

Annex A:



China Green Car Assessment Programme (C-GCAP) - Trial Version

Test & Assessment Rules for Health

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1 Scoring Method

1.1 Indicator System

The health indicators are shown in Table 1-1.

Table 1-1 Health Indicator System

Primary Indicator	Secondary Indicator	Tertiary Indicator
Health	Interior air	Concentrations of VOCs
		Interior odor
	Electromagnetic protection	Human electromagnetic protection

1.2 Weight Assignment of Indicators

1.2.1 Weight Assignment of Secondary Indicators

There are two secondary indicators of health: interior air and electromagnetic protection. The weight of each indicator is shown in Table 1-2.

Table 1-2 Weights of Secondary Indicators of Health

Primary Indicator	No.	Secondary Indicator	Weight
Health	1	Interior air	80%
	2	Electromagnetic protection	20%

1.2.2 Weight Assignment of Tertiary Indicators

There are two tertiary indicators under the secondary indicator of interior air: concentrations of VOCs and interior odor. The weight of each indicator is shown in Table 1-3.

Table 1-3 Scores of Interior Air

Secondary Indicator	No.	Tertiary Indicator	Weight
Interior air	1	Concentrations of VOCs	60%
	2	Interior odor	40%

The secondary indicator of electromagnetic protection includes one tertiary indicator: human electromagnetic protection, and its weight assignment is shown in Table 1-4.

Table 1-4 Score of Electromagnetic Protection

Secondary Indicator	No.	Tertiary Indicator	Weight
Electromagnetic protection	1	Human electromagnetic protection	100%

1.2.3 Weight Assignment of Quaternary Indicators

The concentrations of VOCs shall be evaluated objectively through testing, and it has three quaternary indicators: concentrations of VOCs under ambient mode , concentrations of VOCs under parking mode and concentrations of VOCs under driving mode. The weight of each indicator is shown in Table 1-5.

Table 1-5 Scores of Concentrations of VOCs

Tertiary Indicator	Quaternary Indicator		
	No.	Evaluation Item	Weight
Concentrations of VOCs	1	Concentrations of VOCs under ambient mode	40%
	2	Concentrations of VOCs under parking mode	30%
	3	Concentrations of VOCs under driving mode	30%

The interior odor shall be evaluated subjectively through testing, and it has two quaternary indicators: interior odor under ambient mode and interior odor under parking mode. The weight of each indicator is shown in Table 1-6.

Table 1-6 Table of Interior Odor

Tertiary Indicator	Quaternary Indicator		
	No.	Evaluation Item	Weight
Interior odor	1	Interior odor under ambient mode	60%
	2	Interior odor under parking mode	40%

The human electromagnetic protection shall be evaluated objectively through testing, and it includes one quaternary indicator: minimum margin of human electromagnetic protection, as shown in Table 1-7.

Table 1-7 Score of Human Electromagnetic Protection

Tertiary Indicator	Quaternary Indicator		
	No.	Evaluation Item	Weight
Human electromagnetic field protection	1	Minimum allowance of human electromagnetic protection	100%

1.3 Calculation

1.3.1 Calculation of Primary Indicator

The evaluation result of the primary indicator of health in C-GCAP is based on the scores and weights of secondary indicators, rounded to one decimal place. The calculation method is shown in Equation 1-1.

$$S = \sum_{i=1}^2 S_i \times a_i \quad (1-1)$$

In which: S is the total score of health; i is the number of secondary indicator; S_i and a_i are the score and weight of the secondary indicator numbered i , respectively. The numbers and weights are shown in Table 1-2.

1.3.2 Calculation of Secondary Indicators

The scores of the secondary indicators are based on the scores and weights of the tertiary indicators, rounded to two decimal places. The calculation method is shown in Equation 1-2.

$$S_i = \sum_{j=1}^{n_i} S_{ij} \times b_{ij} \quad (1-2)$$

In which: j is the number of a tertiary indicator under a secondary indicator; n_i is the number of tertiary indicators under the secondary indicator numbered i ; S_{ij} and b_{ij} are the score and weight of the tertiary indicator numbered j under the secondary indicator numbered i , respectively. The numbers of weights of the tertiary Indicators are shown in Tables 1-4 and 1-5.

1.3.3 Calculation of Tertiary Indicators

The scores of the tertiary indicators are based on the scores and weights of the quaternary indicators, rounded to two decimal places. The calculation method is the same as that for the secondary indicators.

1.4 Explanations of the Scores of Indicators

1.4.1 Explanation of the Score of Concentrations of VOCs

The concentrations of VOCs shall be evaluated objectively through testing, and it has three quaternary indicators: concentrations of VOCs under ambient mode, concentrations of VOCs

under parking mode and concentrations of VOCs under driving mode. The test shall be conducted with the method specified in this chapter. The scoring is on the basis of the measured concentrations of the eight volatile organic compounds (VOCs) in the car under ambient mode, parking mode and driving mode. Score of a single VOC is equal to scoring coefficient of a single VOC, which is calculated by dividing measured value by reference value, times the full score of the VOC. The scores of the concentrations of VOCs under ambient mode, parking mode and driving mode are the sum of the eight VOCs under each mode. The scoring method is shown in Table 1-8.

Table 1-8 Scores of Concentrations of VOCs under ambient mode, parking mode and driving mode

Name		Full Score	Reference Value	Measured Value/Reference Value	Scoring Coefficient
			mg/m ³		
Concentrations of VOCs	Benzene	20	0.05	≥ 1.0	0
	Toluene	10	1.00	$\geq 0.9 \cap < 1.0$	0.1
	Xylene	10	1.00	$\geq 0.8 \cap < 0.9$	0.2
	Ethylbenzene	10	1.00	$\geq 0.7 \cap < 0.8$	0.3
	Styrene	10	0.26	$\geq 0.6 \cap < 0.7$	0.4
	Formaldehyde	20	0.10	$\geq 0.5 \cap < 0.6$	0.5
	Acetaldehyde	10	0.20	$\geq 0.4 \cap < 0.5$	0.6
	Acrolein	10	0.05	$\geq 0.3 \cap < 0.4$	0.7
				$\geq 0.2 \cap < 0.3$	0.8
				$\geq 0.1 \cap < 0.2$	0.9
				< 0.1	1.0

1.4.2 Explanation of the Score of Interior Odor

The evaluation method of interior odor should meet the requirements of T/CMIF 13.

The professional interior odor assessors evaluate two quaternary indicators (odour under ambient mode and odor under parking mode) according to T/CMIF 13. The scores of interior odor evaluation are shown in Table 1-9.

Table 1-9 Scores of Interior Odor under ambient and parking modes

Name	Odor Level	Score
Interior odor under ambient mode	≥ 5.0	0
	$> 3.5 \cap < 5.0$	$> 0 \cap < 60$
	3.5	60
	$> 3.0 \cap < 3.5$	$> 60 \cap < 90$
	3.0	90
	$> 2.5 \cap < 3.0$	$> 90 \cap < 100$
	≤ 2.5	100
Interior odor under parking mode	≥ 5.5	0
	$> 4.0 \cap < 5.5$	$> 0 \cap < 60$

	4.0 $>3.5 \cap < 4.0$ 3.5 $>3.0 \cap < 3.5$ ≤ 3.0	60 $>60 \cap < 90$ 90 $>90 \cap < 100$ 100
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1.4.3 Explanation of the Score of Human Electromagnetic Protection

The test shall be conducted according to GB/T 37130-2018 *Measurement Methods for Electromagnetic Fields of Vehicle With Regard to Human Exposure* to measure the magnetic field radiation of a vehicle at constant speed and in acceleration, deceleration and charging conditions. The minimum allowance shall be calculated based on the public reference limits provided in GB 8702-2014 *Controlling Limits for Electromagnetic Environment* and shall be used as the basis of scoring. The score of electromagnetic radiation shall be calculated with linear interpolation. The scoring method is shown in Table 1-10 and Table 1-11:

Note 1: Allowance: the difference between the electromagnetic compatibility level of a device, equipment or system and the emission limit, measured in dB;

Note 2: If the vehicle is equipped with a wireless mobile phone charger in accordance with the requirements of the *Provisional Regulations on Radio Management of Wireless Charging (Power Transmission) Equipment*, the electromagnetic field emissions within the frequency used can be exempted; (a third-party test report is required from the enterprise)

Note 3: The test results will not be assessed for transient and accidental signals.

Table 1-10 Score of Human Electromagnetic Protection

Name	Allowance (dB)	Score
Human electromagnetic protection	≥ 25	100
	15	60
	3	20
	< 3	0

Table 1-11 Calculation of Final Scores

Name	Vehicle Status	Weight
Human electromagnetic protection (PEVs/HEVs)	Driving	70%
	Charging	30%
Human electromagnetic	Driving	100%

protection (gasoline vehicles)		
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2 Test Methods

2.1 Test Methods of Concentrations of VOCs and Interior Odor

2.1.1 Reference Standards

GB/T 27630-2011 Guideline for Air Quality Assessment of Passenger Car

HJ/T 400-2007 Determination of Volatile Organic Compounds and Carbonyl Compounds in Cabin of Vehicles

T/CMIF 13 Specification for Odor Assessment of In-car Air Quality

ISO 12219-1-2012 Interior Air of Road Vehicles - Part 1: Whole Vehicle Test Chamber - Specification and Method for the Determination of Volatile Organic Compounds in Cabin Interiors

2.1.2 Test Preparations

- 1) Any artificial modifications that can affect the emission of interior VOCs should not be applied in the test vehicle prior to the test.
- 2) Adsorption or purification device that affects the test results should not be temporarily placed in the test vehicle, unless these devices are necessary to be configured in accordance with the manufacturing requirements of the manufacturer. .
- 3) The type and amount of fuel in the fuel tank of the test vehicle should be added according to the manufacturer's regulations.
- 4) The testing time of domestically produced passenger cars should be (28 ± 5) days after the new car rolls off the production line (production date).
- 5) The testing time of imported vehicles is determined according to the time of arrival in the Chinese market.
- 6) Before the start of the formal test, the test vehicle should be placed in a test chamber with a temperature $(25 \pm 2)^{\circ}\text{C}$, relative humidity $(50 \pm 10)\%$, wind speed less than 0.3 m/s, and an odor intensity level not more than 2.0 for 24h. The doors, windows, sunroof and trunk of the vehicle should be opened, and the engine, air conditioning and other equipment should be switched off. All interior protective films for transport protection purposes should be removed.

2.1.3 Test Method

The ambient mode is a test mode that simulates the concentration of eight VOCs and the odor in the vehicle after a long period of closure. The parking mode is a test mode that simulates the concentration of eight VOCs and the odor inside the vehicle after being irradiated by sunlight.. The driving mode is a test mode that simulates the vehicle to turn on the air conditioner after sunlight irradiation and investigates the purification effect of the air conditioning of the test vehicle..

The eight VOCs under the ambient mode, parking mode and driving mode should be sampled with the sampling method specified in 4 of HJ/T 400-2007, and the samples should be analyzed with the analysis method specified in 5; the concentrations of the eight VOCs under each modes should be converted to the mass-volume concentration in the standard condition.

After the sampling under ambient mode and parking mode is completed, the interior odor of the test vehicle should be evaluated by the professional interior odor assessors according to the requirements of T/CMIF 13. The interior odor will be processed in accordance with T/CMIF 13.

2.2 Test Method of Human Electromagnetic Protection

2.2.1 Reference Standard:

GB/T 37130-2018 *Measurement Methods for Electromagnetic Fields of Vehicle With Regard to Human Exposure*.

The test site may be indoor or outdoor. The magnetic induction in the test environment shall be lower than 6dB for the allowance requirement corresponding to the score of 100 in Table 1-10.

2.2.2 Test Positions

2.2.2.1 Test Positions in the Driving State

The measurement positions in the driving state include each of the seat positions and foot positions, as shown in Figure 1. In the seat position, there are three test points through the center line of the seat: 1) the center of the headrest; 2) the center of the seat backrest; 3) the center of the cushion, as shown in Figure 2; the foot space in the driver's position is the middle point in a 20cm*20cm area along the floor under the brake pedal and the floor where the left foot is placed, while the foot space in the interior position is a 40cm*40cm floor area in each position. The test points are the centers of the four sub-areas that constitute the whole area, as shown in Figure 3.

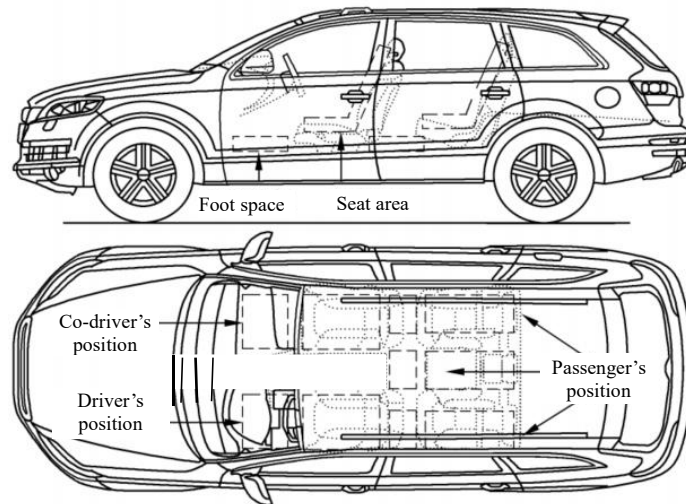


Figure 1 Test Positions in Driving State

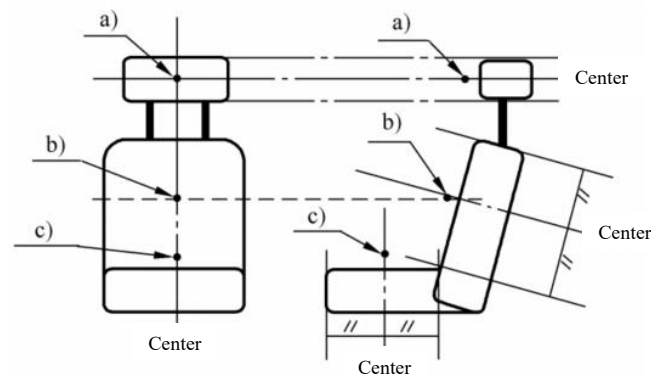


Figure 2 Test Points in the Seat Position

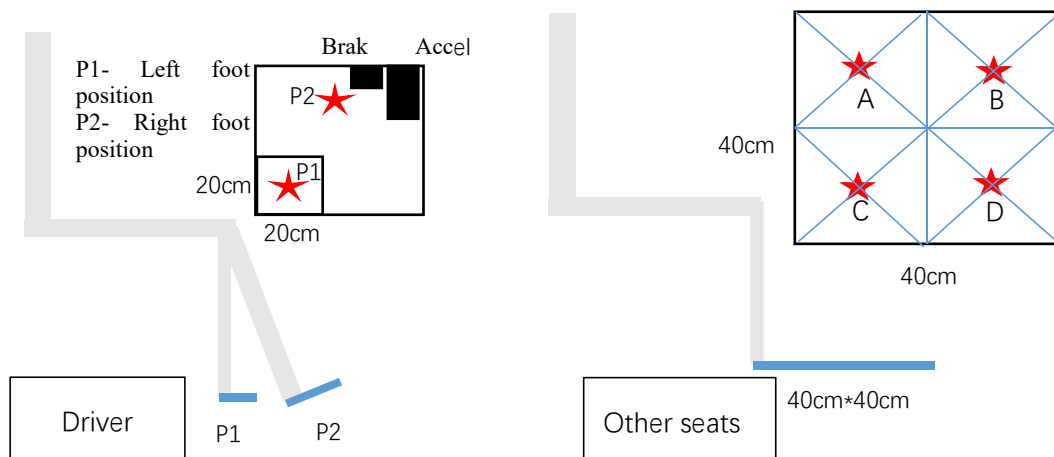


Figure 3 Test Points in the Foot Position

All the adjustable seats shall be adjusted to the central positions within the forward-backward movable range and to the lowest positions within the upward-downward movable range. All the adjustable seat backrests shall be adjusted to $15^{\circ} \pm 5^{\circ}$ rearward, as shown in Figure 4. All the

adjustable headrests shall be in the fully retracted state.

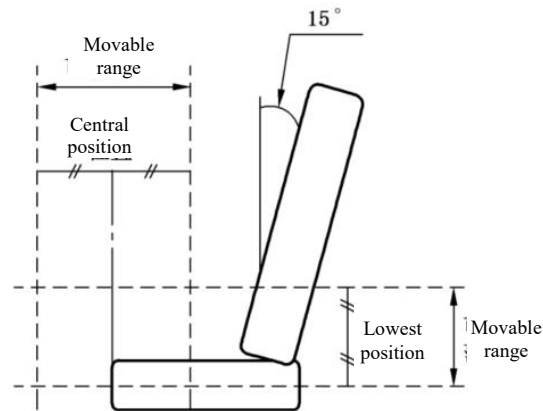


Figure 4 Seat State

2.2.2.2 Test Positions in the Charging State for EVs

The measurement positions in the charging state include each of the seat positions and foot positions, as shown in Figure 1. The test points are the same as those in the driving state.

2.2.3 Test Method

2.2.3.1 Measurement in the Driving State

State of Automotive Electrical Appliances: All the automotive electrical appliances that can be manually switched on by the driver or a passenger and that are in operation for more than 60s shall be placed in typical load states, and the recommended states shall include at least: the headlights set to the high beam state, the instrument lights set to the maximum brightness, the front wiper motor operating at maximum speed, the air conditioning set to the cooling mode (22°C, medium air flow, internal circulation), seat heating (medium), seat massage (medium), audio playing at a medium volume, and wireless mobile phone chargers in the charging state (a mainstream mobile phone shall be used as a typical wireless charging load, and its battery shall be between 20% and 80% throughout the test);

Note: If there are multiple wireless mobile phone chargers mounted in the vehicle, all of them shall be in the charging state.

Vehicle State: During the test, EVs and HEVs shall be in a state of charge (SOC) between 20% and 80%; HEVs shall run on both the electric motor and the internal combustion engine. If this is not possible, they shall be measured separately when running on the internal combustion engine alone and on the electric motor alone.

Measurement Process in the Driving State: The driving states of the vehicle include the constant speed state, the acceleration state and the deceleration state. In the constant state, the

vehicle drives at a speed of 40km/h. In the acceleration state, the vehicle accelerates with an acceleration more than or equal to 2.5m/s^2 from a standstill to a speed of 90km/h or until it reaches the maximum speed, and in the deceleration state, the vehicle decelerates with a deceleration more than or equal to 2.5m/s^2 from a speed of 90km/h or from the maximum speed until it stops. When the vehicle is at a constant speed, a magnetic field exposure analyzer covering the frequency range of 10Hz-400kHz shall be used to test the center of the headrest, the center of the seat backrest, the center of the cushion and the foot position in each seat, and the minimum allowance (expressed in dB) for each position shall be recorded. The position with the minimum allowance shall be tested under the bad acceleration and deceleration operating conditions.

After the automotive electrical appliances in the vehicle under test are set to the desired states, it is desirable to test the vehicle after it has been pre-heated for 10 minutes at an idle speed/in the ready state.

2.2.3.2 Measurement in the Charging State for EVs

State of Automotive Electrical Appliances: All the automotive electrical appliances that can be manually switched on by the driver in the charging state shall be placed in typical load states, and the recommended states shall include at least: the air conditioning set to the cooling mode (22°C , medium air flow, internal circulation), seat heating (medium), seat massage (medium), audio playing at a medium volume, and wireless mobile phone chargers in the charging state (a mainstream mobile phone shall be used as a typical wireless charging load, and its battery shall be between 20% and 80% throughout the test);

Vehicle State: The vehicle shall be in an SOC between 20% and 80%;

The vehicle shall be tested under the AC and DC charging modes:

- If the vehicle supports AC three-phase charging, an AC conduction charging test shall be conducted in this mode only, and the AC charging current shall not be less than 80% of the vehicle's maximum continuous charging current;

- The DC charging current shall not be less than 20A or 20% of the vehicle's maximum continuous charging current, whichever is greater.

Measurement Process in the Charging State: When the vehicle is in charging state, tests shall be conducted in the center of the headrest, the center of the seat backrest, the center of the cushion and the foot area in all the seat positions, and the minimum allowance of each position shall be the result of the magnetic emission test for the vehicle in the charging state.