GM	WORLDWIDE ENGINEERING STANDARDS	Test Procedure	GMW3235

Fogging Characteristics of 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 describes a test method on how to determine the fogging tendencies of all interior and air ventilation system materials.

Two alternative tests are specified with different methods of evaluating the degree of fogging.

1.1.1 Method A - Photometric Method. This method evaluates the volatility of organic constituents by reflectivity measurements (Coding A).

1.1.2 Method B - Gravimetric Method. This method determines the mass of fogging condensate on aluminum foil in mg by means weighing of foil before and after the fogging test (Coding B).

Because of the different dimensions of the available fog test units a factor has been established to compare the results of the different instruments. The factor can be obtained in Appendix A.

1.3 Applicability. This Test Procedure is applicable to all interior and air ventilation materials used in the vehicle interior. The results will provide complementary information to GMW15634.

1.3 Remarks. The test defined in this standard is designed to evaluate the "fogging" tendencies of all interior and air ventilation system materials. The resulting ratings “fogging emission” influenced by the volatile organic constituents, liberated under conditions of high ambient temperatures and subsequently deposited on cooler surfaces, is determined.

Test results obtained by these test methods are not directly comparable and only that test method specified by the appropriate coding in the material specification, engineering drawing etc., shall be used.

2 References

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

2.1 External Standards/Specifications.

DIN 75201	ISO 868	ISO 2813	ISO 5084

2.2 GM Standards/Specifications.

GMW3221	GMW15634

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.

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.

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3.2 Equipment.

3.2.1 Fog Test Unit. A controlled heating unit with multiple chambers with a typical temperature range from (+60 to +130) °C (Haake or Hart type or equivalent). Cooling of the glass plate for each test chamber in the unit is required with a typical temperature range from (+20 to +40) °C. The heating unit and the cooling system shall be able to maintain the temperature within ± 0.5 °C.

A temperature override cut-off to prevent overheating in the event of thermostat failure shall be an integral part of the unit. Temperatures of the heating unit and the cooling system may be monitored during the test.

After placing the beakers in the chambers, the temperature shall not drop by more than 5 °C and the test temperature shall be reached within 20 minutes.

3.2.2 For equipment that uses a heat transfer liquid, the heating liquid shall be temperature resistant and preferably water soluble, e.g., based on polyethylene- or polypropylene-glycol.

3.2.3 Storage chamber, dust free, with suitable desiccant (e.g. silica, phosphorus pentoxide); suitable is a desiccator.

3.2.4 Apparatus for conditioning to the appropriate requirements as described in GMW3221, unless otherwise specified in the relevant materials specification.

3.2.5 Suitable stamping device, punch or equivalent for preparation of test specimens.

3.2.6 Beakers with flat bottoms made of heat resistant glass of a proper size to fit the fog test unit.

3.2.7 Fluoroelastic sealing rings of a size that matches the beaker in use, with a hardness of (65 ± 5) Shore A (hardness to ISO 868).

3.2.8 Metal rings, which are chrome plated steel of a size that match the beaker in use.

3.2.9 Laboratory dish washing machine (e.g. Miele PG 8535 ADP SST or equivalent) with the final cycle being a de-ionized water rinse.

3.2.10 Ultrasonic cleaning device to clean the glass plates (if the plates are reused), (e.g., Sonorex Bandelin or equivalent).

3.2.10.1 Fixture to hold the glass plates in the ultrasonic cleaning device (see Figure 2) made of stainless steel.

3.2.11 Glossmeter with head suitable for measurement at an angle of incidence and reflection of 60°, and complying with ISO 2813 (e.g., Gloss meter MG 268-TRI GLOSS, mtv Messtechnik, or equivalent.

3.2.12 Spacers/Measuring Aids (see Figure 1). Spacers made of non-light permeable material with a thickness of (0.1 ± 0.02) mm, to avoid contact with the condensate on the surface of the glass plates (if the plates are used more than once) during reflectometer measurement.

By applying reference marks to the spacers and the dull black base respectively, the reflectometer is placed in such a way that measuring points from measurements taken before and after the test can be compared.

3.2.13 Apparatus for determination of thickness to ISO 5084 (if necessary).

3.2.14 Float glass plate having a thickness of (3 ± 0.2) mm and an area that completely covers the beaker shall be used. The glass plates can be purchased from the equipment manufacturer.

3.2.14.1 The reflectance of the glass plate shall not vary by more than ±2.0 %.

3.2.14.2 The glass plates shall have the tin and non-tin sides identified.

3.2.14.3 The tin and non-tin sides of the glass plates can be identified by viewing the surfaces in a darkened room under a UV-light at 254 nm wavelength. The tin side will have a white/yellow hue when it is exposed to UV-light. The non-tin side will have a blue/purple hue when it is exposed to UV-light. The tin side shall be engraved for identification purposes. The non-tin side is the test side and faces the sample during the test.

3.2.14.4 Before every test, the glass plates shall be inspected for possible damage, e.g., scratches etc.

3.2.14.5 The glass plates shall be replaced if damaged or after every tenth test at a maximum.

3.2.15 Magnifier 40x.

3.2.16 Forceps and/or tweezers to handle the various pieces of material.

3.2.17 Aluminum foil, 0.03 mm thickness, circular discs with a diameter larger than the seal and the beaker diameter. Preparations see paragraph 4.3.2.2, or commercial available (e.g., Rotilabo aluminum foil R100, Art-no.: 0953.1, Carl Roth GmbH, Karlsruhe).

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3.2.18 Balance with a scale division value of 0.01 mg.

3.2.19 Laboratory filter paper or aluminum foil.

3.2.20 Cleaning fluid for the ultrasonic cleaning device (e.g. Mucasol from Merz, D-60318 Frankfurt/Main). Make a one per cent solution with distilled water.

3.2.21 Detergent for dishwasher cleaning (e.g. Alcojet non-foaming laboratory detergent or equivalent).

3.2.22 Reference standard: Di-iso-decylphthalate (DIDP), CAS No. 68615-49-1. The standard can be obtained at: Swedish National Testing and Research Institute, Materials Technology, P.O box 857, SE-50115 Boras, Sweden, Fax: +46 33 16 53 16, E-mail: mt@sp.se.

3.3 Test Vehicle/Test Piece.

3.3.1 From the available material circular test specimens of diameter to match the size of beaker shall be taken from various uniformly distributed areas of the test material. The thickness of the test specimen shall be equal to that of the test material up to thickness of 20 mm maximum. Materials with a thickness > 20 mm, e.g. foams, shall be reduced to ≤ 20 mm thickness.

3.3.2 Unless otherwise specified, for non flat-shaped materials (profiles, etc.) test specimens of (15 ± 1) cm^3 volume shall be used. For powdered or liquid materials (10 ± 0.2) g samples taken from the bulk shall be used.

3.3.3 For initial sample approval and arbitration purposes at least three test specimens, and for routine quality control at least two test specimens shall be tested.

3.4 Test Time.

Test hours:	(4 to 42) h
Coordination hours:	4 h

3.5 Test Required Information. For test required information see GMW16853, "3.1.7 Test Required information".

3.6 Personnel/Skills. Proper training is required to operate the instrumentation in this procedure. A professional degree in chemistry, chemical engineering, or the health sciences, and familiarity with the operation of the instrumentation is required. Personnel without this background shall be trained carefully on the instrumentation before using it.

4 Procedure

4.1 Preparation. Immediately prior to testing all test specimens (materials) shall be dried per GMW3221 Code D in a desiccator with sufficient desiccant, (see paragraph 3.2.3) without using vacuum. The pre-drying period of the respective materials is shown in Table 1. The coding is given in the relevant Material Specification.

Table 1: Pre-Drying Periods

Coding	Materials	Drying period
Y1	Materials with low water absorption (e.g. Upholstery fabrics, foam, tricot artificial leather)	≥ 1 day
Y2	Materials with high water absorption (e.g. leather, cellulose materials, textiles with > 50 % wool in it)	≥ 7 days
Y3	Materials with no significant water absorption (e.g. plastics)	≥ 4 h
(Y)	Special applications	as specified

Note: If no coding is given in the relevant specification, coding Y3 shall be used.

4.2.2.1 Heating Test Temperatures. The heating test temperature or the heating unit temperature shall be one of the following as defined in the relevant material specification:

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T1 (+90 ± 0.5) °C

T2 (+100 ± 0.5) °C

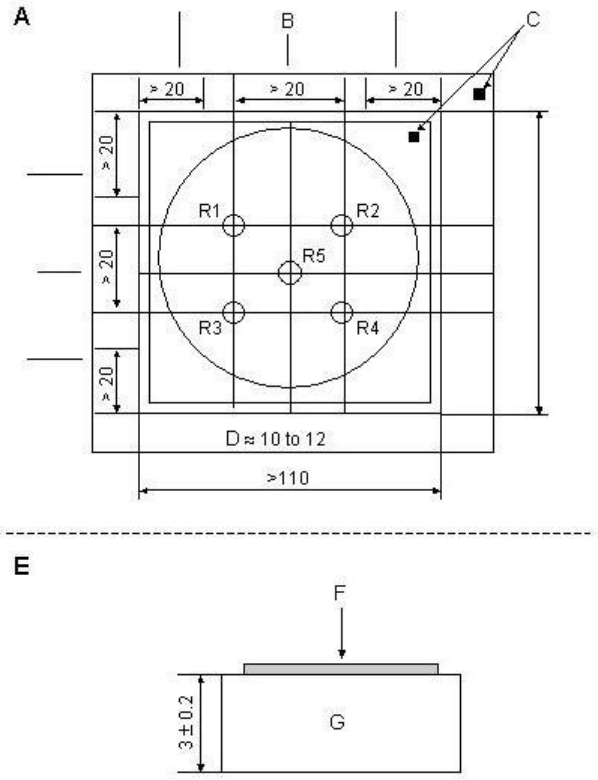
T3 (+110 ± 0.5) °C

T4 (+120 ± 0.5) °C

(T) Temperature as specified
Tolerance: ± 0.5 °C

Note: If no test temperature is given in the relevant specification, coding T2 shall be used.

Figure 1: Base with Glass Plate Placed on Spacer and Reference Marks for Positions and Centering of the Reflectometer for Determination of Reflectance Values



All dimensions are in mm.

A Base with reference marks for placing the reflectometer

B Reference marks

C Marking on glass plate and base

D Spacer

E Cross section of glass plate with tolerance in size

F Width of spacer ≈ (10 to 12) mm
Material: non-light permeable
Thickness of spacer: (0.1 ± 0.02) mm

G Glass plate

R1, R2, R3, R4 Four (4) required measuring points

R5 Optional measuring point

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