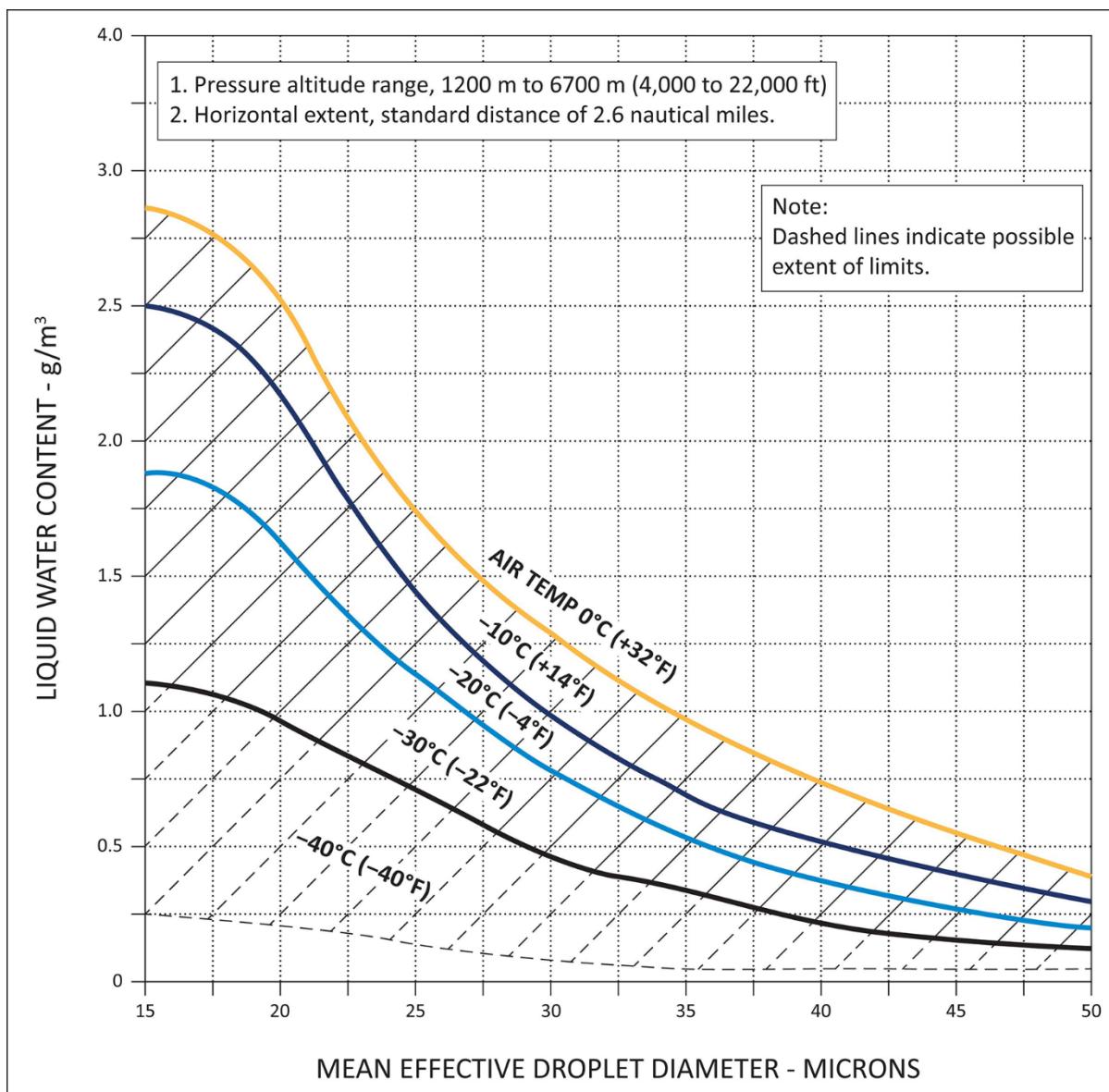
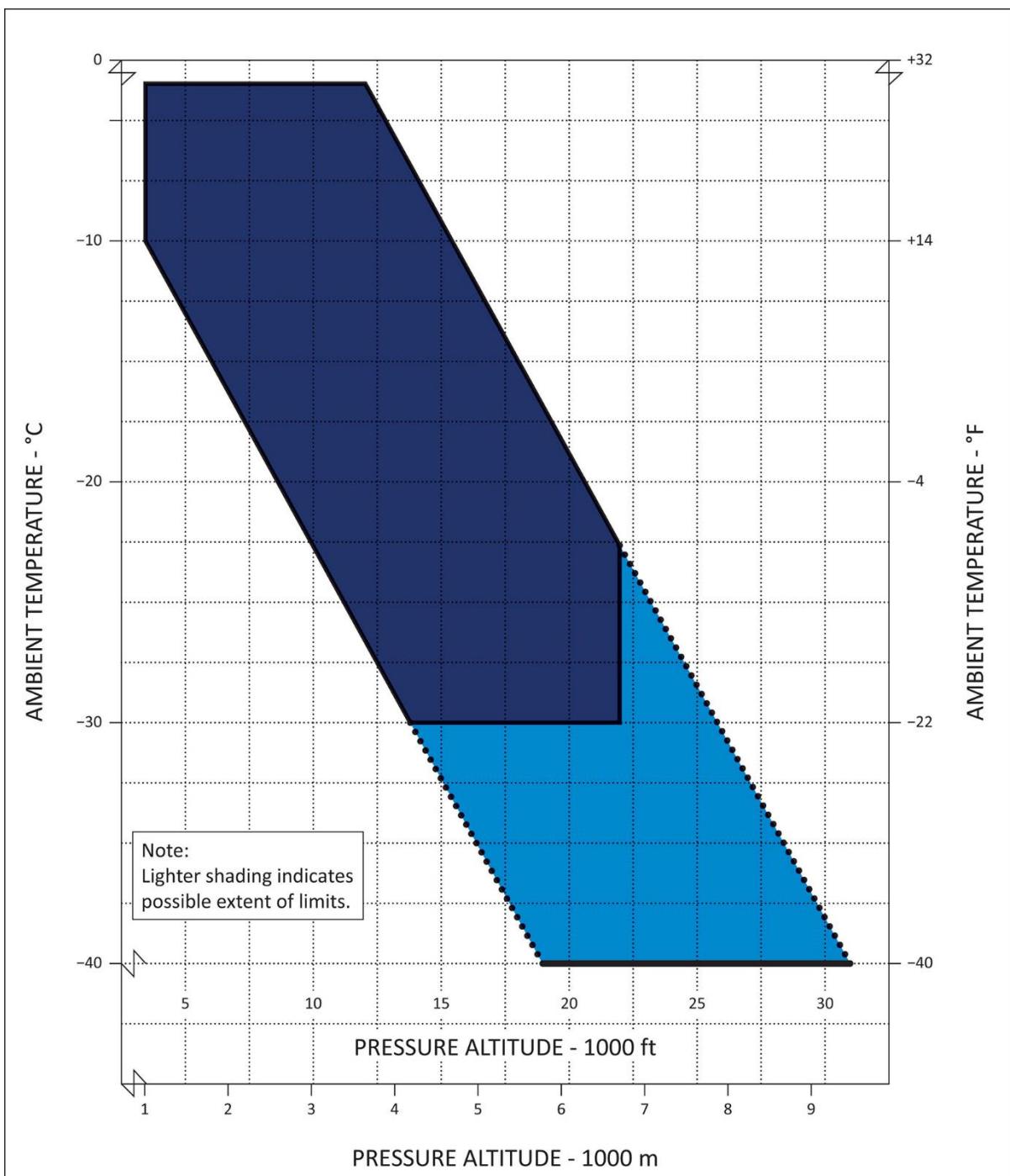
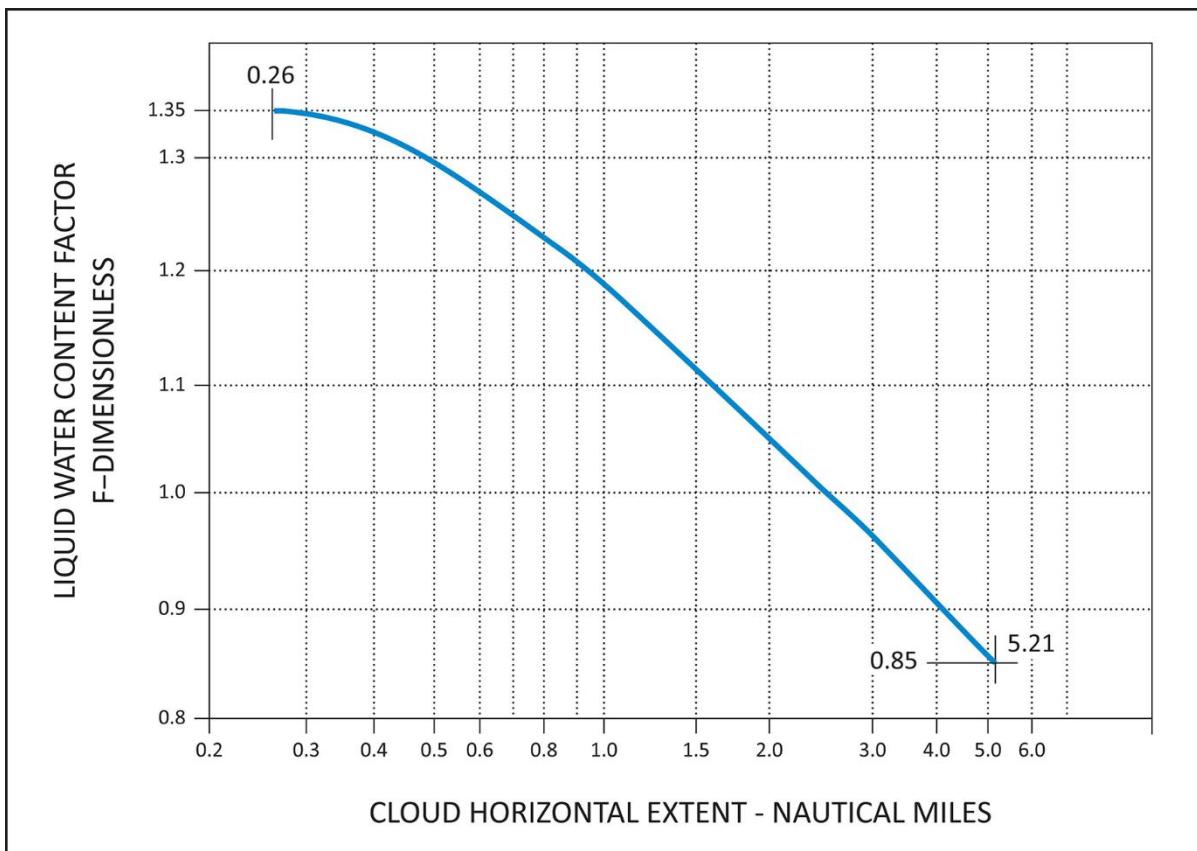

**FIGURE 3**
**CONTINUOUS MAXIMUM (STRATIFORM CLOUDS) ATMOSPHERIC ICING CONDITIONS**
**LIQUID WATER CONTENT FACTOR VS CLOUD HORIZONTAL DISTANCE**
*Source of data – NACA TN No. 2738.*


**FIGURE 4**
**INTERMITTENT MAXIMUM (CUMULIFORM CLOUDS) ATMOSPHERIC ICING CONDITIONS**
**LIQUID WATER CONTENT VS MEAN EFFECTIVE DROP DIAMETER**
*Source of data – NACA TN No. 1855, Class II – M, Intermittent Maximum*


**FIGURE 5**
**INTERMITTENT MAXIMUM (CUMULIFORM CLOUDS) ATMOSPHERIC ICING CONDITIONS**
**AMBIENT TEMPERATURE VS PRESSURE ALTITUDE**
*Source of data – NACA TN No. 2569.*


**FIGURE 6**
**INTERMITTENT MAXIMUM (CUMULIFORM CLOUDS) ATMOSPHERIC ICING CONDITIONS**
**VARIATION OF LIQUID WATER CONTENT FACTOR WITH CLOUD HORIZONTAL EXTENT**
*Source of data – NACA TN No. 2738.*

## APPENDIX D

*ED Decision 2003/2/RM*

*Criteria for determining minimum flight crew.* The following are considered by the Agency in determining the minimum flight crew under [CS 25.1523](#).

(a) *Basic workload functions.* The following basic workload functions are considered:

- (1) Flight path control.
- (2) Collision avoidance.
- (3) Navigation.
- (4) Communications.
- (5) Operation and monitoring of aircraft engines and systems.
- (6) Command decisions.

- 
- (b) *Workload factors.* The following workload factors are considered significant when analysing and demonstrating workload for minimum flight crew determination:
- (1) The accessibility, ease and simplicity of operation of all necessary flight, power, and equipment controls, including emergency fuel shutoff valves, electrical controls, electronic controls, pressurisation system controls, and engine controls.
  - (2) The accessibility and conspicuity of all necessary instruments and failure warning devices such as fire warning, electrical system malfunction, and other failure or caution indicators. The extent to which such instruments or devices direct the proper corrective action is also considered.
  - (3) The number, urgency, and complexity of operating procedures with particular consideration given to the specific fuel management schedule imposed by centre of gravity, structural or other considerations of an airworthiness nature, and to the ability of each engine to operate at all times from a single tank or source which is automatically replenished if fuel is also stored in other tanks.
  - (4) The degree and duration of concentrated mental and physical effort involved in normal operation and in diagnosing and coping with malfunctions and emergencies.
  - (5) The extent of required monitoring of the fuel, hydraulic, pressurisation, electrical, electronic, deicing, and other systems while en route.
  - (6) The actions requiring a crew member to be unavailable at his assigned duty station, including: observation of systems, emergency operation of any control, and emergencies in any compartment.
  - (7) The degree of automation provided in the aircraft systems to afford (after failures or malfunctions) automatic crossover or isolation of difficulties to minimise the need for flight crew action to guard against loss of hydraulic or electrical power to flight controls or other essential systems.
  - (8) The communications and navigation workload.
  - (9) The possibility of increased workload associated with any emergency that may lead to other emergencies.
  - (10) Incapacitation of a flight-crew member whenever the applicable operating rule requires a minimum flight crew of at least two pilots.
- (c) *Kind of operation authorised.* The determination of the kind of operation authorised requires consideration of the operating rules under which the aeroplane will be operated. Unless an applicant desires approval for a more limited kind of operation, it is assumed that each aeroplane certificated under this CS-25 will operate under IFR conditions.

## APPENDIX F

### Part I – Test Criteria and Procedures for Showing Compliance with CS 25.853, 25.855 or 25.869

*ED Decision 2015/019/R*

(a) *Material test criteria –*

(1) *Interior compartments occupied by crew or passengers.*

- (i) Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Part I of this Appendix. The average burn length may not exceed 15 cm (6 inches) and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.
- (ii) Floor covering, textiles (including draperies and upholstery), seat cushions, padding, decorative and nondecorative coated fabrics, leather, trays and galley furnishings, electrical conduit, air ducting, joint and edge covering, liners of Class B and E cargo or baggage compartments, floor panels of Class B, C, E or F cargo or baggage compartments, cargo covers and transparencies, moulded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in sub-paragraph (iv) below, must be self-extinguishing when tested vertically in accordance with the applicable portions of Part I of this Appendix or other approved equivalent means. The average burn length may not exceed 20 cm (8 inches), and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.
- (iii) Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PHI.25 (available from the American National Standards Institute, 1430 Broadway, New York, NY 10018). If the film travels through ducts, the ducts must meet the requirements of sub-paragraph (ii) of this paragraph.
- (iv) Clear plastic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc, used in passenger or crew compartments, may not have an average burn rate greater than 64 mm (2.5 inches) per minute when tested horizontally in accordance with the applicable portions of this Appendix.
- (v) Except for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that would not contribute significantly to the propagation of a fire and for electrical wire and cable insulation, materials in items not specified in paragraphs (a)(1)(i), (ii), (iii), or (iv) of Part I of this Appendix may not have a burn rate greater than 102 mm/min (4.0 inches per minute) when tested horizontally in accordance with the applicable portions of this Appendix.

- (2) *Cargo and baggage compartments not occupied by crew or passengers.*
- (i) Reserved.
  - (ii) A cargo or baggage compartment defined in [CS 25.857](#), as Class B or E must have a liner constructed of materials that meet the requirements of sub-paragraph (a)(1)(ii) of Part I of this Appendix and separated from the aeroplane structure (except for attachments). In addition, such liners must be subjected to the 45-degree angle test. The flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal. The average flame time after removal of the flame source may not exceed 15 seconds, and the average glow time may not exceed 10 seconds.
  - (iii) A cargo or baggage compartment defined in [CS 25.857](#) as Class B, C, E or F must have floor panels constructed of materials which meet the requirements of sub-paragraph (a)(1)(ii) of Part I of this Appendix and which are separated from the aeroplane structure (except for attachments). Such panels must be subjected to the 45-degree angle test. The flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal. The average flame time after removal of the flame source may not exceed 15 seconds, and the average glow time may not exceed 10 seconds.
  - (iv) Insulation blankets and covers used to protect cargo must be constructed of materials that meet the requirements of sub-paragraph (a)(1)(ii) of Part I of this Appendix. Tiedown equipment (including containers, bins, and pallets) used in each cargo and baggage compartment must be constructed of materials that meet the requirements of sub-paragraph (a)(1)(v) of Part I of this Appendix.
- (3) *Electrical system components.* Insulation on electrical wire or cable installed in any area of the fuselage must be selfextinguishing when subjected to the 60 degree test specified in Part I of this Appendix. The average burn length may not exceed 76 mm (3 inches), and the average flame time after removal of the flame source may not exceed 30 seconds. Drippings from the test specimen may not continue to flame for more than an average of 3 seconds after falling.
- (b) *Test Procedures –*
- (1) *Conditioning.* Specimens must be conditioned to  $21\cdot11 \pm 3^\circ\text{C}$  ( $70 \pm 5^\circ\text{F}$ ) and at  $50\% \pm 5\%$  relative humidity until moisture equilibrium is reached or for 24 hours. Each specimen must remain in the conditioning environment until it is subjected to the flame.
  - (2) *Specimen configuration.* Except for small parts and electrical wire and cable insulation, materials must be tested either as a section cut from a fabricated part as installed in the aeroplane or as a specimen simulating a cut section, such as a specimen cut from a flat sheet of the material or a model of the fabricated part. The specimen may be cut from any location in a fabricated part; however, fabricated units, such as sandwich panels, may not be separated for test. Except as noted below, the specimen thickness must be no thicker than the minimum thickness to be qualified for use in the aeroplane. Test specimens of thick foam parts, such as seat cushions, must be 13 mm ( $\frac{1}{2}$ -inch) in thickness. Test specimens of materials that must meet the requirements of sub-paragraph (a)(1)(v) of Part I of this Appendix must be no more than 3·2 mm ( $\frac{1}{8}$ -inch) in thickness. Electrical wire and cable specimens must be the same size as used in the aeroplane. In the case of fabrics, both the warp and fill direction of the weave must be tested to determine the most critical flammability condition. Specimens must be mounted in a metal frame so that the two long edges and the upper edge are held

securely during the vertical test prescribed in sub-paragraph (4) of this paragraph and the two long edges and the edge away from the flame are held securely during the horizontal test prescribed in sub-paragraph (5) of this paragraph. The exposed area of the specimen must be at least 50 mm (2 inches) wide and 31 cm (12 inches) long, unless the actual size used in the aeroplane is smaller. The edge to which the burner flame is applied must not consist of the finished or protected edge of the specimen but must be representative of the actual cross-section of the material or part as installed in the aeroplane. The specimen must be mounted in a metal frame so that all four edges are held securely and the exposed area of the specimen is at least 20 cm by 20 cm (8 inches by 8 inches) during the 45° test prescribed in sub-paragraph (6) of this paragraph.

- (3) *Apparatus.* Except as provided in sub-paragraph (7) of this paragraph, tests must be conducted in a draught-free cabinet in accordance with Federal Test Method Standard 191 Model 5903 (revised Method 5902) for the vertical test, or Method 5906 for horizontal test (available from the General Services Administration, Business Service Centre, Region 3, Seventh & D Streets SW., Washington, DC 20407). Specimens, which are too large for the cabinet, must be tested in similar draught-free conditions.
- (4) *Vertical test.* A minimum of three specimens must be tested and results averaged. For fabrics, the direction of weave corresponding to the most critical flammability conditions must be parallel to the longest dimension. Each specimen must be supported vertically. The specimen must be exposed to a Bunsen or Tirril burner with a nominal 9·5 mm ( $\frac{3}{8}$ -inch) I.D. tube adjusted to give a flame of 38 mm (1½ inches) in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the centre of the flame must be 843°C (1550°F). The lower edge of the specimen must be 19 mm ( $\frac{3}{4}$ -inch) above the top edge of the burner. The flame must be applied to the centre line of the lower edge of the specimen. For materials covered by sub-paragraph (a)(1)(i) of Part I of this Appendix, the flame must be applied for 60 seconds and then removed. For materials covered by sub-paragraph (a)(1)(ii) of Part I of this Appendix, the flame must be applied for 12 seconds and then removed. Flame time, burn length, and flaming time of drippings, if any, may be recorded. The burn length determined in accordance with subparagraph (8) of this paragraph must be measured to the nearest 2·5 mm (tenth of an inch).
- (5) *Horizontal test.* A minimum of three specimens must be tested and the results averaged. Each specimen must be supported horizontally. The exposed surface, when installed in the aircraft, must be face down for the test. The specimen must be exposed to a Bunsen or Tirril burner with a nominal 9·5 mm ( $\frac{3}{8}$ -inch) I.D. tube adjusted to give a flame of 38 mm (1½ inches) in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the centre of the flame must be 843°C (1550°F). The specimen must be positioned so that the edge being tested is centred 19 mm ( $\frac{3}{4}$ -inch) above the top of the burner. The flame must be applied for 15 seconds and then removed. A minimum of 25 cm (10 inches) of specimen must be used for timing purposes, approximately 38 mm (1½ inches) must burn before the burning front reaches the timing zone, and the average burn rate must be recorded.
- (6) *Forty-five degree test.* A minimum of three specimens must be tested and the results averaged. The specimens must be supported at an angle of 45° to a horizontal surface. The exposed surface when installed in the aircraft must be face down for the test. The specimens must be exposed to a Bunsen or Tirril burner with a nominal  $\frac{3}{8}$ -inch (9·5 mm) I.D. tube adjusted to give a flame of 38 mm (1½ inches) in height. The minimum flame temperature measured by a calibrated thermocouple pyrometer in the centre of the

flame must be 843°C (1550°F). Suitable precautions must be taken to avoid draughts. The flame must be applied for 30 seconds with one-third contacting the material at the centre of the specimen and then removed. Flame time, glow time, and whether the flame penetrates (passes through) the specimen must be recorded.

- (7) *Sixty-degree test.* A minimum of three specimens of each wire specification (make and size) must be tested. The specimen of wire or cable (including insulation) must be placed at an angle of 60° with the horizontal in the cabinet specified in sub-paragraph (3) of this paragraph with the cabinet door open during the test, or must be placed within a chamber approximately 61 cm (2 feet) high by 31 cm by 31 cm (1 foot by 1 foot), open at the top and at one vertical side (front), and which allows sufficient flow of air for complete combustion, but which is free from draughts. The specimen must be parallel to and approximately 15 cm (6 inches) from the front of the chamber. The lower end of the specimen must be held rigidly clamped. The upper end of the specimen must pass over a pulley or rod and must have an appropriate weight attached to it so that the specimen is held tautly throughout the flammability test. The test specimen span between lower clamp and upper pulley or rod must be 61 cm (24 inches) and must be marked 20 cm (8 inches) from the lower end to indicate the central point for flame application. A flame from a Bunsen or Tirrill burner must be applied for 30 seconds at the test mark. The burner must be mounted underneath the test mark on the specimen, perpendicular to the specimen and at an angle of 30° to the vertical plane of the specimen. The burner must have a nominal bore of 9.5 mm (3/8-inch) and be adjusted to provide a 76 mm (3-inch) high flame with an inner cone approximately one-third of the flame height. The minimum temperature of the hottest portion of the flame, as measured with a calibrated thermocouple pyrometer, may not be less than 954°C (1750°F). The burner must be positioned so that the hottest portion of the flame is applied to the test mark on the wire. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with sub-paragraph (8) of this paragraph must be measured to the nearest 2.5 mm (tenth of an inch). Breaking of the wire specimens is not considered a failure.
- (8) *Burn length.* Burn length is the distance from the original edge to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discoloured, nor areas where material has shrunk or melted away from the heat source.

[Amdt 25/6]

[Amdt 25/8]

[Amdt 25/17]

## Part II – Flammability of Seat Cushions

ED Decision 2015/019/R

- (a) *Criteria for Acceptance.* Each seat cushion must meet the following criteria:
- (1) At least three sets of seat bottom and seat back cushion specimens must be tested.
  - (2) If the cushion is constructed with a fire blocking material, the fire blocking material must completely enclose the cushion foam core material.
  - (3) Each specimen 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 back cushion than for the bottom cushion, both material combinations must be tested as complete specimen sets, each set consisting of a back cushion specimen and a bottom cushion specimen. If a cushion, including outer dress covering, is demonstrated to meet the requirements of this Appendix using the oil burner test, the dress covering of that cushion may be replaced with a similar dress covering provided the burn length of the replacement covering, as determined by the test specified in [CS 25.853\(a\)](#), does not exceed the corresponding burn length of the dress covering used on the cushion subjected to the oil burner test.
  - (4) For at least two-thirds of the total number of specimen sets tested, the burn length from the burner must not reach the side of the cushion opposite the burner. The burn length must not exceed 43 cm (17 inches). Burn length is the perpendicular distance from the inside edge of the seat frame closest to the burner to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discoloured, or areas where material has shrunk or melted away from the heat source.
  - (5) The average percentage weight loss must not exceed 10 percent. Also, at least twothirds of the total number of specimen sets tested must not exceed 10 percent weight loss. All droppings falling from the cushions and mounting stand are to be discarded before the after-test weight is determined. The percentage weight loss for a specimen set is the weight of the specimen set before testing less the weight of the specimen set after testing expressed as the percentage of the weight before testing.
- (b) *Test Conditions.* Vertical air velocity should average  $13\text{cm/s} \pm 5\text{ cm/s}$  ( $25\text{ fpm} \pm 10\text{ fpm}$ ) at the top of the back seat cushion. Horizontal air velocity should be below  $51\text{ mm/s}$  ( $10\text{ fpm}$ ) just above the bottom seat cushion. Air velocities should be measured with the ventilation hood operating and the burner motor off.
- (c) *Test Specimens*
- (1) For each test, one set of cushion specimens representing a seat bottom and seat back cushion must be used.
  - (2) The seat bottom cushion specimen must be  $457 \pm 3\text{ mm}$  ( $18 \pm 0.125\text{ inches}$ ) wide by  $508 \pm 3\text{ mm}$  ( $20 \pm 0.125\text{ inches}$ ) deep by  $102 \pm 3\text{ mm}$  ( $4 \pm 0.125\text{ inches}$ ) thick, exclusive of fabric closures and seam overlap.