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Test method of exposure to weathering for motor vehicle

汽车整车大气暴露试验方法

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Test method of exposure to weathering for motor vehicle

1 Scope

This Standard specifies test principle, test conditions, instruments and equipment, test samples, exposure period and test cycle, test procedures and requirements, data processing, result evaluation and test report for exposure to weathering for motor vehicle.

This Standard is applicable to exposure test to weathering for the parts and assemblies installed on the entire vehicle.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 250, *Textiles - Tests for colour fastness - Grey scale for assessing change in colour*

GB/T 1766, *Paints and Varnishes - Rating Schemes of Degradation of Coats*

GB/T 3511, *Rubber, vulcanized or thermoplastic - Resistance to weathering*

GB/T 3681, *Plastics - Test methods of exposure to weathering*

GB/T 6739, *Determination of film hardness by pencil test*

GB/T 8807, *Test method for specular gloss of plastics*

GB/T 9286, *Paints and varnishes - Cross cut test for films*

GB/T 9754, *Paints and varnishes - Determination of specular gloss of non-metallic paint films at 20° 60°and 85°*

GB/T 9761, *Paints and varnishes - Visual comparison of the colour of paints*

GB/T 11186.2, *Methods for measuring the colour of paint films - Part 2: Colour measurement*

corrosion of metals in the natural environment of the atmosphere

3.7 temperature normalized radiation; TNR

the radiation equivalent related to total solar radiation and black mark temperature, that is, the total solar radiation after the correction of the total solar radiation using the black mark temperature measured at the same time

4 Principle

Expose the prototype vehicle under natural atmospheric environmental conditions that can be representative of a certain climate type area for the exposure test. Let it withstand the combined effects of sunlight, heat, water vapor, rain, oxygen, ozone and other environmental factors. According to the specified exposure test period, regularly inspect the appearance and other properties of non-metallic material products for prototype vehicles, the corrosion of metal material products and the operation of functional parts, so as to evaluate the resistance of the prototype to the natural environment, atmospheric aging, atmospheric corrosion, and operation and use functions.

5 Test conditions

5.1 Exposure site requirements

5.1.1 Exposure site selection

The exposure site shall be selected within a natural environment that can represent a certain climate type or an environmental area where the prototype vehicle is actually used.

NOTE 1: According to climatic conditions, China's climate can be divided into 14 climatic zones (see GB/T 17297-1998).

NOTE 2: Industrial exposure sites with special needs are located in concentrated areas of factories and mines. Salt spray climate exposure sites are located on the seashore or island where the air is rich in salt.

5.1.2 Standard exposure site requirements

The site shall be flat and open, free of water, and far away from buildings and trees. The distance between the surrounding obstacles and the edge of the site shall not be less than 3 times the height of the obstacle. There shall be no factory chimneys, vents or other facilities that can emit large amounts of corrosive gases and impurities near the site. The site shall maintain the local

natural vegetation status. The height of the plant shall not exceed 200mm.

NOTE: In order to adapt to special test purposes, cement floors can also be used and indicated in the report.

5.1.3 Exposure site equipment requirements

Meteorological element observation and atmospheric media analysis equipment shall be installed in or near the exposure site, so as to carry out the long-term continuous observation and recording of the main meteorological elements and regular measurement of the atmospheric composition of the surrounding environment. In addition to general meteorological equipment in the exposure field, there shall be different angles (5°, 45°, 90°, local latitude) under the glass and direct solar radiation energy receiving devices. Flat glass for automobiles shall be used.

NOTE: Angle refers to the angle between the sensor plane and the ground.

5.2 Test environment

5.2.1 Visual inspection environment

Under normal circumstances, natural daylight shall be used. It is advisable to use the cloudy daylight of the northern sky in the northern hemisphere or the cloudy daylight of the southern sky in the southern hemisphere (that is, from 3h after sunrise to 3h before sunset, avoid the skylight directly exposed to sunlight). There shall be no reflected light from colored objects, such as red brick walls or green trees.

For special requirements, the visual evaluation of the appearance of the whole vehicle shall use strictly controlled artificial light sources. Observers shall wear neutral-colored clothing. In the field of view, there shall be no other colored objects except the specimen. The artificial light source lighting conditions and observer conditions in the laboratory shall meet the requirements of GB/T 9761.

The same light source shall be used throughout the test. Other conditions shall be as consistent as possible.

5.2.2 Environmental conditions for sampling of harmful substances in the air in the vehicle

The sampling of harmful substances in the air in the vehicle shall be carried out in a sunny day during the day.

After the test sample vehicle is cleaned and dried, it shall be parked for more than 24h under the environmental conditions specified in 7.3. It can also be parked for more than 24h under normal laboratory conditions and indicated in the record and report.

8 Exposure period and testing cycle

8.1 Exposure period setting method

8.1.1 The exposure period can be set according to the time (such as month, year), the total solar radiation received by the surface of the main components or a specified limit reached by TNR, and a specified limit reached by the change (such as loss of light, discoloration) in the performance of the sample.

8.1.2 If there are no special requirements, the exposure period is generally not less than 1 year when setting by time.

8.2 Representation of exposure period

8.2.1 When the time limit is used, the unit is day, month, and year.

8.2.2 When the total solar radiation or TNR is the time limit, the unit is MJ/m^2. The start date and end date of the exposure shall be clearly recorded.

NOTE: If there are no special regulations, the total solar radiation measured under the flat glass of the automobile with the plane of the pyranometer receiver facing the south and 45° deviated from the horizontal plane is used as the solar radiation energy received by the sample vehicle to determine the time limit.

8.2.3 When the performance change of the sample vehicle is the time limit, the unit is to reach the specified aging level. The start and end dates of exposure and the total solar radiation and total solar ultraviolet radiation received by the sample shall be clearly recorded.

8.3 Exposure start date

According to the climate type of the exposure site, the start date of the exposure test is recommended to be late spring or early summer. For example, marginal tropical humid climate exposure test shall start in March or April of each year; the mid-temperate arid climate exposure test shall start in May or June each year.

8.4 Testing cycle

8.4.1 The sample vehicle is tested before exposure. After exposure according to the provisions of 9.2, during the entire test period, the detection period of

various performance changes is:

- The new product test is required: within three months after exposure, once every half a month; within three months to one year, once every month; after one year, once every three months.

- Appraisal or acceptance test for mass production: The detection interval can be relatively extended. It is also possible to take a certain amount of total solar radiation or TNR on the surface of the specimen as the testing cycle.

During the test, the parts with aging phenomena shall be photographed and recorded. It is required to indicate the logo and date when taking pictures or edit the pictures accordingly.

8.4.2 When the weather changes suddenly, it shall be checked at any time. Any abnormal changes shall be recorded or photographed.

9 Test procedures and requirements

9.1 Test preparation

9.1.1 Test sample vehicle acceptance

The new test sample vehicle shall be cleaned and dried. Shipment damage, assembly defects and other surface condition defects shall be inspected. Make original records. Take pictures or video recordings if necessary. Then test the specimen. The storage of standard samples shall be carried out in accordance with 7.3.

9.1.2 Determination of measurement location

9.1.2.1 For the surface and component assembly for gloss, color, vividness and coating thickness measurement, the measurement position shall be selected on the most conspicuous plane that receives the most total solar radiant energy. The position and direction sequence of each measurement shall be consistent. Permanent markers can be made with a non-fading marker to ensure that the position of each measurement is consistent.

9.1.2.2 The temperature measurement point of the component is the highest temperature point where multiple measurements are taken at different parts of the component during the time period when the sun is the strongest on a sunny day (for example, between 12 o'clock and 15 o'clock in Beijing).

9.1.2.3 For the components for measuring total solar radiation or TNR, the measurement location shall be selected to receive as much total solar radiation

next to the corresponding black mark temperature sensor.

9.2 Exposure requirements

9.2.1 Exposure method

In the northern hemisphere, the front windshield of the prototype is facing due south. In the southern hemisphere, the front windshield of the prototype faces north. If there is no special requirement for outdoor atmospheric tracking sun exposure test, the front windshield of the sample vehicle shall be selected to face the direct sun.

NOTE: For the outdoor atmospheric static exposure test, the orientation can be adjusted arbitrarily in order to adapt to the special test purpose.

9.2.2 Exposure state

During the exposure test, the distance between the test vehicles shall not be less than 3 times the height of their adjacent vehicles. The ventilation shall be free. They shall not block each other from sunlight.

During the test, all doors, windows and ventilation systems shall be tightly closed. All parts in the vehicle shall be adjusted to receive as much solar radiation as possible.

NOTE: Adjust the driver's side headrest to the upper position. Adjust the other headrests to the lower position. The left sun visor closes to the ceiling. The right sun visor is put down. Turn the steering wheel to the highest position. The central armrest is the lowered (used) position. Sun blinds (if any) are fully rolled up. Sunroof (if any) sun visor (curtain) are closed to 3/4. The retractable coat rack is open. The battery cable of the sample vehicle is connected.

For fuel-fueled vehicles, the fuel filling amount shall not exceed half of the fuel tank volume.

9.3 Testing items and methods

9.3.1 Visual inspection of appearance

According to the testing cycle selected by the test plan, in the environment specified in 5.2, perform visual inspection of various aging phenomena in accordance with the contents of the vehicle appearance inspection specified in Annex A. During inspection, a magnifying glass of 5 to 10 times can be used to observe the specimen.

NOTE: Before the specimen is cleaned, make a pre-observation. Then visually inspect the aging phenomena such as dialysate, mildew, frosting.

9.3.2 Gloss measurement

The surface gloss of non-metallic coating is measured and recorded in accordance with the method determined by GB/T 9754. Plastic surface gloss is measured and recorded according to the method determined by GB/T 8807. Measuring method of texture surface gloss of vehicle decoration parts: Mark the 0° position arbitrarily on the measuring position. Then start from the 0° position and rotate 90°, 180° and 270° clockwise to measure in 4 directions. Read gloss data for each measurement direction. The choice of gloss measurement geometric angle shall comply with the regulations in GB/T 9754 or GB/T 8807.

NOTE: The surface gloss of the metal coating can be carried out in accordance with GB/T 9754. The measuring angle shall be 20°. The measured value is for reference only and cannot fully represent its gloss.

9.3.3 Color and distinctness of image (DOI) measurement

The measurement of the surface color of the coating shall meet the requirements in GB/T 11186.2. Perform under the standard illuminator D65 and the observer's field of view angle of 10°. The measurement of the surface color of plastic and rubber shall comply with the regulations in GB/T 15596 and GB/T 3511.

9.3.4 Coating scratch corrosion testing

Observe the time, state and corrosion products of scratches. Measure the distance between the largest corrosion point of the coating area on both sides of the horizontal scratch (X) and vertical scratch (Y) perpendicular to the original scratch. Record the measurement data in mm. It can also be measured in accordance with the method determined by GB/T 30789.9.

9.3.5 Coated pencil hardness testing

The pencil hardness is measured according to the manual method determined by GB/T 6739.

9.3.6 Coating cross-hatch testing

It shall meet the requirements in GB/T 9286.

9.3.7 Coating thickness testing

It shall meet the requirements in GB/T 13452.2.

9.3.8 Operation inspection of sample vehicle

In the exposure test, the sample vehicle shall be started once a week and idling

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