

C-AHI

China-Automobile Health Index

No.: CAHI-SM-HPI.VAR-A0-2023

Health Protection Index Vehicle Allergens Risk Test and Rating Protocol

(Version 2023)

Published by **China Automotive Engineering Research Institute Co., Ltd.**

Table of Contents

1	Scope	1
2	Normative References	1
3	Terms and Definitions	2
4	Test Method for Skin Contact Allergen	4
5	Test Method for Respiratory Tract Allergen	5
6	Rating Procedures for Vehicle Allergens Risk (VAR)	7
	Annex A (Normative) Harmful Dyes	10
	Annex B (Normative) Chinese Name, English Name, CAS No. and Molecular Formula of PAEs	12
	Annex C (Informative) Example of Detection Parameters for Gas Chromatography-Mass Spectrometry (GC-MS)	13

Vehicle Allergens Risk Test and Rating Protocol

1 Scope

This document specifies the test and rating methods for allergens in passenger cars.

This document is applicable to the test of skin contact allergen and respiratory tract allergen in passenger cars.

2 Normative References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard.

GB 18401 National General Safety Technical Code for Textile Products

GB/T 2912.3 Textiles - Determination of Formaldehyde - Part 3: High Performance Liquid Chromatography Method

GB/T19941.1 Leather and Fur - Determination of Formaldehyde Content - Part 1: High Performance Liquid Chromatography Method

GB/T 7573 Textiles - Determination of pH of Aqueous Extract (GB/T 7573-2009, ISO 3071:2005, MOD)

QB/T 2724 Leather - Chemical Tests - Determination of pH

GB/T 30512 Requirements for Prohibited Substances on Automobiles

QC/T 944 Test Methods of Polybrominated Biphenyls and Polybrominated Diphenyl Ethers in Automotive Materials

GB/T 17593.2 Textiles - Determination of Heavy Metals - Part 2: Inductively Coupled Plasma Atomic Emission Spectrometry

GB/T 17593.3 Textiles - Determination of Heavy Metals - Part 3: Chromium (VI) - Spectrophotometry

GB/T 17593.4 Textiles - Determination of Heavy Metals - Part 4: Arsenic and Mercury - Atomic Fluorescence Spectrophotometry

GB/T 22930-2008 Leather and Fur - Chemical Tests - Determination of Heavy Metal Content

GB/T 22807 Leather and Fur - Chemical Tests - Determination of Chromium(VI) Content: Colorimetric Method

GB/T 19942 Leather and Fur - Chemical Tests - Determination of Banned Azo Colorants

GB/T 33392-2016 Leather and Fur - Chemical Tests - Determination of 4-aminoazobenzene Derived from Azo Colorants

GB/T 17592 Textiles - Determination of Prohibited Azo Dyes

GB/T 23344 Textiles - Determination of 4-Aminoazobenzene

GB/T 20383 Textiles - Determination of Allergenic Disperse Dyestuffs

GB/T 20382 Textiles - Determination of Carcinogenic Dyestuffs

GB/T 30398 Leather and Fur - Chemical Tests - Determination of Allergenic Disperse Dyestuffs

GB/T 30399 Leather and Fur - Chemical Tests - Determination of Carcinogenic Dyestuffs

GB/T 23345 Textiles - Determination of Dyestuffs of Disperse Yellow 23 and Disperse Orange 149

GB/T 6682 Water for Analytical Laboratory Use - Specification and Test Methods (GB/T 6682-2008, ISO 3696:1987, MOD)

GB/T 28189 Textiles - Determination of Polycyclic Aromatic Hydrocarbons

GB/T 36946 Leather - Chemical Tests - Determination of Polycyclic Aromatic Hydrocarbons - Gas Chromatography - Mass Spectrometry

GB/T 20388 Textiles - Determination of the Phthalate Content - Tetrahydrofuran Method

GB/T 22931 Leather and Fur - Chemical Tests-Determination of Plasticizers

GB/T 24253-2009 Textiles - Evaluation for Anti-mites Activity

C-AHI Test and Evaluation Standard for Volatile Organic Compounds and Odor in Cabin of Vehicles

3 Terms and Definitions

For the purposes of this standard, the following terms and definitions apply.

3.1 passenger car

a motor vehicle which, by its design and technical characteristics, is primarily intended for the carriage of passengers and their baggage and/or temporary articles, with a maximum of 9 seats, including the driver's seat, and which may also tow a trailer

3.2 skin contact allergen

a substance or mixture that causes an allergic reaction at the contact part through skin contact

3.3 respiratory tract allergen

a substance or mixture that causes allergic respiratory diseases

3.4 mite

a small-sized animal belonging to the subclass Acari of class Arachnida of the phylum Arthropoda, with a spherical or elongated body consisting of two parts: gnathosoma and idiosoma, and four pairs of legs in the adult and nymph stages, and three pairs of legs in the larval stage

The mites in this document refer to dust mites that can cause allergic reactions to the human body.

3.5 anti-mite performance

the performance of products in repelling mites or inhibiting their growth and reproduction

Test principle: Place the test sample and control sample in Petri dishes respectively and have them in contact with mites at the same time under specified conditions. After a certain period of cultivation, count the number of mites living in the test sample Petri dish and the control sample Petri dish, and calculate the mite repellency rate or mite inhibition rate according to the adopted test method to evaluate the anti-mite effect.

3.6 selection of test method

selection from two or more test methods for the same item, based on the equipment and technical conditions

3.7 vehicle confirmation and sample collection

3.7.1 vehicle confirmation

confirmation of vehicle appearance and performance See Tables 1 and 2 for the list of key parts and the confirmation form of basic information of sample vehicle.

Table 1 List of Key Parts

Name	Color	Material	Thickness	Manufacturer
Seat				
Steering wheel				
Armrest box				
A/C filter				

Table 2 Confirmation Form of Basic Information of Sample Vehicle

Item	Sample Description
Product name	
Manufacturer	
Vehicle/material model	
Vehicle/material color	
Sales model	
Trademark	
Date of manufacture	

3.7.2 sample collection

3.7.2.1 skin allergen test sample

sample taken at the part positions in Table 2 using a mechanical tool (including but not limited to scissors and drillers) in such a way that the samples are representative and uniform as much as possible to ensure that the analysis results can correctly reflect the quality of vehicle interior trims

- For the same material at the same position, only 1 sampling point is required. For example, if it is confirmed that the materials of 4 seats are the same, samples can be taken only from 1 seat; if not the same, samples shall be taken from all the seats.
- For different materials at the same position, samples of different materials shall be taken for test. For example, the seats are covered with alternating red and black leather. Red and black leather shall be sampled.
- For the same material at different positions, separate samples shall still be taken for test.

Note: Different materials shall be distinguished by material type first; the sample size of 50 ~ 80g can meet the test requirements.

3.7.2.2 respiratory allergen test sample

including the A/C filter cloth that shall be disassembled and removed by the tester from the vehicle under test (VUT) The sampling method for seat surface materials is the same as that described in 3.7.2.1 herein.

3.7.3 storage requirements for test samples

storing the samples collected from a new vehicle that has been off the production line within the past 3 months in a sealable container Skin allergen test samples shall be analyzed within 15 working days, and respiratory allergen test samples shall be analyzed within 30 working days.

4 Test Method for Skin Contact Allergen

The skin contact allergen test mainly involves the coating materials of the steering wheel, armrest box and seat. See Table 3 for test items and standards.

Table 3 Test Items and Standards for Skin Contact Allergen

Test Substance		Applicable Standards	
		Textile	Leather
pH value		GB/T 7573	QB/T 2724
Formaldehyde content (mg/kg)		GB/T 2912.3	GB/T 19941.1
Polybrominated biphenyls and polybrominated diphenyl ethers (mg/kg)	Polybrominated biphenyl	QC/T 944	
	Polybrominated diphenyl ether		
Extractable heavy metals (mg/kg)	Antimony (Sb)	GB/T 17593.2-2007 GB/T 17593.3-2006 GB/T 17593.4-2006	GB/T 22930-2008 GB/T 22807
	Arsenic (As)		
	Lead (Pb)		
	Cadmium (Cd)		
	Chromium (Cr)		
	Hexavalent chromium (Cr(VI))		
	Cobalt (Co)		
	Copper (Cu)		
	Nickel (Ni)		
	Mercury (Hg)		
Harmful dyes (mg/kg)	Decomposable carcinogenic aromatic amine dyes	GB/T 17592	GB/T19942
	Aniline	GB/T 17592	GB/T19942
	Carcinogenic dyes	GB/T 20382	GB/T 30399
	Allergenic dyes	GB/T 20383	GB/T 30398
	Other prohibited dyes	GB/T 23345	GB/T 30399
Phthalates (%)	Total (except DINP)	GB/T 20388	GB/T22931
	Total		
Polycyclic aromatic hydrocarbon (PAH) (mg/kg)	Benzo[a]pyrene	GB/T 28189	GB/T 36946
	Total, 16 kinds of PAHs		

4.1 Description of materials

Leather: genuine leather material;

Textiles: Non-woven fabrics, textiles, microfiber products, PVC and PU are tested according to the standards for textiles, while polyurethane materials are tested with reference to the standards for textiles.

4.2 Description of test items

Total phthalates include DEP, DMP, DBP, BBP, DEHP, DNOP and DINP.

5 Test Method for Respiratory Tract Allergen

5.1 Sampling and testing of formaldehyde and xylene

5.1.1 Sample collection

After removing the surface coverings (such as plastic film used to protect seats and carpets) from interior components of the vehicle outside the VOC test environment chamber, push the vehicle into the environment chamber. Maintain the vehicle stationary in the chamber, with doors, windows, passenger compartment air inlet damper, engine and all other equipment (e.g., A/C) closed. Additionally, turn the A/C to internal circulation position.

Select the midpoint of the connection line of front seat headrest connection line (for adjustable front seat, slide it to the rearmost point of the slide rail) as the sampling point, ensuring the height of the sampling point is aligned with that of the breathing zone of driver and passengers. The schematic diagram of sampling points is shown in the "C-AHI Test and Evaluation Standard for Volatile Organic Compounds and Odor in Cabin of Vehicles". Then install the sampling device assembly, which consists of metal fixture, sampling conduit, sampling tube, etc. The metal fixture is used to fix the sampling conduit at the headrest of the front seat. The sampling conduit is made of PTFE, and its ends are sealed. Then, the sampling device assembly is checked for leakage. When the sampling device assembly is installed, at least one temperature transfer and sensing device shall be used to measure the air temperature at the sampling point, and a hygrometer shall be placed in the vehicle to record the relative humidity.

Start the vehicle VOC test environment chamber, set the temperature to 28°C and the relative humidity to 50%RH. At this stage, the VOC test environment chamber shall meet the following conditions: a) ambient temperature: 28°C ± 2°C; b) relative humidity: 50%RH ± 10%RH; c) air speed: ≤ 0.3 m/s.

Fully open all doors and windows, trunk and openable storage compartments inside the vehicle for 6 h. In the last 4 h, ensure that the environmental conditions in the environment chamber meet the above-mentioned requirements.

After the 6 h, close all doors and windows, trunk and storage compartments inside the vehicle. Begin the enclosure stage, which shall last for at least 16 h. At this stage, ensure that there is no air exchange between the vehicle and the chamber. At the enclosure stage, the environment chamber still shall meet the following conditions: a) ambient temperature: 28°C ± 2°C; b) relative humidity: 50%RH ± 10%RH; c) air speed: ≤ 0.3 m/s.

Perform a flow rate calibration for the gas sampling pump with a first-class soap film flow meter. See "5.2" herein for details of the sampling tube and sampling flow rate.

Once the enclosure time is sufficient, use corresponding sampling tubes for sampling. See "5.2" herein for details of the sampling tube and sampling flow rate. During the collection of air in the vehicle, air samples shall be collected from the sampling environment chamber as blank samples. The sampling point for the chamber air shall be located within a space not more than 0.5 m away from the outer surface of the VUT, and at a height equivalent to that of the sampling point in the vehicle. One background sample, each for VOC and aldehyde and ketone components, shall be taken from the chamber. **All sampling duration shall be 30 min.**

After sampling, stop the sampling pumps used for collecting VOC and aldehyde and ketone components both inside and outside the vehicle, seal the sampling tube opening with a sealing cap, wrap the sampling tube tightly with tin foil or aluminum foil, and store and transport it at low temperature (< 4°C) for a **maximum duration of 30 days.**

5.1.2 Sampling tube and sampling flow rate

Table 5.1 Sampling Tube Type, Sampling Flow Rate, Sampling Duration and Sample Storage

Item	Sampling Tube Type	Sampling Flow Rate (ml/min)	Sampling Duration (min)	Sample Storage Duration
Formaldehyde	DNPH sampling tube	100-500	30	Below 4°C, 30 d
Xylene	Tenax TA	100-200	30	Below 4°C, 30 d

5.1.3 Test methods

The test is conducted with reference to the method at the normal temperature stage prescribed in the China-Automobile Health Index *Test and Evaluation Standard for Volatile Organic Compounds and Odor in Cabin of Vehicles*.

5.2 Test of mite repellency rate

5.2.1 Test preparation

Male and female *Dermatophagoides farinae* Hughes at the adult or the nymph stage shall be used in the test.

A/C filter cloth collected according to 3.7.2 of this standard: Select a representative test sample from each type of sample, and cut it into a circle with a diameter of 58 mm as the test sample.

3 test samples and 3 control samples shall be collected respectively. The control sample is a 100% cotton fabric that has been cooked at a high temperature and washed with distilled water.

5.2.2 Test method

In this standard, the anti-mite performance of materials shall be tested by the repellency method.

Put a piece of sponge with a thickness of 10 mm and side length of about 200 mm into the container with a lid, and fill an appropriate amount of saturated saline (with height just enough to immerse the sponge).

Take 7 Petri dishes, place one in the center of the sticky plate as a central Petri dish, and evenly place the other 6 Petri dishes around the central Petri dish in a petal-like pattern, and stick the edges between each Petri dish with transparent tapes of the same width (serving as a bridge). Then fix 7 Petri dishes on the sticky plate.

Place the test sample and control sample in 6 peripheral Petri dishes alternately. Evenly, flatly and tightly place the test sample on the bottom of the Petri dish and place 0.05 g of feed for mite in the center of the test sample.

Place (2000 ± 200) live mites on the central Petri dish.

Place the sticky plate assembly with mites for test and feed on the sponge, cover the upper lid of the container, and place it in a constant temperature and humidity incubator at a temperature of 25°C ± 2°C and relative humidity of 75%RH ± 5%RH.

After 24 h of incubation, observe with a dissecting microscope or stereomicroscope and count the number of mite adults and nymphs living in the Petri dishes with test samples and the Petri dishes with control samples by appropriate methods.

5.2.3 Calculation and rating of results

The repellency rate (Q) is calculated by Formula (5-1):

$$Q = \frac{B - T}{B} \times 100 \quad (5-1)$$

Where,

B - average of the number of living mites in three control samples;

T - average of the number of living mites in three test samples.

6 Rating Procedures for Vehicle Allergens Risk (VAR)

6.1 Evaluation principle

To ensure the scientific, fair and impartial rating of VAR in the "China-Automobile Health Index", the following principles shall be followed:

(1) Focuses

The rating shall focus on the health indexes of occupants during vehicle usage, and involve a special rating of allergy risk-prone areas in vehicles. The purpose is to promote the development and application of environmentally friendly materials, configurations and processes, drive automobile enterprises to develop vehicles that are safe, environmentally friendly, and health-conscious, and guide the industry to a healthy development path.

(2) Objectivity

Rating indexes, methods and modes shall objectively and fully reflect the essential characteristics of products, ensuring the objective and fair rating results.

(3) Comprehensiveness

Comprehensive ratings shall be performed from multiple aspects and perspectives. The rating indexes shall not be limited to the requirements of current domestic standards.

(4) Operability

The rating indexes shall not only fully reflect the VAR, but also be operable. The rating mode shall be concise and reasonable, and there shall be clear levels for rating indexes.

6.2 Scoring rules

6.2.1 Scoring rules for skin contact allergen risks

The rating is conducted on 3 sampling locations of seat, steering wheel and armrest box, with a total score of 270 points.

Table 5 Scoring Rules for Skin Contact Allergen Risks

Rating Criteria						
Item	Technical Requirements		Full Score	Range of Results (Detected Values ÷ Technical Requirements)	Weight Coefficient	
	Textile	Leather				
pH value	4.0 - 7.5	3.5-7.5	3	/	/	
Formaldehyde content (mg/kg)	20	10	12	≤ 0.01 > 0.01 and ≤ 0.1 > 0.1 and ≤ 0.4 > 0.4 and ≤ 0.7 > 0.7 and ≤ 0.9 > 0.9 and ≤ 1 > 1	1 0.8 0.6 0.3 0.1 0.01 0	
Polybrominated biphenyls and polybrominated diphenyl ethers (mg/kg)	Polybrominated biphenyl	100	100			9
	Polybrominated diphenyl ether	100	100			9
Extractable heavy metals (mg/kg)	Antimony (Sb)	30	30			21
	Arsenic (As)	0.2	0.2			9
	Lead (Pb)	0.2	0.2			9
	Cadmium (Cd)	0.1	0.1			9
	Chromium (Cr)	1.0	5.0			30
	Hexavalent chromium (Cr(VI))	0.5	3.0			18
	Cobalt (Co)	1.0	1.0			12
	Copper (Cu)	25.0	25.0			12
	Nickel (Ni)	1.0	1.0			21
	Mercury (Hg)	0.02	0.02			9
Harmful dyes (mg/kg)	Decomposable carcinogenic aromatic amine dyes	20	20			9
	Aniline	50	50			18
	Carcinogenic dyes	50	50			9
	Allergenic dyes	50	50			12
	Other prohibited dyes	50	Not to be used			3
Phthalates (%)	Total (except DINP)	0.05	0.05			9
	Total	0.1	0.1	12		
Polycyclic aromatic hydrocarbon (PAH) (mg/kg)	Benzo[a]pyrene	0.5	0.5	3		
	Total, 16 kinds of PAHs	5.0	5.0	12		

Example

For a vehicle model, there are 3 kinds of allergenic materials: armrest box material (1 kind), seat material (1 kind) and steering wheel material (1 kind).

Calculation: The detected formaldehyde content of the armrest box material (textile) is 5 mg/kg. Range of results of this material (detected values/technical requirements):

$$(5 \text{ mg/kg}) / (20 \text{ mg/kg}) = 0.25 (> 0.1 \text{ and } \leq 0.4)$$

Corresponding weight coefficient: 0.6.

Therefore, the individual score of armrest box material is: $12 \div 3 \times 0.6 = 2.4$ points

Note: 12 points - full score of formaldehyde content for the vehicle; 3 points - score of material type; $12 \div 3$ - individual full score of material;

0.6 - weight coefficient.

6.2.2 Scoring rules for respiratory tract allergen risks

The total score for rating respiratory tract allergen risks is 130 points, including 100 points as the total score for anti-mite performance, and 30 points as the total score for formaldehyde and xylene in the air of the vehicle.

6.2.2.1 Scoring rules for anti-mite performance

Table 7 Scoring Rules for Anti-mite Performance

Anti-mite Performance of Textiles	Full Score	Repellency Rate (%)	Repellency Rate (%) - Partitioning	Weight Coefficient
A/C filter	100	≥95	≥95	1.0
		[80-95)	[90-95)	0.95
			[85-90)	0.90
			[80-85)	0.85
		[60-80)	[75-80)	0.75
			[70-75)	0.70
[65-70)	0.65			
<60	<60	0.60		
		<60	0	

Example

The test results show that the mite repellency rate of A/C filter cloth of a vehicle model is 72.31%.

The score of the anti-mite performance of this model is calculated as $100 \times 0.70 = 70$ points

6.2.2.2 Scoring rules for formaldehyde and xylene

Table 5 Scoring Rules for Respiratory Allergen Formaldehyde and Xylene

Evaluation Item	Concentration (mg/m ³)	Full Score	Range of Results (Detected Values ÷ Technical Requirements)	Weight Coefficient
Formaldehyde	0.1	15	≤0.1	1.0
			>0.1 and ≤ 0.2	0.7
			>0.2 and ≤ 0.4	0.5
			>0.4 and ≤ 0.7	0.3
			>0.7 and ≤ 0.9	0.1
Xylene	0.1	15	>0.9 and ≤ 1	0.01
			>1	0

6.3 Result evaluation and release

The total score of VAR part in China-Automobile Health Index consists of score of skin allergy risk and that of respiratory tract allergy risk.

The total score of all items in the above scoring rules is 400 points. The total score of the vehicle under assessment is the sum of the score for each item, and the relative score of each model is obtained by dividing the total score by 4.

Annex A (Normative) Harmful Dyes

A.1 Toxic aromatic amines not allowed to be generated through the decomposition of dyes under reducing conditions

A.1.1 Category I: aromatic amines that are carcinogenic to humans, as shown in Table A.1.

Table A.1 Harmful Dyes of Category I

No.	Name of Compound	CAS No.
1	4-aminobiphenyl	92-67-1
2	4-chloro-o-aminotoluene	95-69-2
3	Benzidine	92-87-5
4	2-naphthylamine	91-59-8

A.1.2 Category II: aromatic amines that are carcinogenic to animals and may be carcinogenic to humans, as shown in Table A.2.

Table A.2 Harmful Dyes of Category II

No.	Name of Compound	CAS No.
1	o-Aminoazotoluene	97-56-3
2	4,4-methylene-bis(2-chloroaniline)	101-14-4
3	2-amino-4-nitrotoluene/5-nitro-o-toluidine	99-55-8
4	4,4-diaminodiphenyl ether	101-80-4
5	p-Chloroaniline	106-47-8
6	4,4-diaminodiphenyl sulfide	139-65-1
7	2,4-diaminoanisole	615-05-4
8	o-Toluidine	95-53-4
9	4,4'-diaminodiphenylmethane	101-77-9
10	2,4-diaminotoluene	95-80-7
11	3,3'-dichlorobenzidine	91-94-1
12	2,4,5-trimethylaniline	137-17-7
13	3,3'-dimethoxybenzidine	119-90-4
14	o-Aminoanisole	90-04-0
15	3,3'-dimethylbenzidine	119-93-7
16	2,4-dimethylaniline	95-68-1
17	3,3'-dimethyl-4,4'-diaminodiphenylmethane	838-88-0
18	2,6-dimethylaniline	87-62-7
19	2-methoxy-5-methylaniline	120-71-8
20	4-aminoazobenzene	60-09-3

A.2 Carcinogenic dyes, as shown in Table A.3

Table A.3 Carcinogenic Dyes

No.	Name of Compound	CAS No.
1	Acid Red 26	3761-53-3
2	Disperse Blue 1	2475-45-8
3	Basic Red 9	569-61-9
4	Disperse Yellow 3	2832-40-8
5	Direct Red 28	573-58-0
6	Direct Black 38	1937-37-7
7	Direct Blue 6	2602-46-2
8	Basic Violet 14	2475-45-8

9	Disperse Orange 11	2475-45-8
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A.3 Allergenic dyes, as shown in Table A.4

Table A.4 Allergenic Dyes

No.	Name of Compound	CAS No.
1	Disperse Blue 1	2475-45-8
2	Disperse Blue 3	2475-46-9
3	Disperse Blue 7	3179-90-6
4	Disperse Blue 26	3860-63-7
5	Disperse Blue 35	12222-75-2
6	Disperse Blue 102	12222-97-8
7	Disperse Blue 106	12223-01-7
8	Disperse Blue 124	61951-51-7
9	Disperse Orange 1	2581-69-3
10	Disperse Orange 3	730-40-5
11	Disperse Orange 37	13301-61-6
12	Disperse Red 1	2872-52-8
13	Disperse Red 11	2872-48-2
14	Disperse Red 17	3179-89-3
15	Disperse Yellow 1	1216941-48-8
16	Disperse Yellow 3	2832-40-8
17	Disperse Yellow 9	6373-73-5
18	Disperse Yellow 39	12236-29-2
19	Disperse Yellow 49	54824-37-2
20	Disperse Brown 1	23355-64-8

A.3 Other prohibited dyes, as shown in Table A.5

Table A.5 Other Prohibited Dyes

No.	Name of Compound	CAS No.
1	Disperse Orange 149	85136-74-9
2	Disperse Yellow 23	6250-23-3

Annex B (Normative) Chinese Name, English Name, CAS No. and Molecular Formula of PAEs

Table B.1 Chinese Name, English Name, CAS No. and Molecular Formula of PAEs

No.	Chinese Name	English Name	Abbreviation	CAS No.	Molecular Formula
1	邻苯二甲酸二甲酯	Dimethyl phthalate	DMP	131-11-3	C ₁₀ H ₁₀ O ₄
2	邻苯二甲酸二乙酯	Diethyl phthalate	DEP	84-66-2	C ₁₂ H ₁₄ O ₄
3	邻苯二甲酸二丁酯	Dibutyl phthalate	DBP	84-74-2	C ₁₆ H ₂₂ O ₄
4	邻苯二甲酸丁基苄基酯	Benzyl butyl phthalate	BBP	85-68-7	C ₁₉ H ₂₀ O ₄
5	邻苯二甲酸二(2-乙基)己酯	Bis(2-n-butoxyethyl) phthalate	DEHP	117-81-7	C ₂₄ H ₃₈ O ₄
6	邻苯二甲酸二正辛酯	Di-n-octyl phthalate	DNOP	117-84-0	C ₁₀ H ₃₈ O ₄

Annex C (Informative) Example of Detection Parameters for Gas Chromatography-Mass Spectrometry (GC-MS)

Since the test results depend on the instrument used, it is not possible to provide universal parameters for chromatographic analysis. The following parameters have been proven to be suitable for test:

C.1 Chromatographic conditions

C.1.1 Capillary chromatographic column: DB-5MS, 30 m × 0.25 mm × 0.1 μm or equivalent.

C.1.2 Injection port temperature: 300°C;

C.1.3 Temperature rise procedure:

- 100°C (1 min), 100°C ~ 180°C (15°C /min);
- 180°C (1 min), 180°C ~ 300°C (5°C /min);
- 300°C (10 min).

C.1.4 Carrier gas: helium, purity ≥ 99.999%, flow rate of 1.2 ml/min;

C.1.5 Injection mode: split injection or splitless injection (valve opened after 1.5 min).

C.1.6 Injection volume: 1 μL.

C.2 Mass spectrometric conditions

C.2.1 Chromatography and mass spectrometry interface temperature: 280°C.

C.2.2 Ionization mode: electron impact (EI).

C.2.3 Determination method: selected ion monitoring (SIM).

C.2.4 Ionization energy: 70 eV.

C.2.5 Solvent delay: 4 min.

Table C.1 Reference Retention Time, Qualitative and Quantitative Ions of PAEs

S/N Name of Compound				
No.	Name of Compound	Retention Time (min)	Qualitative Ion (m/z)	Quantitative Ion (m/z)
1	Dimethyl phthalate (DMP)	6.0	163,77,194	163
2	Diethyl phthalate (DEP)	7.1	149,177,105	149
3	Dibutyl phthalate (DBP)	9.6	149,150,205	149
4	Benzyl butyl phthalate (BBP)	-	149,206,150	149
5	Bis(2-ethylhexyl) phthalate (DEHP)	12.9	149,167,279	149
6	Di-n-octyl phthalate (DNOP)	13.8	279,167,261	279