion constructions; that is, both vertical and horizontal assemblies in the seat test sample have identical construction and materials proportioned to correspond to either the actual seat bottom or back cushion, but not both. For various reasons, seat bottom and back cushions on actual aircraft seats are typically slightly different.

NOTE: Foam headrest and footrest cushions should be treated the same as vertical and horizontal assemblies and tested as complete samples if their construction is different from the seat bottom (horizontal) and/or seat back (vertical) cushions. In some cases, it may be reasonable to include the headrest as part of the seat back cushion. In such a case, the cushions should be constructed as for foam combinations.

A3.2.4 Seat Test-Sample Set

A seat test-sample set consists of three or more replicate seat test samples.

A3.2.5 Burn Lengths

The four principal burn lengths are measured along the top side of the horizontal assembly, bottom side of the horizontal assembly, front side of the vertical assembly, and the back side

of the vertical assembly. The four burn lengths are defined as the distance measured in inches from the inside edge of the test-sample mounting frame (nearest the burner cone) to the farthest point where damage to the seat test sample occurred due to that area's combustion, including partial or complete consumption, charring, or embrittlement. However, this does not include areas that are merely sooted, stained, warped, or discolored.

A3.2.6 Percent Weight Loss

The percentage weight loss for a seat test sample is the pretest weight of the seat test sample less the posttest weight of the seat test sample expressed as the percentage of the pretest weight. All droppings falling from the seat test sample and test-sample mounting frame are to be discarded prior to determining the post-test weight.

A3.3 Apparatus

A3.3.1 Test-Sample Apparatus

The test-sample apparatus includes the seat test-sample mounting frame and drip pan. The test-sample apparatus must allow movement of the test sample so it can be positioned in front of the burner at the proper distance. It is recommended that the apparatus allow for a minimum 36 inches of distance between the burner cone and sample during burner warmup to prevent preheating of the sample.

A3.3.1.1 Test-sample Mounting Frame

The mounting frame for the seat test sample will be fabricated of 1- by 1- by 0.125-inch (25- by 25- by 3-mm) stainless-steel angle and 1- by 0.125-inch (25- by 3-mm) stainless steel flat stock as shown in figure A3-1. The dimensions listed for the test-sample mounting frame are all inside measurements. The frame's upright section used for mounting the vertical assembly must be 33 ± 0.125 inches high and 18.125 ± 0.125 inches wide. The frame's bottom section used for mounting the horizontal assembly must be 18.125 ± 0.125 inches wide and 22.125 ± 0.125 inches long. The vertical and horizontal mounting surfaces should have two supporting braces made from 1- by 0.125-inch steel flat stock. The centerlines of the flat stock braces are 6 ± 0.125 inch measured from the outer edges of the steel angle on the left and right sides of the frame. Four legs fabricated of 1- by 1- by 0.125-inch steel angle and 12 ± 0.125 inches tall are located below the four corners of the horizontal assembly mounting section of the frame. All connecting joints of the stand are welded, and the flat stock components are butt welded. The test-sample mounting frame is used for mounting the seat test sample's horizontal and vertical assemblies. The position of the test-sample mounting frame relative to the burner cone during testing must be positioned as shown in figure A3-2.

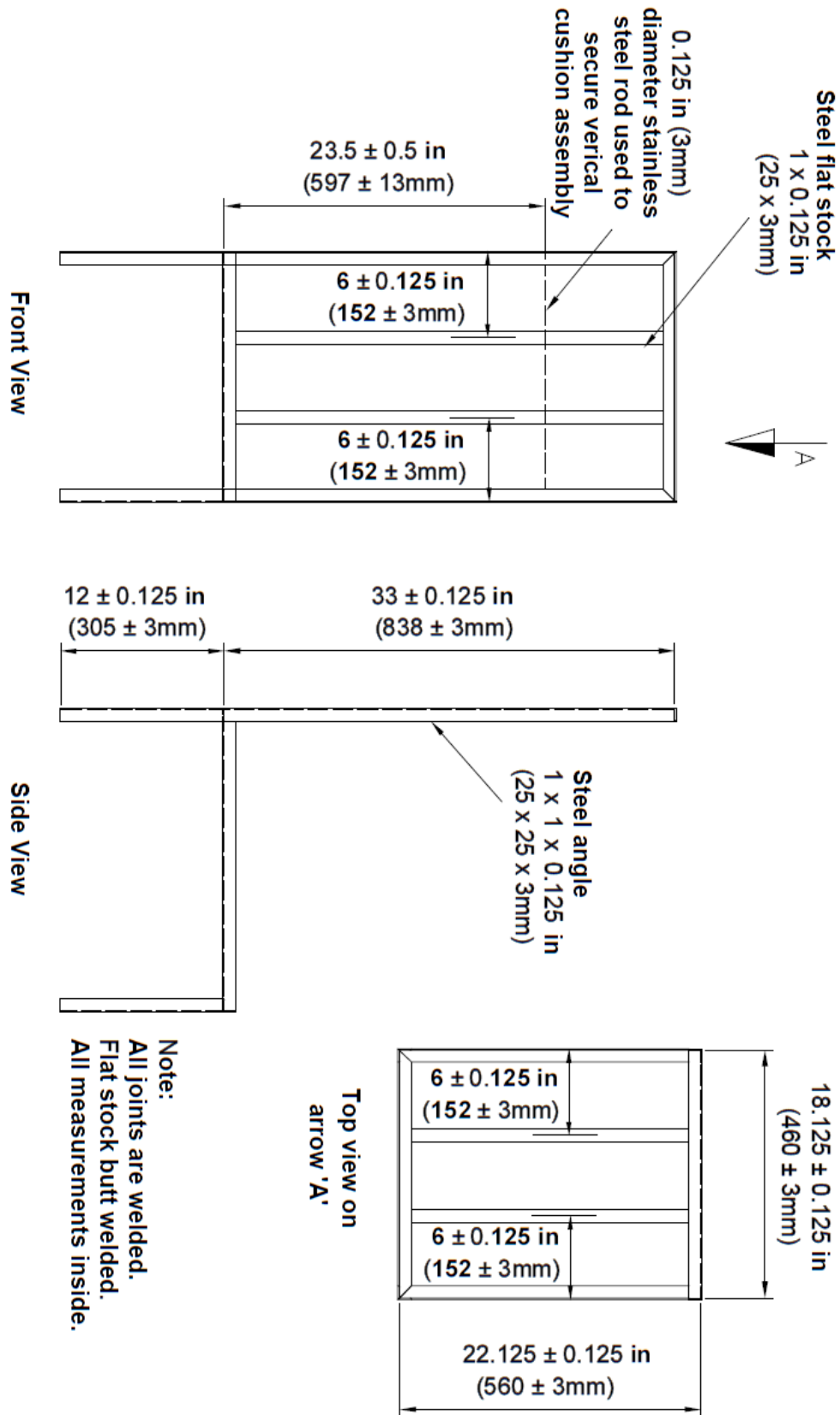


Figure A3-1. Front, side, and top views of seat test-sample mounting frame

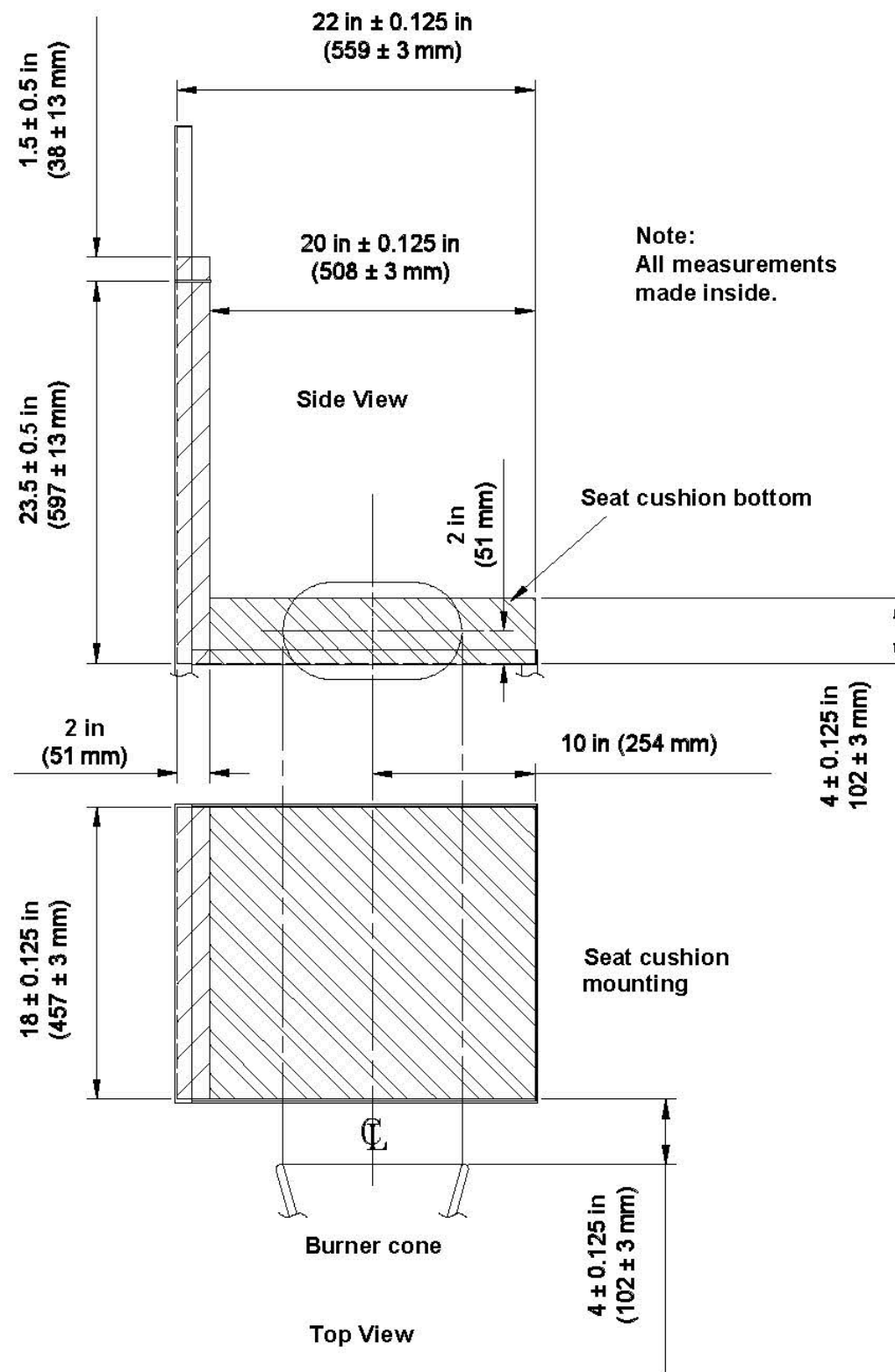


Figure A3-2. Top and side view of seat test sample in seat test-sample mounting frame

A3.3.1.1.1 Restraint Method for Fabric Dress Covered Samples

A stainless-steel rod will be used to aid in securing the vertical seat cushion to the sample frame (see figure A3-2). The rod (see figure A3-3) will be uninsulated, solid, 0.125 inch (3 mm) in diameter and be located 1.5 ± 0.5 inch (38 ± 13 mm) from the top surface of the back (vertical) cushion assembly as it sits in the sample test frame.

A3.3.1.1.2 Restraint Method for Leather Dress Covered Samples

Because of leather's tendency to shrink away from the flame during testing, both the vertical and horizontal cushion assemblies will require rod restraints. The rods must be uninsulated, solid stainless steel measuring 0.125 inch (3 mm) in diameter (see figure A3-3). Two rods must be used to restrain the back cushion assembly, and one rod must be used to restrain the bottom cushion assembly, as shown in figures A3-4 and A3-5.

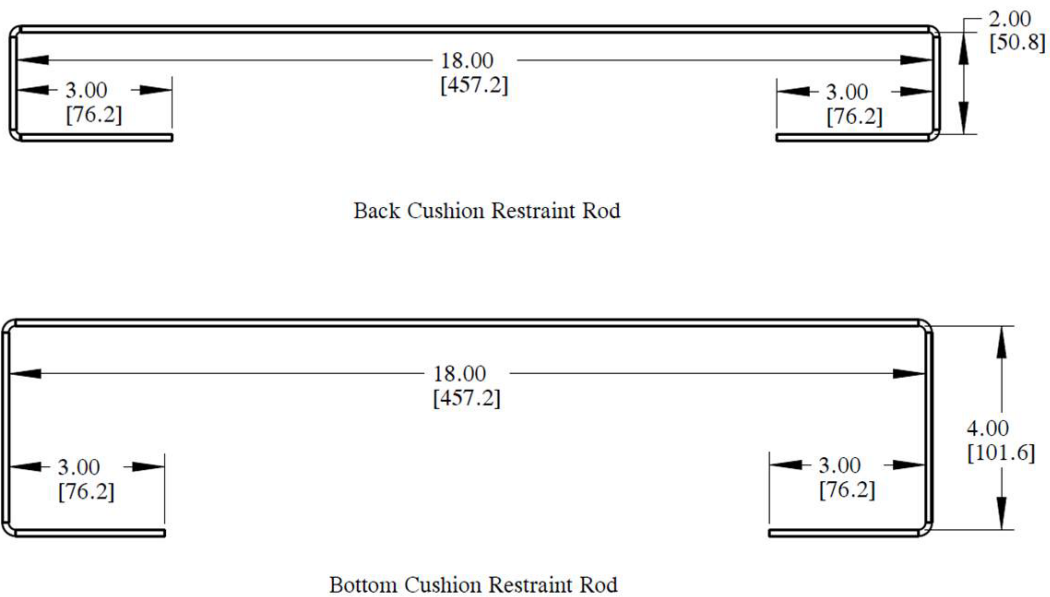


Figure A3-3. Back cushion and bottom cushion restraint rods

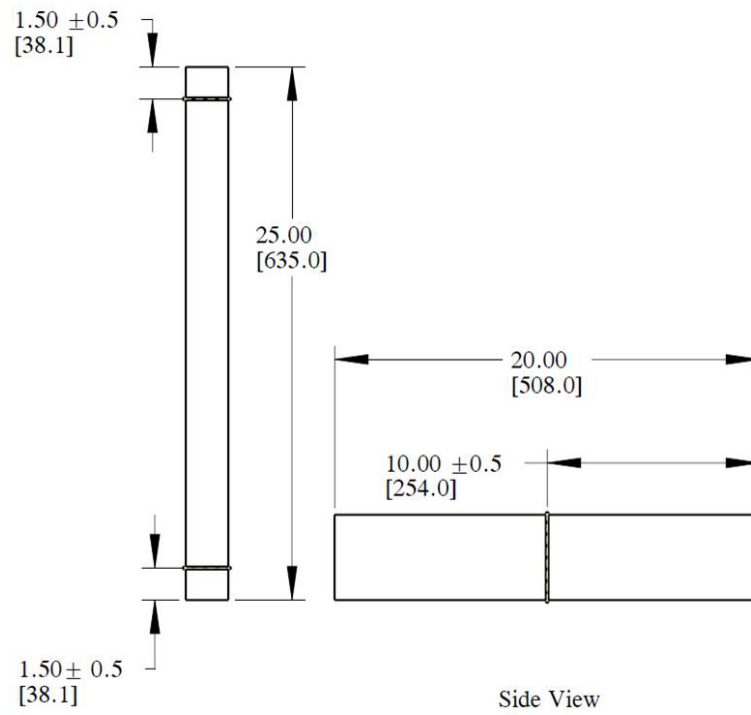


Figure A3-4. Side view of restraint rod locations for leather-covered seat samples

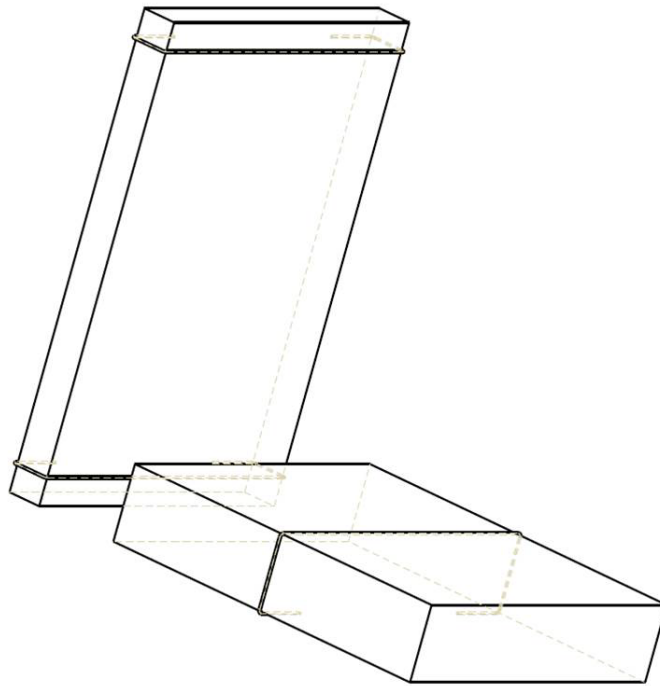


Figure A3-5. Leather-covered seat sample with rod restraints

A3.3.1.2 Drip Pan

The test-sample apparatus must include a suitable drip pan lined with aluminum foil with the dull (less reflective) side facing up. The drip pan must be located at the bottom of the test-sample mounting frame legs at a distance of 12 inches (305 mm) or greater below the portion of the test-sample mounting frame that supports the bottom (horizontal) cushion assembly.

A3.3.2 Burner

The test burner is the Sonic Fire Test Burner, described in detail in appendix K. The burner configuration for this test method is displayed in table A3-1.

Table A3-1. Burner configuration for the seat cushion flammability test

Fuel	Nozzle	2.0 gal/hr 80° Solid Spray
	Volumetric Flow Rate (gal/hr)	2.0 ± 0.1
	Pressure (psig)	110 ± 10
Air	Diffusion Method	Stator and Turbulator
	Pressure (psig)	45 ± 1
	Mass Flow Rate (SCFM)	54.2
	Burner Orientation	Horizontal

A3.3.2.1 Inlet Condition Measuring

To obtain an accurate measurement of the conditions entering the burner, the fuel pressure and temperature, and air pressure and temperature measurements must be made nearest to the burner inlet (see figure A3-6). To minimize air-stream disruptions, the intake air temperature must be measured prior to the sonic nozzle.

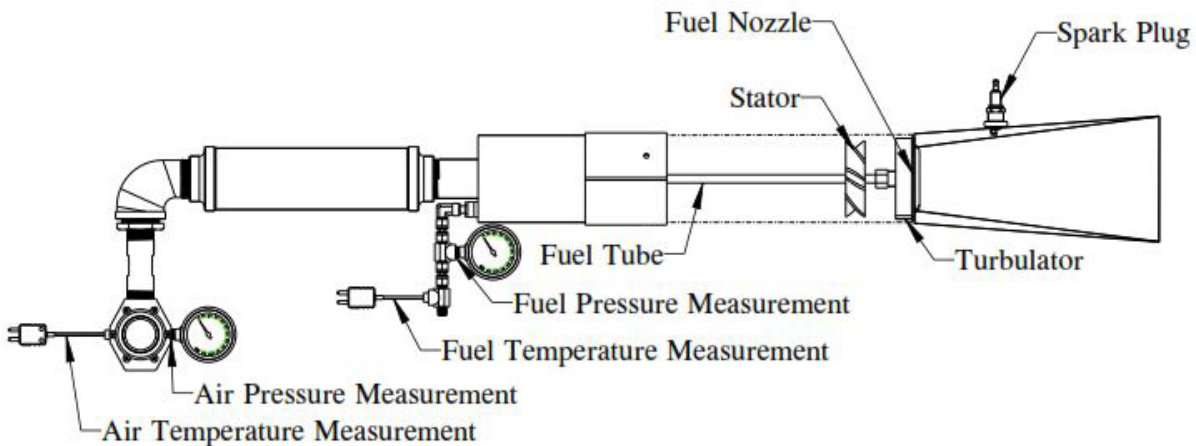


Figure A3-6. Inlet condition measurement location (side view)

A3.3.2.2 Fuel Nozzle

A screw-in style fuel nozzle is required to maintain a fuel pressure that will yield a 2 ± 0.1 gal/hr (7.57 L/hr $\pm$ 0.38 L/hr) fuel flow. A Delavan type-B fuel nozzle with an 80 degree solid spray angle nominally rated at 2.0 gal/hr (7.57 L/hr) at 100 lb/in² (0.69 MPa) has been found to deliver the appropriate flow rate and produce the proper flame pattern and is recommended. Actual flow rate measurements may deviate from the advertised flow rate. The actual flow rate must be measured manually using a flexible tube, graduated cylinder, and timing device, as described in section A3.5.4.5. The fuel pressure must then be adjusted accordingly to produce the required fuel flow of 2 ± 0.1 gal/hr (7.57 L/hr $\pm$ 0.38 L/hr). For more details, refer to appendix K, section K.3.4.4, Fuel Nozzle.

A3.3.2.3 Fuel Pressure Regulation

The fuel must be properly pressurized to deliver the proper fuel flow. Ideally, this pressure must be in the range of 100 to 120 lb/in² (0.69 to 0.83 MPa). For details on fuel pressurization and regulation, refer to appendix K, section K.3.4, Fuel System.

A3.3.2.4 Fuel Type

A kerosene-type fuel is used in the burner equipment. Jet A and JP-8 (military equivalent to Jet A) fuel is recommended; however, other fuels are permissible if the flame temperature can be maintained according to section A3.6.1.3. For more details, refer to appendix K, section K.3.4.6, Fuel.

A3.3.2.5 Burner Cone

A 12 ± 0.125 -inch (305 ± 3 -mm) burner extension cone is fitted to the end of the burner draft tube. The opening must be 6 ± 0.125 inches (152 ± 3 mm) high and 11 ± 0.125 inches (280 ± 3 mm) wide. For more details, refer to appendix K, section K.3.7, Burner Cone.

A3.3.2.6 Spark Plug

An automotive-style spark plug is fitted into a threaded boss, which is welded to the burner extension cone. The threaded boss is centered on the upper surface of the burner cone, at a distance of 6 ± 0.125 inches (152 ± 3 mm) from the intake end of the burner cone. For more details, refer to appendix K, section K.3.5, Ignition System.

A3.3.3 Burner Flame Consistency Validation Thermocouples

Seven thermocouples must be used to check the flame temperature of the burner. The thermocouples must be 0.125-inch (3.2-mm) diameter, insulation packed, 310 stainless-steel sheathed, type K (Chromel-Alumel), grounded junction with a nominal 24 American Wire Gauge (AWG) size conductor. Thermocouples purchased with a certificate of calibration may provide more accurate readings but are not required. The seven thermocouples must be attached to a steel mounting plate to form a thermocouple rake for placement in front of the burner cone during the burner-flame consistency-validation procedure (see figure A3-7). It is recommended the thermocouple mounting plate be a minimum of 4 inches (102 mm) away from the tips of the thermocouples.

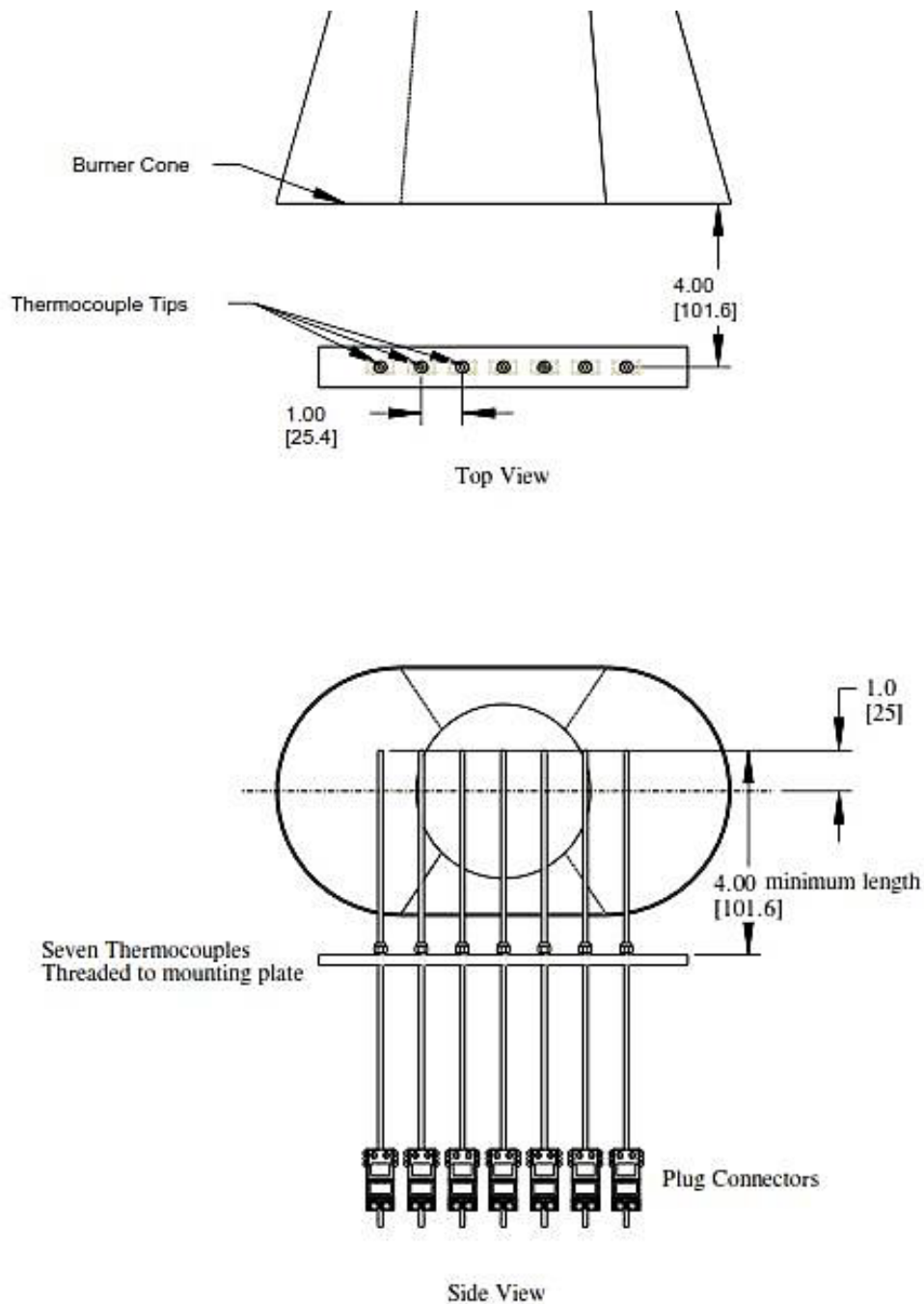


Figure A3-7. Top and side view of thermocouple rake bracket

A3.3.4 Instrumentation and Supporting Equipment

A3.3.4.1 Data Acquisition

A calibrated recording device or a computerized data-acquisition system with an appropriate range must be used to measure and record the outputs of the thermocouples.

A3.3.4.2 Timing Device

A stopwatch or other device, accurate to within ± 1 second per 8 hours (± 3 sec/day), must be used to measure the time of application of the burner flame and the test-sample extinguishment times.

A3.3.4.3 Test Chamber Anemometer

A handheld vane- or hotwire-type air velocity sensing unit capable of measuring accurately in the 0–100 ft/min range must be used to monitor the flow of air inside the test chamber when the ventilation hood is operating. Airflow measurements should be taken at the beginning of the day prior to operating the test burner. A suitable hotwire anemometer, which may be mounted to the sample test frame, is manufactured by Dwyer Instruments, model number 641-6-LED. A suitable handheld hotwire anemometer is manufactured by TSI, model number 9515. Vane-type anemometers typically do not function properly with airflow rates less than 50 ft/min.

A3.3.4.4 Digital Weight Scale

A suitable weight scale must be used to determine the initial and final weights of the test sample. The scale must have a resolution of 0.02 pounds (0.01 kg) and an accuracy of ± 0.02 pounds (± 0.01 kg).

A3.3.4.5 Test Chamber

A suitable test chamber must be used to reduce or eliminate the possibility of test fluctuation due to air movement. Although not required, the recommended minimum of the test-chamber floor area is 15 feet by 15 feet (4.57 m by 4.57 m) or larger.

NOTE: Smaller test cells may experience significant increases in ambient air temperature while testing. This may increase the severity of the test.

A3.3.4.6 Ventilation Hood

The test chamber must have an exhaust system capable of removing the products of combustion expelled during the tests.

A3.4 Test Samples

A3.4.1 Vertical Assembly (Back Cushion)

The constructed, finished sample assembly must be $18 + 0, -0.125$ inches ($457 + 0, -3$ mm) by $25 + 0, -0.125$ inches ($635 + 0, -3$ mm), by $2 + 0, -0.125$ inches ($51 + 0, -3$ mm), not including fabric closures (e.g., hook-and-loop) and seam overlap.

A3.4.2 Horizontal Assembly (Bottom Cushion)

The constructed, finished sample assembly must be $18 + 0, -0.125$ inches ($457 + 0, -3$ mm) by $20 + 0, -0.125$ inches ($508 + 0, -3$ mm) by $4 + 0, -0.125$ inches ($102 + 0, -3$ mm), not including fabric closures (e.g., hook-and-loop) and seam overlap.

A3.4.3 Seat Test-sample Number

A minimum of three seat test samples of the same construction and configuration must be prepared for testing.

A3.4.4 Seat Test-sample Fabrication

Each cushion assembly tested must be fabricated using the principal components (i.e., foam core, flotation material, fire-blocking material, if used, and dress covering) and assembly processes (representative seams and closures) intended for use in the production articles. If a different material combination is used for the production back cushion than for the production bottom cushion, both material combinations must be tested as a complete seat test sample. Each seat test sample will consist of a vertical cushion assembly and a horizontal cushion assembly (see figure A3-8).

NOTE: If several seat models use similar foam combinations, it is not necessary to test each combination if it is possible to bracket the various combinations. For example, if foam “A” makes up 80 percent and foam “B” makes up 20 percent of the foam volume in one seat model, and in another similar seat model foam “A” makes up 20 percent and foam “B” makes up 80 percent of the foam volume, it is generally acceptable to approve all combinations of “A” and “B” foams between these limits if the 20/80 and 80/20 extremes are tested and pass. In addition, for foams of a given chemical composition, low-density foam can be used in lieu of foams of higher density. In this case, as in the case of foam combinations, all other elements that make up the cushion must be the same (see figure A3-8 and A3-9).

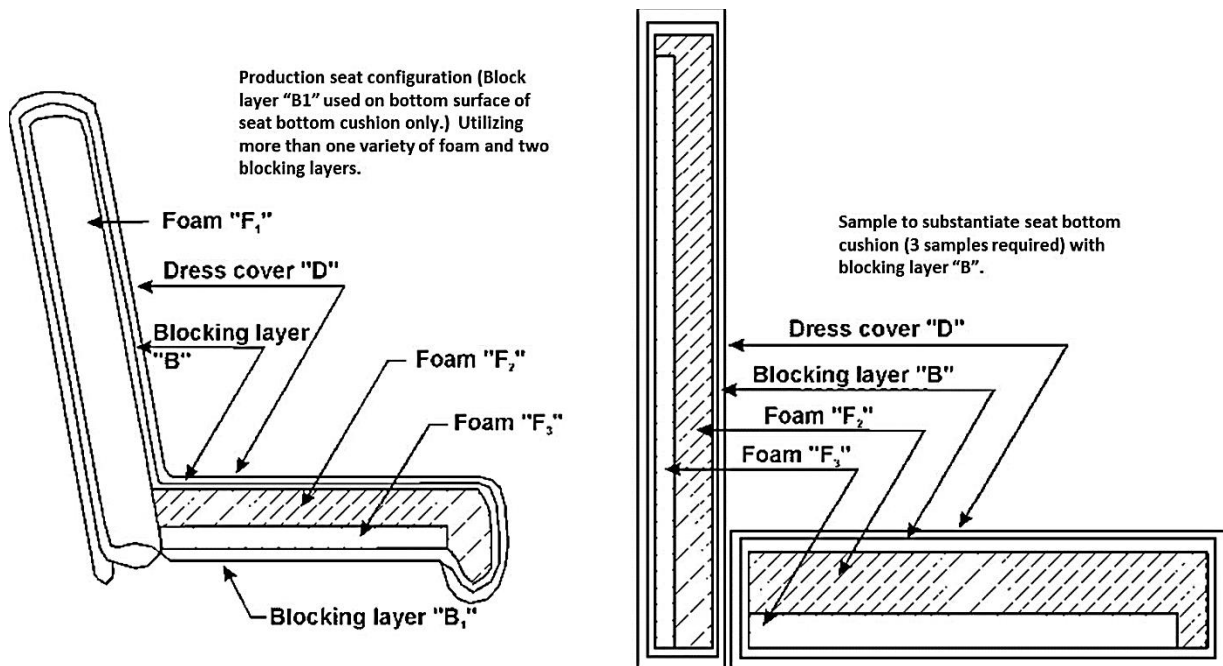


Figure A3-8. Example of production seat configuration and seat test sample to substantiate production seat bottom cushion with blocking layer "B"

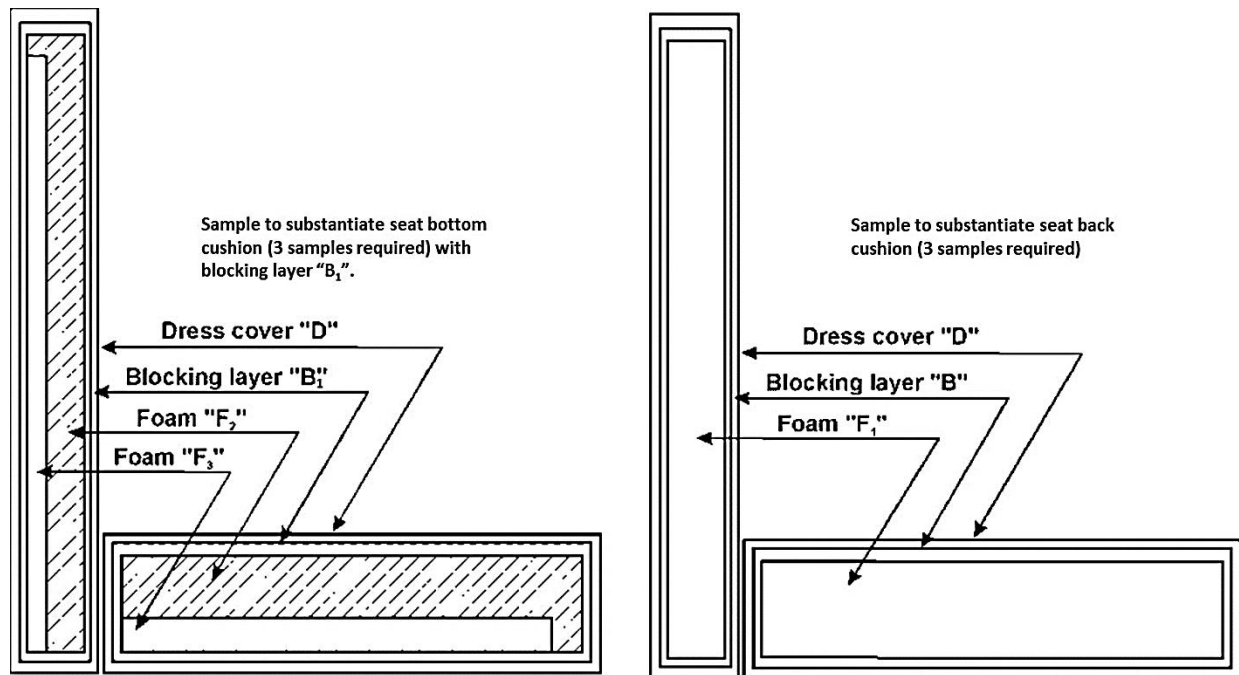


Figure A3-9. Seat test sample to substantiate production seat bottom with blocking layer "B₁" and seat test sample to substantiate production seat back with blocking layer "B"

A3.4.4.1 Fire-Blocking Material

If the cushion is constructed with a fire-blocking material, the fire-blocking material must completely enclose the cushion foam core material.

A3.4.4.1.1 Cushion Assembly Fire-Blocking Fabrication

The method of fabricating blocking layer seams and closures must be the same as the production method. In fabricating a cushion assembly, the fire blocker must be configured so that any possible weak point is exposed to the burner flame. This may require configuring a cushion assembly so that the seam is exposed to the test burner, even though a seam may not be positioned as such on a production cushion.

A3.4.4.1.2 Multiple Fire-Blocking Materials

If more than one fire-blocking layer material is used on a given production cushion, each blocking layer material must be subjected to this test procedure as separate test samples. The fire-blocking material must completely encapsulate a cushion assembly so that all fire-blocking layers are subjected to the same level of test severity. Fire-blocking layers cannot be used in combination for this test (see figure A3-9).

A3.4.4.2 Foam

Seats that utilize more than one variety of foam (composition, density) must have test samples constructed that reflect the foam combination used.

A3.4.4.3 Dress Covering

If a production seat construction utilizes more than one dress covering, the test configuration may be represented as shown in figure A3-10.

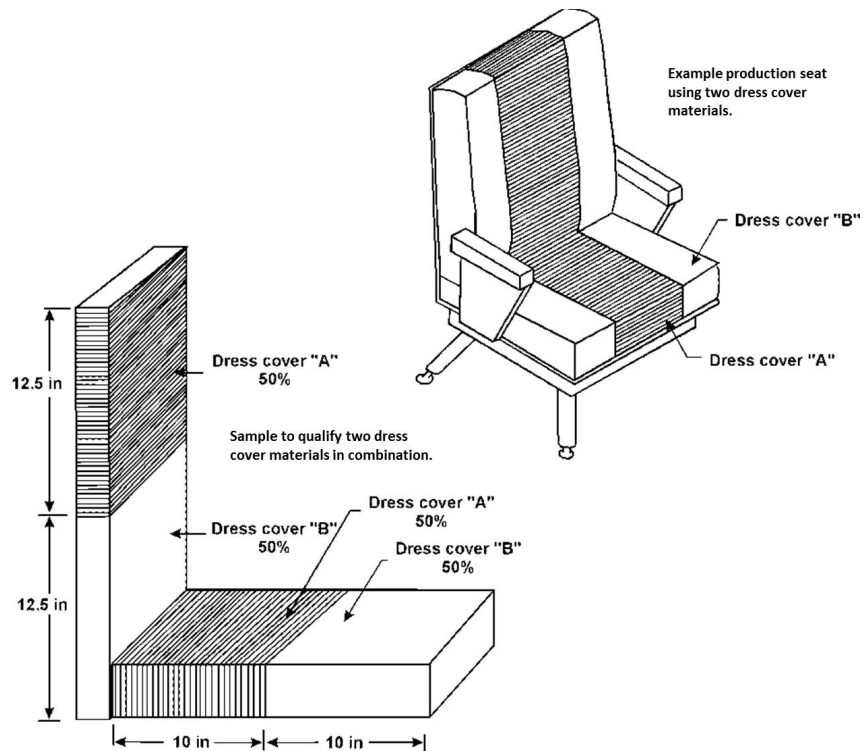


Figure A3-10. Example of production seat configuration using two dress cover materials and a seat test sample to substantiate dress cover combination

NOTE: When any seat construction tested has passed, a separate test is not required for another seat construction if the only difference from the first test is the dress covering, provided the replacement dress covering is comprised of a similar weave design and fiber type, as described in section A3.4.4.3, and the burn length of the replacement dress covering, as determined by the Bunsen burner test specified in § 25.853(b), does not exceed the burn length of the dress covering used for the test.

Seat test samples are intended to represent the principal material elements and construction methods of the production seats. Items that are decorative in nature, such as buttons, detail stitching, hand-hold straps, Velcro®-attached strips, or thin outer cover paddings like armrest covers and filler around food trays, that do not penetrate the fire-blocking layer when fastened are not required to be represented on the test sample. Dress cover details and items not associated with the cushion construction, such as metal seat pans or other metal structures, should not be included in the sample weight because they are not part of the principal seat construction. Layers of padding or filler immediately under the dress cover material are considered to be part of the dress cover material and should be included in the seat test samples.

Similar dress covering (from Advisory Circular 25.853-1, “Flammability of Aircraft Seat Cushions,” sections 5d [1] and [2]) refers to dress covering materials having the same material composition, weave style, and weight. Material blends can be considered similar when the constituent materials fractions are the same, $\pm 6\%$, as the tested material. Examples of different weave styles include plain, jacquard, or velvet. With regard to

weight, lighter fabrics are generally more critical than heavier fabrics. Because of the severe shrinking and unpredictable distortion experienced by leather dress cover materials, similarity approvals for leather are not recommended.

Certification by similarity to previously tested dress covers should be limited to instances in which the material composition is the same and the weight and weave type are essentially the same. In all cases, results of the Bunsen burner test per § 25.853(a) for the new material should be equal to or better than the tested material with respect to burn length. In addition, it may be useful to evaluate the weight-loss and burn-length results of the oil-burner test to determine if the tested material is a good basis for similarity; that is, the closer weight loss and burn length with the oil burner are to the maximum allowed, the more alike the dress covering materials should be for similarity. In general, test data and resultant experience gained from conducting tests should also be major sources of information to determine if approval by similarity is acceptable.

A3.4.5 Sample Conditioning

Samples will be conditioned at $70^{\circ} \pm 5^{\circ}\text{F}$ ($21^{\circ} \pm 3^{\circ}\text{C}$) and $55\% \pm 10\%$ relative humidity for a minimum of 24 hours prior to testing. Remove only one sample at a time from the conditioning environment immediately before testing.

A3.5 Preparation of Apparatus

A3.5.1 Alignment

Mount a test sample on the test-sample frame. Level and center the sample frame assembly to ensure alignment with the burner cone. Move the test-sample frame into the test position in front of the burner, and check for proper alignment (i.e., distance from exit of burner cone to face of test sample, proper sample height with respect to cone centerline). The movable assembly should incorporate mechanical stops or detents to ensure that the samples can be moved into position quickly without measurement during testing.

A3.5.2 Chamber Ventilation

Turn on the ventilation hood for the test chamber. Do not turn on the pressurized burner air. With the test sample still in place on the test frame, measure the airflow in the test chamber using a hotwire anemometer or equivalent measuring device. The vertical air velocity can be measured 0.5 inch from the rear face of the vertical assembly, and 2 inches below the midpoint of the vertical assembly top surface. The vertical air velocity must be no greater than 100 ft/min (50.8 cm/sec). The horizontal air velocity can be measured 0.5 inch above the midpoint of the horizontal assembly top surface. The horizontal air velocity must be no greater than 50 ft/min (25.4 cm/sec).

NOTE 1: Airflow measurements do not have to be taken for each sample tested. It is recommended the airflow measurements be taken at the beginning of the day before testing and at the end of the day when testing is completed.

NOTE 2: Personnel present within the test cell may influence air velocity readings. This may be avoided by mounting the anemometer instrumentation to the sample holder during test cell air velocity measurements.

A3.5.3 Test Chamber Air Temperature

The temperature of the test chamber should be between 50°F and 100°F (10°C and 38°C) before the start of each test. The chamber air temperature should be measured 0.5 inch (13 mm) above the center of the horizontal (cushion) assembly. Remove the sample from the test frame. Do not use this sample for testing. The sample may be kept for future test chamber airflow and temperature measurements.

A3.5.4 Sonic Burner Configuration

A3.5.4.1 Fuel Nozzle Location

The tip of the fuel nozzle, or fuel exit plane, must be located 0.1875 ± 0.020 inch (4.763 ± 0.5 mm) from the exit plane of the turbulator (see figure A3-11).

A3.5.4.2 Stator Adjustment

The stator is positioned by adjusting its translational position and its axial position on the fuel rod.

A3.5.4.2.1 Stator Translational Position

The front face of the stator must be located 2.6875 ± 0.020 inches (68.263 ± 0.5 mm) from the exit plane of the turbulator (see figure A3-11). This stator translational position is also 2.5 inches (63.5 mm) from the tip of the fuel nozzle.

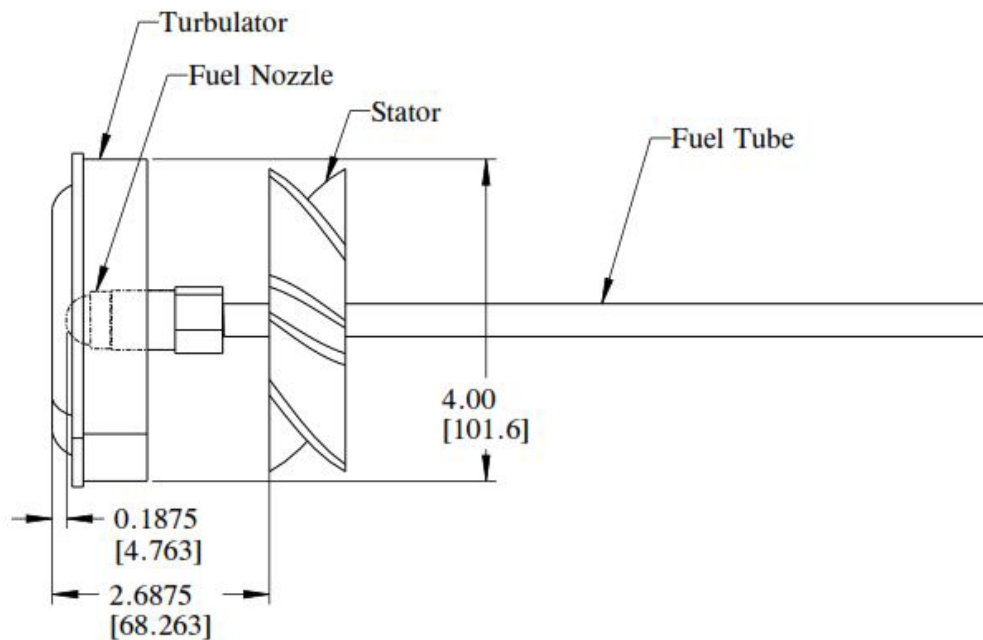


Figure A3-11. Fuel nozzle and stator locations

A3.5.4.2.2 Stator Axial Position

The line running through the set screw and geometric center of the stator will be used as a reference for properly orienting the rotational position of the stator. The stator must be positioned so the reference line angle is 0 degrees (12 o'clock) from the zero position when looking into the burner draft tube (see figure A3-12).

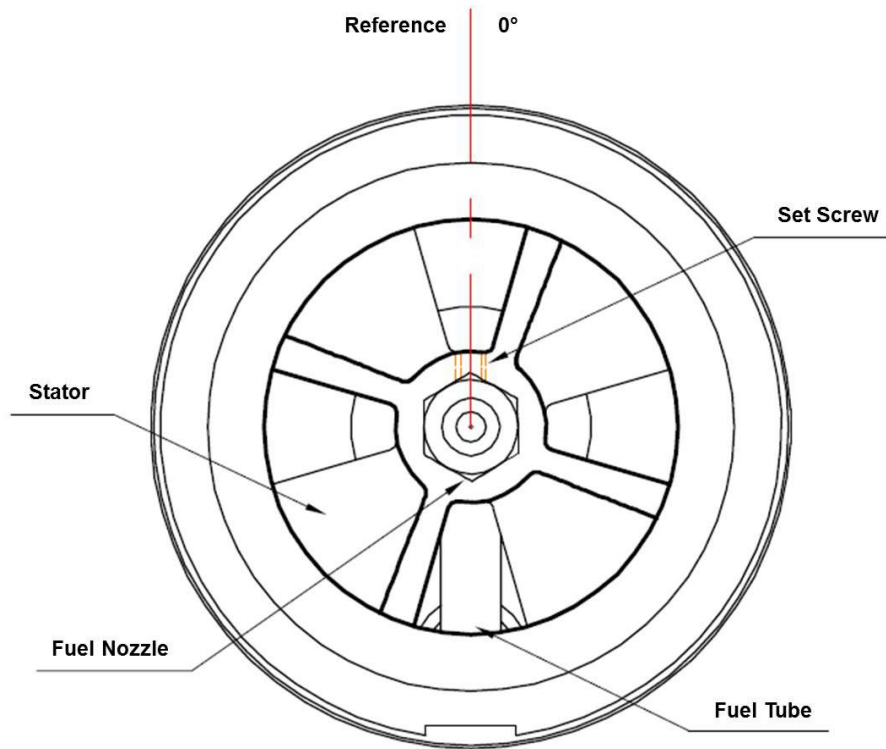


Figure A3-12. Stator axial position

A3.5.4.3 Spark Plug

A high-voltage oil-burner ignition transformer with an output of 10 kilovolts is used to create an arc across an automotive-type spark plug mounted in the burner extension cone.

A3.5.4.3.1 Spark Plug Gap

The spark plug gap (distance) between the two electrodes must be 0.100 inch (2.5 mm), as shown in figure A3-13.

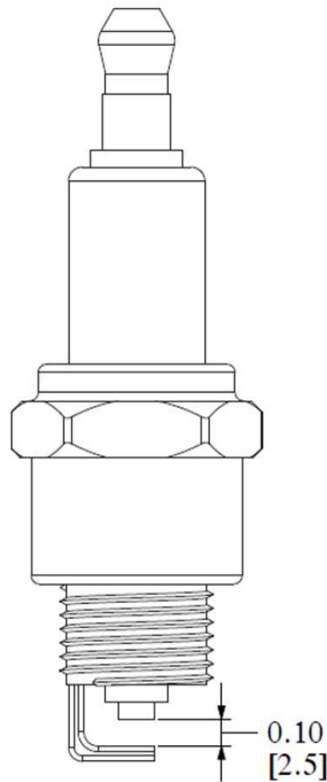


Figure A3-13. Spark plug gap measurement

A3.5.4.3 Spark Plug Wire Routing

The length and arrangement of the spark plug wire must be monitored to prevent heat damage during flame-temperature validation and testing. Once the burner is ignited, the outside surface temperature of the burner cone will increase rapidly, becoming capable of damaging the wire if it comes in contact with the cone. The spark plug wire should be carefully routed to prevent contact with the cone or other hot surfaces and should also be shielded in a heat-resistant covering to further protect it from convective heat damage from the burner flames. The wire can be routed as shown in figure A3-14, in which it does not contact any components in the vicinity of the burner cone.

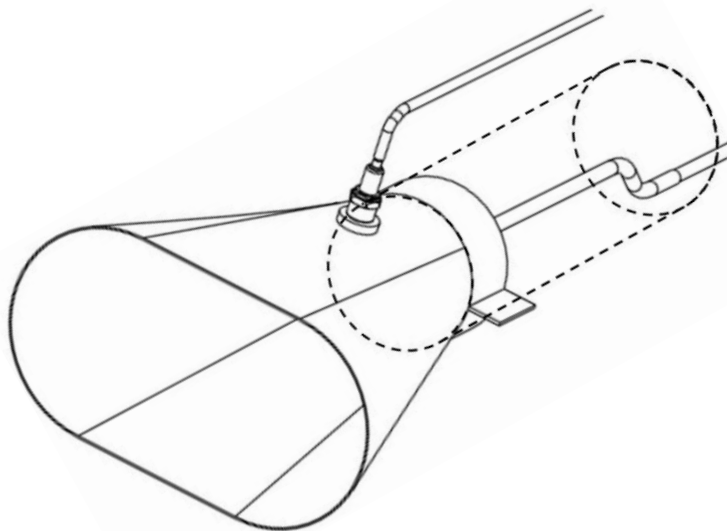


Figure A3-14. Proper routing of the spark plug wire

A3.5.4.4 Volumetric Airflow Control

The volumetric airflow is controlled via a regulated sonic nozzle. Adjust the upstream supply air pressure to $45 \pm 1 \text{ lb/in}^2$ ($0.31 \pm 0.007 \text{ MPa}$). The intake air temperature must be maintained within the range of 40°F to 60°F (4°C to 16°C). For more details, refer to appendix K, section K.3.2, Combustion Air Control.

A3.5.4.5 Fuel Flow Calibration

If a calibrated flow meter is not available, measure the fuel flow directly using a length of Tygon tubing and an appropriately sized graduated cylinder. Slip the Tygon tubing over the end of the fuel nozzle, making certain to establish a good seal. Direct the exit of the Tygon tubing into a small bucket or other collection basin. Turn on the fuel solenoid, making sure the ignition system is off. After establishing a steady stream of fuel flow, simultaneously direct the tubing exit into the graduated cylinder while beginning the stopwatch or timing device. Do not disturb or move the tube while collecting fuel in the graduated cylinder. Collect the fuel for a 2-minute period, making certain to immediately remove the graduated cylinder from the fuel stream at precisely 2 minutes. Calculate the flow rate, and ensure that it is $2 \pm 0.1 \text{ gal/hr}$ ($7.57 \pm 0.38 \text{ L/hr}$). If the flow rate is not within the tolerance, adjust the fuel pressure accordingly. Record the fuel pressure necessary to achieve the required fuel flow. The recorded fuel pressure must be monitored and maintained during burner operation and fluctuate no more than $\pm 2 \text{ lb/in}^2$ ($\pm 0.0138 \text{ MPa}$) during flame-consistency validation and sample testing. A flame-temperature validation or sample test will be void should the fuel pressure fluctuate outside of this range during either

procedure. The temperature of the fuel must be maintained within the range of 32°F–52°F (0°C –11°C).

NOTE: It is important to establish a steady stream of fuel before starting the fuel-flow measurement process. It is recommended the fuel flow steadily from the hose for a minimum 10-second period before collecting fuel in the graduated cylinder.

A3.6 Burner Flame Consistency Validation

A3.6.1 Sonic Burner

The sonic burner used in the test must be checked to ensure the proper flame temperature is being produced for consistent and accurate test results.

A3.6.1.1 Move the test-sample apparatus from the test position to the warmup position. Examine and clean the burner cone of any evidence of buildup of combustion products, such as soot. Soot buildup inside the cone may affect the flame characteristics and cause flame temperature validation difficulties. Check to ensure burner cone dimensions are within specified tolerances before flame validation.

A3.6.1.2 Mount the thermocouple rake on a movable stand that can be quickly moved into position in front of the burner. Move the rake into the flame-validation test position and check the distance of each of the seven thermocouples to ensure that they are located 4 ± 0.125 inches (102 ± 3 mm) from the vertical plane of the burner cone exit. Ensure that the horizontal centerline of the thermocouples is offset 1 ± 0.063 inch (25.4 ± 1.6 mm) above the horizontal centerline of the burner cone (see figure A3-7). Place the center thermocouple (thermocouple number 4) in front of the vertical center of the burner cone exit. Note that the movable thermocouple rake stand must incorporate detents that ensure proper centering of the thermocouple rake with respect to the burner cone so that rapid positioning of the rake can be achieved during the validation procedure. Once the proper position is established, move the thermocouple rake away, and move back into the flame-temperature validation position to recheck distances. When all distances and positions are confirmed, move the thermocouple rake away from the burner.

A3.6.1.3 While the thermocouple rake is away from the burner, turn on the spark plug, pressurized air, and fuel flow, and light the burner. Allow the burner to warm up for 2 minutes. After warmup, move the thermocouple rake into position and allow 1 minute for thermocouple stabilization, then record the temperature of each of the seven thermocouples once every second for 30 seconds. Remove the thermocouple rake from the flame-temperature validation position, and turn off the burner. Calculate the average temperature of each thermocouple over this period and record. Although not a requirement for testing, the recommended average temperature of each of the seven thermocouples should be $1700^{\circ}\text{F} \pm 100^{\circ}\text{F}$ ($927^{\circ}\text{C} \pm 55^{\circ}\text{C}$). The burner should be rechecked to ensure it is configured properly if temperatures are measured outside this recommended range. A flame that appears biased to one side, or produces significantly higher temperatures on one end of the flame validation thermocouple rake, may indicate that an adjustment of the fuel nozzle, internal stator orientation, or distance from the end of the draft tube may be

necessary if the adjustments are within allowable tolerances. If no problems are found with the burner, any thermocouple reading outside this range may require replacement. It is recommended that the burner flame temperature be validated at the beginning and end of each day testing is performed.

NOTE 1: The thermocouples are subjected to high temperature durations during calibration. Because of this type of cycling, the thermocouples may degrade with time. Small but continuing decreases or extreme variations in temperature or no temperature reading at all are signs that the thermocouple or thermocouples are degrading or open circuits have occurred. In this case, the thermocouple or thermocouples should be replaced to maintain accuracy in calibrating the burner. It is recommended that a record be kept for the amount of time the thermocouples are exposed to the oil burner's flame.

NOTE 2: The sonic burner is sensitive to proper alignment of the fuel nozzle. It is crucial that the fuel nozzle be aligned to the geometric center of the turbulator. A slight adjustment of the fuel tube between the stator and fuel nozzle may be required to obtain an even temperature profile across the thermocouple rake. The center point of the nozzle where the fuel exits should not deviate more than 0.0625 inch from the geometric center of the turbulator exit plane when looking into the burner draft tube. This should be performed only after checking the burner for proper configuration.

A3.7 Test Procedure

A3.7.1 Examine and clean the cone of soot deposits and debris. Remove any debris or remains of prior test samples from the test-sample apparatus.

A3.7.2 Record the weight of a seat test sample to the nearest 0.02 pound (0.01 kg). Refer to section A3.10 to determine if the test sample is considered lightweight. If so, the covering will need to be removed from each cushion sample, and the covering and the foam cushion must be weighed separately and recorded for each sample.

A3.7.3 Secure the seat test sample to the sample mounting frame. The seat back cushion assembly can be secured at the top with a 0.125-inch diameter stainless-steel rod. Reference sections A3.3.1.1.1 and A3.3.1.1.2 for guidance information on securing samples.

A3.7.4 Ensure that the vertical plane of the burner cone is at a distance of 4 ± 0.125 inches (102 ± 3 mm) from the test sample and that the horizontal centerline of the burner cone is aligned with the horizontal centerline of the bottom cushion assembly, as shown in figure A3-2.

NOTE 1: It is important to ensure the burner cone is aligned to the horizontal assembly when testing a sample, as described in section A3.7.4. The position of the burner relative to the test-sample mounting frame may differ slightly because of dimensional tolerances.

NOTE 2: Dress cover features such as hook-and-loop closures may protrude beyond the dress covering material. The additional thickness of such features is not to be included in the $4 \pm$

0.125-inches (102 ± 3 mm) distance from the seat test-sample horizontal assembly to the vertical centerline of the burner cone exit plane.

A3.7.5 Move the test-sample apparatus into the warmup position so that the flame does not impinge on the mounted test sample during the warmup period. Ignite the burner and allow the flame to stabilize for 2 minutes.

A3.7.6 Begin the test by moving the test-sample apparatus into the test position and start the timing device when the sample is fully in the test position.

A3.7.7 Expose the test sample to the burner flame for 2 minutes, and then turn off the burner. Immediately move the sample apparatus out of the test position.

A3.7.8 Terminate the test when the sample self-extinguishes. If the sample does not self-extinguish after 5 minutes from the time the burner has been turned off, observe and record the post-test weight of the sample at the 5-minute mark, then terminate the test by extinguishing the seat test sample.

NOTE: Only gaseous extinguishers should be used that do not impact the weight of the seat test-sample remains. Care should be used during extinguishment to prevent disturbing remaining seat material, which may affect the posttest weight of the sample.

A3.7.9 Immediately after test termination, determine the post-test weight of the remains of the seat sample to the nearest 0.02 pound (0.01 kg), excluding droppings.

A3.7.10 Measure the four burn lengths.

NOTE: An industry practice acceptable to the FAA for determining sample damage length, to measure burn length, has been to use an object with a dull point, such as a pencil, and scrape the dress covering. If the object used penetrates the dress covering, damage has occurred because of that area's combustion. If the dress covering is not penetrated, damage has occurred because of pyrolysis and is not considered damaged by combustion.

A3.7.11 Repeat steps A3.7.1–A3.7.10 for the remaining seat test samples.

A3.8 Report

A3.8.1 Identify and describe each sample being tested. Report the type of foam (flame retardant [FR] molded or cut), foam density if known, and manufacturer and type of FR treatment if known.

A3.8.2 Report the number of samples tested.

A3.8.3 Report the pretest and posttest weight of each seat sample, the calculated percentage weight loss of each sample, and the calculated average percentage weight for the total number of samples tested.

A3.8.4 Report each of the four burn lengths for each sample tested.

A3.8.5 Provide a record of flame-temperature validation.

NOTE: Although not required, it may be useful to record the date, time, ambient air temperature, humidity level, and any other data that may be used to study the burn characteristics of the samples.

A3.9 Requirements

A3.9.1 For each of the four burn lengths measured on each test sample, no burn length may exceed 17 inches (432 mm) on the three samples tested. Should the burn length on the underside of the horizontal (cushion) assembly of a test sample extend to the frame angle support farthest from the burner cone, it is considered to have exceeded the 17-inch burn length criteria (i.e., it has reached the side of the cushion opposite the burner, and the test sample is a failure; see figure A3-15).

A3.9.2 The individual percentage weight loss of each of the three samples tested will not exceed 10 percent.

A3.9.3 Eighty percent of the test samples must meet the criteria of paragraphs A3.9.1 and A3.9.2.

A3.9.4 In addition, the combined average percentage weight loss of all samples tested will not exceed 10 percent.

A3.9.5 If the minimum three samples fail to meet the above requirements, it is possible to run additional tests if 80 percent or more of the total number of samples meet the requirements. For example, if one of the three original samples fails the test requirement, two additional passing tests can be conducted for a total of four passing tests in five opportunities ($4/5 = 80\%$).

NOTE: The additional testing is intended for materials that typically meet the test requirements but experience an unexpected failure for unknown reasons. These failures, often referred to as rogue failures, are unanticipated and cannot be explained. Additional testing should not be viewed as a technique for meeting the requirement with inferior materials.

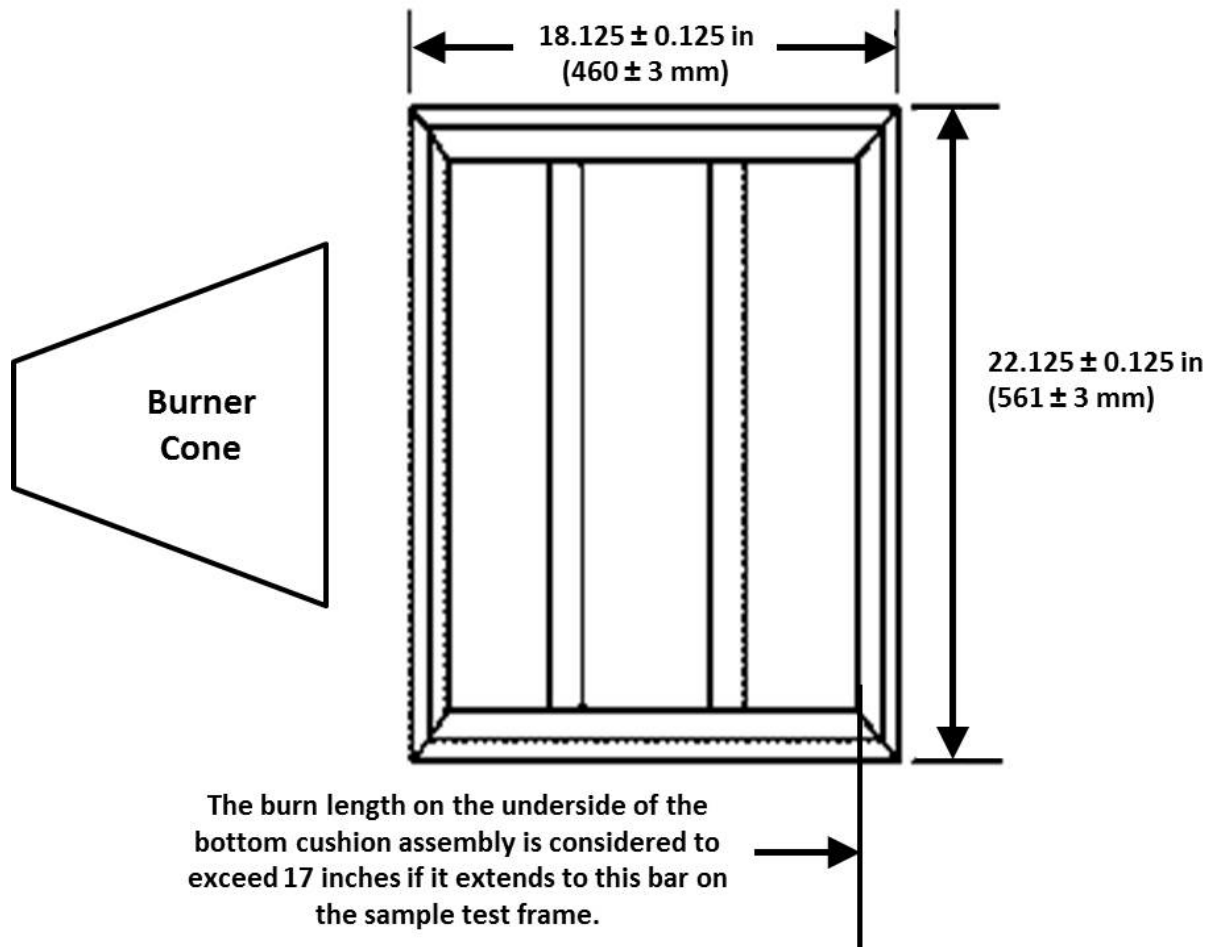


Figure A3-15. View above sample test frame bottom, indicating burn-length failure

A3.10 Requirements for Lightweight or Nonstandard Seat Test Samples

A3.10.1 A lightweight seat test sample is defined as weighing less than 3 pounds.

A3.10.2 If the total weight of the seat test sample is less than 3 pounds, the ratio of cushion weight to cover weight must be determined. The dress covers will be removed from the top and bottom foam cushion assemblies for each seat test sample so the dress covers and foam cushion assemblies can be weighed separately. The ratio of cushion weight to dress cover weight is then determined using the equation:

$$\text{Ratio of Cushion Weight to Cover Weight} = (\text{Cushion Weight})/(\text{Cover Weight})$$

When this ratio has been determined for each seat test sample, the average cushion-weight-to-cover-weight ratio can be calculated. The average ratio will be used to select the appropriate pass/fail criteria.

A3.10.3 See table A3-2 for pass/fail criteria. table A3-2 was taken from memo No. ANM-115-07-002, "Policy Statement on Certification for Flammability of Lightweight Seat Cushions."

A3.10.4 For each of the four burn lengths measured on each test sample, no burn length may exceed the permissible burn length specified in table A3-2 on any of the three seat test samples tested.

A3.10.5 The individual percentage weight loss of each of the three samples tested will not exceed the permissible weight-loss percentage specified in table A3-2 corresponding to the particular seat test-sample configuration being tested.

A3.10.6 Eighty percent of the test samples must meet the criteria of paragraphs A3.10.4 and A3.10.5.

A3.10.7 In addition, the combined average percentage weight loss of all samples tested will not exceed the permissible weight-loss percentage corresponding to the particular seat test-sample configuration being tested.

A3.10.8 If the minimum three samples fail to meet the above requirements, it is possible to run additional tests if 80 percent or more of the total number of samples meet the requirements. For example, if one of the three original samples fails the test requirement, two additional passing tests can be conducted for a total of four passing tests in five opportunities ($4/5 = 80\%$).

NOTE: The additional testing is intended for materials that typically met the test requirements but experienced an unexpected failure for unknown reasons. These failures, often referred to as rogue failures, are unanticipated and cannot be explained. Additional testing should not be viewed as a technique for meeting the requirement with inferior materials.

Table A3-2. Pass/fail criteria for lightweight seat test samples

Total Test-sample Weight (lb)	Average Ratio of Cushion Weight to Cover Weight	Permissible Weight Loss (%)	Permissible Burn Length (Inches)
Less than 3	1.8 to 2.0	12	16
	1.5 to 1.79	14	15
	1.1 to 1.49	16	14
	0.60 to 1.09	18	13
	0 to 0.59	20	12