



Test Methods for Emissions of Interior Components

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. The test procedures described in this specification qualifies both Tedlar Bag and 1 Meter Cube chamber testing as qualified test procedures for testing materials and parts for Volatile Organic Compounds (VOC) and Semi-Volatile Organic Compounds (SVOC). The Baggy Odor Test Method C is used to determine and isolate odors of vehicle materials and components.

1.2 Applicability. For regions other than China, either test procedure, Tedlar Bag, Method A, or 1 Meter Cube Chamber, Method B, may be used when testing materials and/or parts for VOCs/SVOCs. The Baggy Odor Test is Method C. These test methods will be used to obtain air quality results for materials and components per GMW16853.

1.3 Remarks. For all materials and parts manufactured or supplied to China, only GMW17914 Method A and Method C are acceptable.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15600

GMW15654

GMW16818

GMW16853

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.

3.2 Equipment. Not applicable.

3.3 Test Vehicle/Test Piece. Test pieces should be obtained from suppliers as soon as possible after production. Unless otherwise specified in this standard, no pre- or post-treatment of the test samples besides the production process and the test sample preparation (e.g., drying if necessary) is allowed. Care should be taken to prevent material out-gassing before analysis (package, refrigerate).

3.4 Test Time.

Calendar time: 14 d

Test time: 0 h

Coordination time: 0 h

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Trained laboratory skills are required to perform these tests.

4 Procedure

4.1 Preparation.

4.1.1 Test Method A - Tedlar Bag Test.

4.1.1.1 Gas Chromatography (GS) with Mass Spectrometer Detector (MSD): Agilent 7890A/5975C or equivalent.

4.1.1.2 Thermal desorption system (TDS): Gerstel TDS 3/CIS 4, Markes TD-100 or equivalent.

4.1.1.3 High Purity Liquid Chromatography (HPLC): Agilent 1200; Thermo U-3000 or equivalent.

4.1.1.4 Walk-in Oven Chamber, capable of maintaining a temperature of $+65\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

4.1.1.5 Sampling bag: 2000 L Poly Vinyl Fluoride (PVF) bag (thickness=0.05 mm) with at least two (2) Polytetrafluorethylene (PTFE) valves, one bag can be re-used up to five times if it meets requirement when empty.

4.1.1.6 Sealing strips for sealing the sampling bag: SNS sealing strips.

4.1.1.7 Gas samplers, sampling pumps.

4.1.1.8 Flow-meter calibrators.

4.1.1.9 Tenax tubes: stainless steel tubes or glass tubes packed with at least 200 mg of Tenax TA/GR (60/80) sorbent.

4.1.1.10 Dinitrophenylhydrazine (DNPH) cartridges.

4.1.1.11 Sampling tube, Teflon or PTFE Tube, outside diameter: 6 mm; inside diameter: 4 mm; heated at $+100\text{ }^{\circ}\text{C}$ for at least 6 h before use.

4.1.1.12 Silicon tubes, use as tube connectors.

4.1.1.13 Vacuum pumps.

4.1.1.14 Zip-lock bags.

4.1.1.15 Ultra pure N_2 .

4.2 Conditions.

4.2.1 Environmental Conditions. Indoor, well ventilated, temperature control at $+25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.2.1 Turn the bag inside out and bake in the oven at $+80\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$. The bake duration shall be 48 h after target temperature is attained for the new bags and 12 h minimum. if an old bag is being reused.

4.2.2.2 The samples are packed and transported within 7 days after production in aluminum foil or Polyethylene (PE) bags, avoiding direct sunlight; Components shall remain sealed. Components shall be conditioned for 24 h minimum at $+23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $50 \pm 5\%$ relative humidity prior to testing.

4.2.2.3 Test specimens name, part number, size and weight, material, production date, date of sample received, sampling date, analysis date and storage condition shall be documented.

4.3 Instructions.

4.3.1 Bag Blank Verification Procedure - Phase 1. Sampling bag should be checked for leakage using a vacuum pump. After the seal is confirmed, fill Ultra- pure N_2 to 50% of the bag volume, and then evacuate the bag, repeat 3 times. Fill 50% of the volume of the pretreated bag with N_2 . Heat the bag to $+65\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for $2\text{ h} \pm 10\text{ minutes}$, use a Tenax tube and DNPH cartridge to verify the blank. GC MSD and HPLC should be used for the analysis. All the required compounds must be lower than method detection limits, otherwise the bag cannot be used.

4.3.1.1 Sealing the Component/Automotive Interior Product - Phase 2. Seal the component/automotive interior product in the sampling bag, the sample shall be put into the bag with the A surface facing up. Samples shall not be stacked on top of each other. The bag should be checked for leakage using a vacuum pump. After the seal is confirmed, fill Ultra-pure N_2 to 50% of the bag volume, and then evacuate the bag, repeat three times. Fill 50% of the volume of the pretreated bag with N_2 . Heat the bag to $+65\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ for $2\text{ h} \pm 10\text{ minutes}$, use two (2) Tenax tubes and one DNPH cartridge to sample the gas. Follow Figure 1 to connect the Teflon tube and sampling pump to the sampling bag in the oven. The correct air flow direction shall be followed. Shake the bag several times before starting the pumps.

4.3.1.1.1 When the sampling is complete (see Table 1, sampling time), close the valves. Immediately remove cap and package the Tenax tubes in a zip-lock bag and the DNPH cartridge in a sealed aluminized bag. Store at +4 °C to +10 °C. Analysis must be performed within 7 days.

Figure 1: Test Equipment Setup

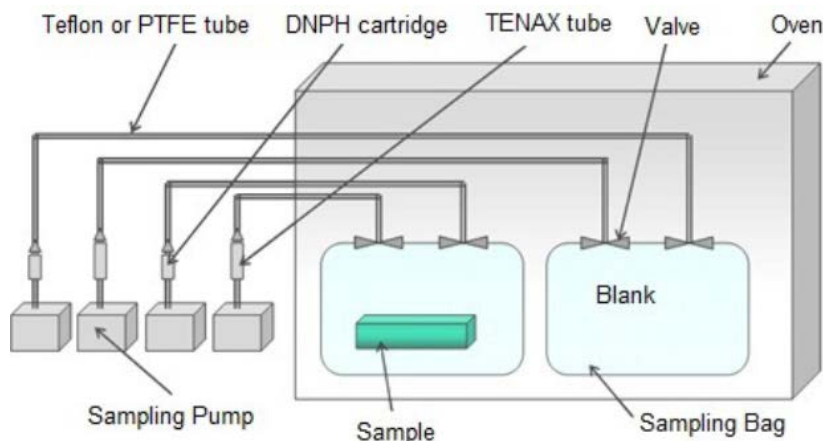


Table 1: Sampling Condition

Item	VOC	Aldehydes
Sampling tube	Tenax tube	DNPH cartridge
Flow rate (mL/minute)	200	800
Sampling time (minutes)	15	15
Sampling volume (L)	3	12

4.3.1.2 Results Analysis - Phase 3:

4.3.1.2.1 Analyze the Tenax tubes per GMW15654.

4.3.1.2.2 Analyze the DNPH cartridge per GMW15600.

4.3.1.2.3 Calculate the Benzene, Toluene, Ethyl Benzene, Xylenes, Styrene (BTEX), total VOC and Aldehyde (Formaldehyde, Acetaldehyde, Acrolein, Acetone) results.

4.3.1.2.4 Calculation of BTEX analytes.

$$M (\mu\text{g}) = (C/V_2 - C_0/V_{02}) * V_1$$

- M: Concentration of single analyte from the test specimen (μg)
- C: Mass of volatiles absolute from the Tenax tube (μg)
- C₀: Mass of volatiles from the blank tube (μg)
- V₁: N₂ volume filled into the sampling bag (L)
- V₂: Sampling volume of Tenax tube (L)
- V₀₂: Sampling volume of the blank tube (L)

4.3.1.2.5 Calculation of Total VOCs (TVOC). Analyze all of compounds whose retention time is between Hexane (C₆) and Hexadecane (C₁₆). It is calculated by TIC calibration curve of Toluene.

4.3.1.2.6 Calculation of Aldehydes Analytes.

$$M (\mu\text{g}) = (C/V_2 - C_0/V_{02}) * V * V_1$$

- M: Concentration of single analyte from the test specimen (μg)

- C: Mass of aldehydes absolute from DNPH cartridge (mg/L)
- C₀: Mass of aldehydes from the blank bag DNPH cartridge (mg/L)
- V: Volume of eluting solution (mL)
- V₁: N₂ volume filled into the sampling bag (L)
- V₂: Sampling volume of DNPH cartridge (L)
- V₀₂: Sampling volume of the blank bag DNPH cartridge (L)

4.3.1.2.7 This test method is applicable to all components and materials that may influence the air quality in vehicles. For applicable sampling for parts requirements, see Table 2 and Table 4. For applicable sampling for materials requirements see Table 3 and Table 5.

Table 2: Tedlar Bag Test Method for Parts

No.	Parts List	Sampling Requirements	Bag Size
1	Instrument Panel Assembly (ASM)	Includes Instrument Panel (IP) carrier, deco moldings, glove box	2000 L
2	Floor Console ASM	1 set	2000 L
3	Door Trim ASM	Front and Rear doors (Half side)	2000 L
4	Front Seats ASM	Driver side with the head rest	2000 L
5	Back Seats ASM	Whole rear seat with head rest	2000 L
6	Seat Cover	1 set	2000 L
7	Seat Foam	1 set	2000 L
8	Headliner ASM	1 set	2000 L
9	Carpet ASM	1 set	2000 L
10	Floor Insulator	1 set	2000 L
11	Foot Mat	1 set	2000 L
12	Dash Inner	1 set	2000 L
13	Rear Compartment Side Trim Hatch Back(HB)	1 set	2000 L
14	Rear Compartment Floor Trim (HB)	1 set	2000 L
15	Rear Compartment Side Trim Notch Back (NB)	1 set	2000 L
16	Rear Compartment Floor Trim (NB)	1 set	2000 L
17	Package Shelf ASM or Rear Window Trim	1 set	2000 L
18	Garnish Trim	A, B, C, D pillars (half side)	2000 L
19	Steering Wheel	1 set	2000 L
20	Air Conditioning ASM	1 set	2000 L
21	Duct ASM	1 set	2000 L
22	Wire Harness I (body wire harness)	1 set	2000 L
23	Wire Harness II (non-body wire harness)	1 set	2000 L
24	Shift	1 set	2000 L

No.	Parts List	Sampling Requirements	Bag Size
25	Sunroof Shade	1 set	2000 L
26	Electric Sunshade Curtain	1 set	2000 L
27	Covering Curtain	1 set	2000 L
28	Sealing Strip	1 set	2000 L

Note: Parts are subject to a single supplier SOR.

Table 3: Tedlar Bag Test Method for Materials

No.	Materials List	Application Parts	Sampling Requirements	Bag Size
1	Polypropylene (PP)	IP/DP/CNSL	4 kg plastic panel (Injection mold temp = +280 °C)	2000 L
2	Paint	Interior Parts	Spray 1 m ² paint on aluminum foil, with film thickness per paint type: soft touch paint 50 µm ± 5 µm, solid color 25 µm ± 5 µm, metallic color 20 µm ± 5 µm	2000 L
3	Leather	Seats	4 m ²	2000 L
4	PVC	Seats	4 m ²	2000 L
5	Polyurethane (PU)	Seats	4 m ²	2000 L
6	Suede	Seats	4 m ²	2000 L
7	Laminated Fabric	Seats/headliner package shelf	4 m ²	2000 L
8	Thermo Plastic Olefin (TPO) rolled	IP/Door Panel (DP)	0.6 m ²	2000 L

Note: Only materials in applications listed in Table 3 require testing per Method A.

Table 4: Limit Value for Assembled Parts Using Tedlar Bags

Assembly/ Parts	Benzene	Toluene	Ethylbenzene	Xylene	Styrene	Formaldehyde	Acetaldehyde	Acrolein	TVOC
	Unit (µg/m ³)								
IP (ASM)	50	800	500	1000	400	300	120	200	28000
Floor Console (ASM)	30	600	400	1000	400	200	60	80	15000
Door Trim (ASM)	50	600	400	1000	400	200	100	80	25000
Front Seats (ASM)	50	400	200	400	150	270	250	100	18000
Back Seats (ASM)	80	800	400	800	300	330	350	200	25000
Seat Cover	30	400	200	400	50	130	200	200	10000
Seat Foam	50	800	200	400	300	300	200	400	40000
Headliner (ASM)	30	800	400	800	100	200	130	30	15000
Carpet ASM (Foam)	30	400	400	800	100	400	350	100	15000

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Assembly/ Parts	Benzene	Toluene	Ethylbenzene	Xylene	Styrene	Formaldehyde	Acetaldehyde	Acrolein	TVOC
	Unit (µg/m³)								
capacity ≤ 4.5 kg)									
Carpet ASM (Foam capacity > 4.5 kg)	30	400	400	800	100	400	350+60 kg	100	15000
Floor Insulator	30	200	200	400	100	200	80	100	7000
Floor Mat	30	200	200	400	50	80	60	30	7000
Dash Inner	30	200	200	800	100	200	130	400	7000
Rear Compartment Side Trim (HB)	30	200	200	400	50	200	60	30	7000
Rear Compartment Floor Trim (HB)	30	200	200	400	50	200	120	30	7000
Rear Compartment Side Trim (NB)	30	200	200	400	50	200	120	30	7000
Rear Compartment Floor Trim (NB)	30	200	200	400	50	200	150	30	7000
Package Shelf (ASM)	30	400	200	400	50	200	60	80	5000
Garnish Trim	30	200	200	400	50	80	40	30	9000
Steering wheel	30	200	200	800	50	100	40	30	10000
Air conditioning (ASM)	80	400	200	400	500	300	80	30	18000
Duct (ASM)	50	400	200	400	300	100	80	30	2500
Wire harness (Body wire harness)	50	2500	400	800	50	200	100	30	35000
Wire Harness II (Non-body wire harness)	50	1500	400	800	50	100	100	30	18000
Shift	30	800	200	400	50	80	40	30	3000
Sunroof Shade	30	600	200	400	50	100	80	30	3000
Electric Sunshade curtain	30	200	200	400	50	80	60	30	2500
Cover Curtain	30	200	200	400	50	80	60	30	2500
Sealing Strip	30	200	200	400	50	80	60	30	10000