GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW3232

Test Method for Determining the Flammability of Interior Trim Materials

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This test procedure shall be used to determine the horizontal burn rate of automotive materials. Burn rate is determined immediately following an exposure for a short duration to a small flame. The small flame is placed in contact with one (1) edge of the material.

1.1.1 This test procedure defines requirements, testing conditions and reporting requirements for interior raw materials, including but not limited to textiles, leather, plastics, etc. to support the production part conformance to government regulations. Aging and statistical requirements address variability seen in some raw materials including textiles as well as sampling conditions defined in government regulations.

1.1.2 Part requirements and reporting shall conform to government regulations.

1.2 Applicability. The method permits testing of materials and parts of the vehicle interior, individually or in combination up to a thickness of 13 mm. It is normally only applicable to materials and parts within a 13 mm range to the passenger compartment air space.

1.2.1 Lot Identification. Each lot of material tested shall remain readily available and identifiable, until the tests are complete so it may be retrieved in the event of inspection and/or test failure. Each lot of material shall have a unique identification.

1.2.2 Use of Incoming Material Test Data. When a source location can demonstrate that their process does not adversely affect flammability, the source location may use test data from each lot of incoming material. See 4.1.3 through 4.1.3.2.1.

1.3 Remarks. Not applicable.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

49 CFR 571.302	FMVSS 302	ISO 2768	KMVSS Article 95
CONTRAN Resolution 498/14	GB 8410		

2.2 GM Standards/Specifications.

GMW3221

2.3 Additional References.

- CG5817 Part Level Flammability Test Result Data Sheet
- GBH (Part number FTTS0170)
- Test Report labelled GMW3232 PROTBEF_eng. available at GM SupplyPower (https://gmsupplypower.covisint.com/web/portal/home) under Collaborate and Document Library

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

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3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Test Cabinet. One (1) configuration satisfying these requirements is shown in Appendix A, Figure A1 through Figure A3. The test cabinet consists of a rectangular steel cabinet with internal dimensions of 381 mm ± 1.0 mm long, 203 mm ± 1.0 mm deep and 356 mm ± 1.0 mm high. It shall have a heat resisting glass observation window, a closable opening to permit insertion of the test specimen mounting fixture and a hole to accommodate tubing for a gas burner. A 13 mm clearance space around the top of the cabinet, ten (10) 19 mm diameter holes in the base of the cabinet and legs to elevate the bottom of the cabinet by 10 mm are to be provided for ventilation.

3.2.2 Conditioning Apparatus. Apparatus for conditioning as required and to the appropriate requirements as described in GMW3221, (Code A), unless otherwise specified in the relevant material specification.

3.2.3 Oven. Drying oven capable of maintaining the specified temperature within the specified tolerances.

3.2.4 Chemical Fume Cupboard. Chemical fume cupboard suitable for mounting the test cabinet to avoid the diffusion of combustion products to the laboratory during test. A natural venting hood is permissible, provided adequate ventilation is assured. Any forced air ventilation shall be the minimum required for venting**.**

3.2.4.1 Specific Chinese Legal Requirements (GB 8410) Ventilating Cabinet (Reference Deviation Section). The combustion box shall be placed in a ventilating cabinet. The inner volume of the cabinet shall be 20x to 110x that of the combustion box, and none of the length, width or height may be more than 2.5x than either of the other two (2) dimensions. At points 100 mm from the front and back of the final position of the combustion box, measure the speed of air passing the ventilating cabinet. The speed must be 0.10 m/s to 0.30 m/s.

3.2.5 Test Specimen Mounting Fixture. One (1) configuration satisfying these requirements is shown in Appendix A, Figure A4 and Figure A5. This shall consist of two (2) matching U-shaped frames of metal (e.g., aluminum) stock 25 mm wide and 10 mm thick. The interior dimensions of the U-shaped frames shall be 51 mm wide by 330 mm long. Gauge lines shall be marked (e.g., by slots) on the upper frame 38 mm and 292 mm respectively from its open end. It is recommended that the frame include markings in 0.5 cm increments up to 25.5 cm for burn distance measurement. This frame can be obtained from GBH (Part number FTTS0170).

In order to support sub size test specimens and those that soften and bend during test, the lower frame shall have the means to accommodate thin heat resistance wires that span the width of the U-shaped frame at 25 mm intervals. (Grooves cut into the lower frame to accommodate 0.25 mm, nickel-chrome, thermo wire are recommended.)

3.2.5.1 Specific Korean Legal Requirements (KMVSS Article 95) (Reference Deviation Section). In order to support sub size specimens where the maximum available width is 50 mm or less, or in the case of specimens that show vertical burning caused by sagging at the flaming end, the lower frame shall have the means to accommodate thin heat resistant wires that span the width of the lower U-shaped frame at 25 mm intervals. Wires shall not be used for other reasons for certification to KMVSS Article 95. (Grooves cut into the lower frame to accommodate 0.25 mm, nickel chrome, thermo wire are recommended.)

3.2.6 Support Stand. One (1) configuration satisfying these requirements is shown in Appendix A, Figure A6. A metal stand to locate and support the test specimen mounting fixture (3.2.5) in the center of the cabinet during test is required.

3.2.7 Weights. In order to detect when the flame front has progressed to each of the gauge lines, it is recommended to use lightweight cotton thread counterbalanced with approximately 14 g weights spanning the full width of the lower U-shaped frame at the gauge lines (Appendix A, Figure A4).

3.2.8 Timer. A calibrated timer with a measurement accuracy of 0.5 s.

3.2.9 Burner. Bunsen burner with a tube of 10.0 mm ± 0.5 mm inside diameter and provided with a gas adjusting valve to give a flame 38 mm ± 1 mm high when the tube is vertical and the air inlet to the burner is closed.

3.2.10 Gas Source. Gas to provide a flame temperature equivalent to that of natural gas.

3.2.11 Comb. Comb with seven (7) to eight (8) smooth rounded teeth per 25 mm.

3.2.12 Cutting Instruments. Cutting dies or shears for preparation of test specimens.

3.3 Test Vehicle/Test Piece.

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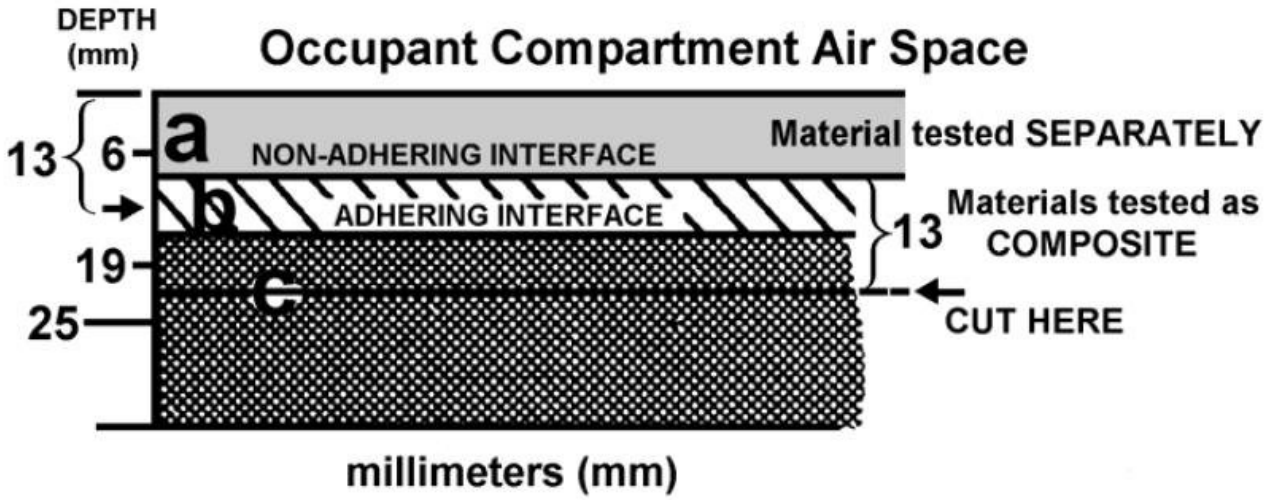
3.3.1 Ideal Specimen Size. Wherever possible, from the available material or component, rectangular test specimens 355 mm ± 2 mm long and 100 mm ± 2 mm wide, shall be taken. The thickness of the test specimens shall be that of the single or composite material used in the vehicle, except when the materials or composites thickness exceeds 13 mm. If material or composite thickness exceeds 13 mm, the test specimens shall be cut down to 13 mm, measured from the surface of the specimen closest to the passenger compartment air space, as shown in the figure in S4.2.2 of 49 CFR 571.302 and presented as Figure 1 in this standard for convenience.

Figure 1: Occupant Compartment Air Space



Note: Material A has a non-adhering interface with material B and is tested separately. Part of material B is within 13 mm of the occupant compartment air space, and materials B and C adhere at every point of contact; therefore, B and C are tested as a composite. The cut is in material C as shown, to make a specimen 13 mm thick.

3.3.2 Curved Specimen Size. Where it is not possible to obtain flat test specimens due to surface curvature, the test specimens shall be cut to not more than 13 mm in thickness at any point. As far as possible, the test specimens shall be of uniform thickness.

3.3.2.1 Specific Chinese Legal Requirements (GB 8410) (Reference Deviation Section). If the part is bent so that it is impossible to take a flat sample, take the part that is most flat and make the arch rise of the sample not more than 13 mm. If the arch rise of the sample exceeds 13 mm, make a standard sample with the same material, same technique and same structure as the part (356 mm long × 100 mm wide), and let the thickness be the minimum width but not > 13 mm.

3.3.3 Testing of Smaller Sized Samples.

3.3.3.1 Specific Japanese Legal Requirements (Reference Deviation Section). The minimum acceptable sample size shall be 25 mm in width and 293 mm in length.

3.3.3.2 Specific Brazilian Legal Requirements (Reference Deviation Section). (CONTRAN Resolution 498/14). The sample thickness shall correspond to the part/material to be tested but may not exceed 13 mm. Samples should have a constant section throughout the length.

a. For samples having a width of 3 mm to 60 mm, the length shall be 356 mm ± 2 mm.

b. For samples having a width of 60 mm to 100 mm, the length shall be at least 138 mm.

3.3.3.3 Specific Chinese Legal Requirements (GB 8410) (Reference Deviation Section). Where the shape and size of the part are insufficient to be made into a standard sample of the specified size, make a sample of the following minimum size, and keep records per a, b and c in 3.3.3.3.

a. If the part is 3 mm to 60 mm wide, it shall be at least 356 mm long. In this case, make the width of the sample as close to that of the part as possible.

b. If the part is wider than 60 mm, it shall be at least 138 mm long. In this case, the possible burnt distance is equivalent to the distance from the first gauge mark to the place where the flame goes out or from the first gauge mark to the end of the sample as shown in Figure 2.

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c. If the part is 3 mm to 60 mm wide but shorter than 356 mm, or if it is wider than 60 mm but shorter than 138 mm, it shall not be tested per GB 8410. Samples that are narrower than 3 mm shall also not be tested.

3.3.3.4 Specific U.S. Legal Requirements (Reference Deviation Section). Where the shape and size of the part are insufficient to be made into a standard sample of 100 mm ± 2 mm in width and 355 mm ± 2 mm in length, it is permissible to cut a sample of the following minimum size, and keep records per a, b and c in 3.3.3.4. If these requirements cannot be met, the sample shall be molded into the ideal specimen size per 3.3.4.

a. If the part is 3 mm to 60 mm wide, it shall be at least 356 mm long. In this case, make the width of the sample as close to that of the part as possible.

b. If the part is wider than 60 mm, it shall be at least 138 mm long. In this case, the possible burnt distance is equivalent to the distance from the first gauge mark to the place where the flame goes out or from the first gauge mark to the end of the sample as shown in Figure 2.

c. If the part is 3 mm to 60 mm wide but shorter than 356 mm, or if it is wider than 60 mm but shorter than 138 mm, it shall not be tested per FMVSS 302. Samples that are narrower than 3 mm shall also not be tested.

3.3.4 Molded Samples. Where sample sizes or shapes restrict the ability to test, molded samples of raw material or composites shall be made 100 mm ± 2 mm in width and 355 mm ± 2 mm in length with a thickness no thicker than the thinnest component cross-section from the actual part for which the sample is being substituted.

In sampling the test panels, it shall be ensured the test panels are fully representative of the material or composite under test.

3.3.5 Multiple Non-Composite Layers. In the case of materials made of superimposed layers of different materials which are not composite materials, all the layers of the materials included within a depth of 13 mm from the surface facing towards the passenger compartment air space shall be tested individually.

3.3.6 Test Directionality. For foam, textiles, and composites containing foam or textiles, test specimens shall be cut from materials or composites both in production direction and perpendicular to this (e.g., warp and weft direction, longitudinal and lateral direction respectively) if possible. The material direction of the longitudinal and lateral test specimens must be clearly marked in a manner to identify their original orientation within the roll as shown in Figure 1. For plastics, painted plastics, or composites not containing foam or textiles, plaques or parts shall be burnt in only one direction. There shall be no markings to prevent contamination or alteration within the test area of the specimen.

3.3.7 Sample Sectioning. The requirement concerning transmission of a flame front shall not apply to a surface created by the cutting of a test specimen for purposes of testing.

3.3.8 Napped or Tufted Samples. Materials or composites with napped or tufted surface shall be placed on a flat surface and combed twice against the nap with a comb as listed in 3.2.11.

3.3.9 Plastic. The data of the initial tested color in plaque or part form can be used as surrogate for other colors in plaque or part form if the first three criteria in 3.3.11 are fulfilled and:

- The burn rate (B_{max} and B_{stat}) is ≤ 72 mm/minute for the tested color.
- Part or plaque thickness is equal to or greater than that of the previously tested part or plaque.

3.3.10 Painted Plastic. The data of the natural plastic, mold-in-color plastic, or the initial tested painted color in plaque or part form can be used as surrogate for other painted colors in plaque or part form if the first three criteria in 3.3.11 are fulfilled and:

- The burn rate (B_{max} and B_{stat}) is ≤ 72 mm/minute for the natural plastic, mold-in-color plastic, or for the tested painted color.
- Part or plaque thickness is equal to or greater than that of the previously tested part or plaque.

3.3.11 Plastic and Painted Plastic Criteria.

- Material is painted, natural or integrally colored plastic.
- Material is painted or made of one (1) layer (no laminate, no composite, no cellular structure).
- Same filler/additive package is used.
- For material level testing of plastics, plaque thickness must be < 2.2 mm.

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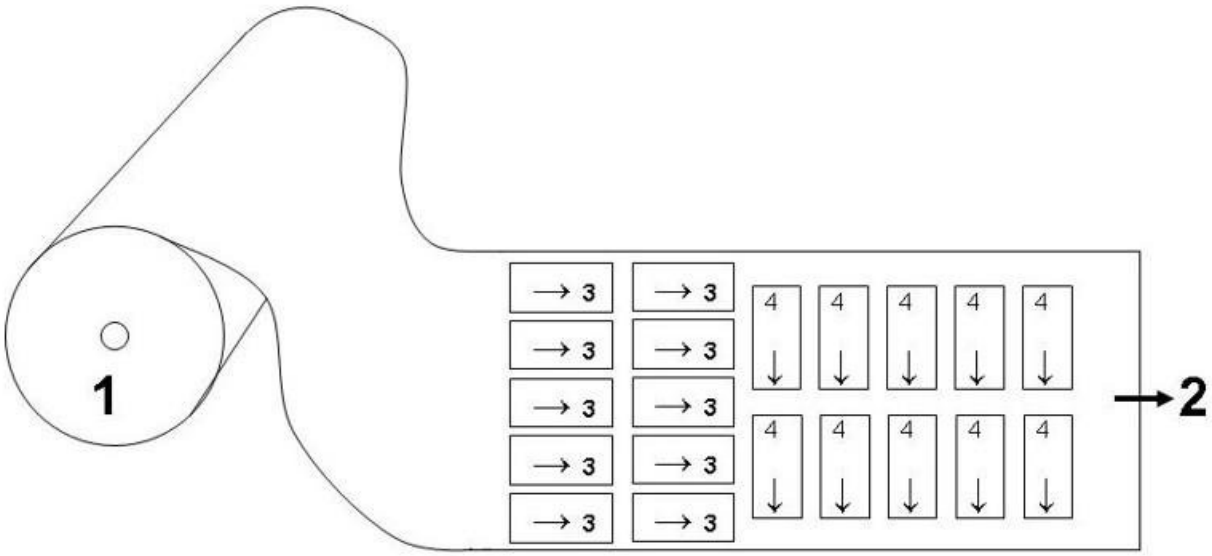
Figure 2: Example of Sampling



1 Example, Material Roll.
2 Material Direction.
3 Longitudinal Test Specimens.
4 Lateral Test Specimens.
Note: For specimens cut from direction 3, mark in alternating directions so that the material may be burned with the flame traveling into the roll (nearest to furthest) or out from the roll (furthest to nearest). For specimens cut from direction 4, mark in alternating directions so that the material may be burned from left to right or from right to left. See 4.3.1.1.

3.4 Test Time.

Calendar time:	Reference Section 4 and Section 5 for timing details
Test time:	Reference Section 4 and Section 5 for timing details
Coordination time:	Reference Section 4 and Section 5 for timing details

3.5 Test Required Information. Material component information such as vendor name, raw material, production date and pretreatment shall be reported to the test engineer.

3.6 Personnel/Skills. Personnel trained in accordance with the laboratory accreditation and Standard Operating Procedure requirements.

4 Procedure

4.1 Preparation.

4.1.1 Specimen Handling. Specimens shall be maintained so that specimens remain free of contaminants prior to testing. Samples shall not be placed on uncontrolled floors, tables/shelves or transports; Operators are to use clean gloves; parts are to be transported in clean bags; specimens shall be cut at test site; and other appropriate practices.

4.1.2 Preparation of Material Level Testing.

4.1.2.1 Conditioning. Immediately prior to testing all test specimens shall be conditioned for a minimum of 24 h according to GMW3221, Code A.

4.1.2.2 Aging. In addition to tests conducted in the as received condition, all textile, foam, and composites containing textile or foam materials, shall also be tested for flammability after the following Aged Test Cycle. Both exposures defined in the Aged Test cycle shall be completed without interruption:

Aged Test Cycle:

- 48 h ± 1 h at +40 °C ± 3 °C and 93% ± 5% relative humidity.
- 168 h ± 1 h at +90 °C ± 3 °C.

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4.1.2.3 Quantity of Test Specimens for Materials with Directional/Aged Requirements.

4.1.2.3.1 Initial Approval and Arbitration. For initial sample approvals and arbitration purposes, materials that have directional burn and aged requirements such as textiles, foams, and composites containing textiles or foams, materials shall test at least 20 specimens except when any individual specimen burn rate exceeds 100 mm/minute. If any individual specimen has a burn rate that exceeds 100 mm/minute, the material does not meet the flammability requirement and all additional testing shall be terminated. If all burn rates are < 100 mm/minute, test at least 10 specimens each, from the longitudinal and lateral directions with at least five (5) specimens tested as received, and at least five (5) specimens tested after having been aged. For each direction and aging condition, see 5.2.1.2 to determine if additional specimens must be tested.

4.1.2.3.2 Routine Quality Control. For quality control purposes, at least two (2) specimens each from both the lateral and longitudinal direction in the as received condition shall be tested from each production lot. For the samples from any one direction, half of the samples shall have the burn direction 180°degrees from the burn direction of the other half of the samples. For each direction (lateral and longitudinal), test specimens in alternating directions following the **Note** in Figure 1. The test shall be performed and the material must comply with the requirements of 5.2.2 and 5.2.2.1 of this procedure prior to the release of the lot from the manufacturing facility.

4.1.2.4 Quantity of Test Specimens for Materials with non-Directional/Aged Requirements.

4.1.2.4.1 Initial Approval and Arbitration. For initial sample approvals and arbitration purposes, materials that do not have directional burn and aged requirements such as plastic, painted plastic materials, or composites not containing textiles or foams shall test at least five (5) specimens except when any individual specimen burn rate exceeds 100 mm/minute. If any individual specimen has a burn rate that exceeds 100 mm/minute, the material does not meet the flammability requirement and all additional testing shall be terminated. See 5.2.1.2 to determine if additional specimens must be tested.

4.1.2.5 Inherently Flame Resistant Materials. Materials which contain no added flame retardant additives and exhibit no burn rates in excess of 75 mm/minute during approval testing and after quality control testing of twenty successive production lots, shall be considered inherently flame resistant. No further production quality control testing shall be required.

4.1.3 Preparation of Part Level Testing.

4.1.3.1 Conditioning. Immediately prior to testing, all test specimens shall be conditioned for a minimum of 24 h according to GMW3221, Code A.

4.1.3.2 Aging. In addition to tests conducted in the as received condition, all textile, foam, and composites containing textile or foam materials, shall also be tested for flammability after the following Aged Test Cycle. Both exposures defined in the Aged Test cycle shall be completed without interruption:

Aged Test Cycle:

- 48 h ± 1 h at +40 °C ± 3 °C and 93% ± 5% relative humidity.
- 168 h ± 1 h at +90 °C ± 3 °C.

4.1.3.3 Quantity of Test Specimens.

4.1.3.3.1 Approval and Arbitration. For part approvals and arbitration purposes, test at least five (5) specimens except when any individual specimen burn rate exceeds 100 mm/minute. If any individual specimen has a burn rate that exceeds 100 mm/minute, the material does not meet the flammability requirement and all additional testing shall be terminated.

4.1.3.3.2 Directional Burn Parts. It is acceptable to burn in only the worst case burn direction in a textile, foam, or composite part, if it is known and have proof that worst case direction was chosen. Example of proof can be material level testing that shows one direction worse than the other. Proof must be clearly shown in compliance document. If worst direction is unknown, test at least ten (10) specimens each, from the longitudinal and lateral directions with at least five (5) specimens tested as received, and at least five (5) specimens tested after having been aged. All burn rates are < 100 mm/minute, see 5.2.1.2 to determine if additional specimens must be tested.

4.1.3.4 Non Flammable Parts. Parts made from materials that do not ignite or burn such as aluminum, steel, and chrome plated plastic shall not be tested if a validation judgement letter exists which documents agreement not to test part types.

4.2 Conditions.

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