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Method of running test - Automotive ride comfort

汽车平顺性试验方法

(ISO 2631-1:1997, Mechanical vibration and stock - Evaluation of human exposure to whole-body vibration - Part 1: General requirements, NEQ)

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Method of running test - Automotive ride comfort

1 Scope

This Standard specifies the automotive ride comfort test method under pulse input running and random input running conditions.

This Standard applies to type M and type N vehicles.

2 Normative references

The terms in the following documents become the terms of this Standard by reference to this Standard. For dated references, all subsequent amendments (not including errata content) or revisions do not apply to this standard. However, parties to agreements that are based on this Standard are encouraged to study whether the latest versions of these documents can be used. For undated references, the latest edition applies to this Standard.

GB/T 3730.1-2001, *Motor vehicles and trailers - Types - Terms and definitions*

GB/T 4971, *Terms and definitions for Automotive ride comfort*

GB/T 7031-2005, *Mechanical vibration - Road surface profiles - Reporting of measured data* (ISO 8608:1995, IDT)

GB/T 12534-1990, *Motor vehicles - General rules of road test method*

GB/T 13441.1-2007, *Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Part 1: General requirements* (ISO 2631-1:1997, IDT)

GB/T 15089-2001, *Classification of power-driven vehicles and trailers*

3 Test conditions

3.1 Road

The test road shall be straight; the longitudinal slope shall not be larger than 1%; the road surface shall be dry; the unevenness shall be uniform without sudden change. The total length of the test road shall not be less than the shortest path length required by the number of test samples; there shall be a steady speed section of 30 m ~ 50 m at both ends.

The pulse input running test road shall be a bituminous road surface or a cement road surface; the road surface grade is in accordance with the grade-A road surface specified in GB/T 7031-2005. The random input running test road shall be a bituminous road surface or a cement road surface; the specific test road surface grade is determined as required.

3.2 Wind speed

The wind speed is not more than 5 m/s.

3.3 Automotive technology status

3.3.1 All automobile assemblies, parts, accessories and auxiliary devices (including tools and spare tires) shall be fully equipped as required and installed in the specified positions. The adjustment status shall meet the requirements of the vehicle design technical conditions.

3.3.2 The tire inflation pressure shall meet the requirements of the vehicle design technical conditions; the error shall not exceed ±3% of the specified inflation pressure.

3.4 Load of the vehicle

The load of the vehicle is the rated maximum loading mass; other loading conditions can be tested as needed. The load shall be evenly distributed and firmly fixed. During the test, it shall not be shaken or overturned; the mass shall not be changed due to moisture, loss, etc.

3.5 Load of the human-chair system

3.5.1 The load of the test part shall be a real person whose height is 1.70 m ± 0.05 m and weight is 65 kg ± 5 kg.

3.5.2 The load of the non-test part shall comply with the relevant regulations in Table 1 of GB/T 12534-1990.

3.6 Seated position

The occupants at the test part shall relax their whole body, wear a seat belt, and place their hands on their thighs naturally. The driver's hands shall be placed on the steering wheel naturally, and the seated position shall be kept unchanged during the test. Under normal circumstances, the occupants shall naturally lean on the backrest; otherwise, it shall be noted.

3.7 Test vehicle speed

5 Test method

5.1 The acceleration transducer is installed in the following locations:

a) Type M vehicles: above the driver and the rear seat cushion on the same side; on the seat back; on the floor where the feet are supported;

b) Type N vehicles: above the driver's seat cushion; on the seat back; on the floor where the feet are supported; at the center of the compartment floor; on the compartment floor at a distance of 300 mm from the compartment sideboard on the same side as the driver and the compartment backboard.

The vibration in three directions need be measured above the seat cushion, on the seat back, and on the floor where the feet are supported. The acceleration time history includes vertical (Z-axis) vibration, transverse (Y-axis) vibration and longitudinal (X-axis) vibration. The acceleration transducer on the compartment floor only needs to measure the vertical vibration.

The layout of the transducer on the seat back is shown in Figure 2; the transducer on the floor where the feet are supported is arranged in the middle of the driver's (or occupant's) feet. The transducers which are installed above the seat cushion and on the seat back shall be in close contact with the human body. The structure of the transducer above the seat cushion is shown in Figure B.1; the structure of the transducer on the seat back is shown in Figure B.2.

The measuring points can be added appropriately as required.

5.2 Pulse input running test method

5.2.1 Place the bumps in the middle of the test road; adjust the distance between the two bumps according to the vehicle wheelbase. To ensure that the left and right wheels of the vehicle pass the bumps at the same time, the two bumps shall be placed on a straight line perpendicular to the direction of the vehicle.

5.2.2 During the test, the vehicle runs over the bumps at a constant speed of the specified speed. The vehicle speed shall be stabilized 50 m before the vehicle passes the bump. Start recording when the front wheel of the vehicle approaches the bump; stop recording when the vehicle passes over the bump and the impact response disappears.

5.2.3 The number of effective tests for each vehicle speed shall be no less than 5 times.

on the seat back, on the floor of the occupant's (or driver's) feet, and on the floor of the compartment. AND the vehicle speed v

6.1.2 Auxiliary evaluation method

When the peak factor is greater than 9, the basic evaluation method cannot fully describe the impact of vibration on the human body, and the auxiliary evaluation method, namely the fourth power vibration dose, shall be used for evaluation (see Appendix A).

Refer to Appendix A for the meaning and calculation of the evaluation index of the basic evaluation method and auxiliary evaluation method of the pulse input running test.

6.2 Random input running evaluation method

For the vibration of human body of the occupant (or driver) and the floor on which the feet are supported, use the weighted root-mean-square acceleration $\bar{a}_w$ for evaluation, and respectively use $\bar{a}_{wx}$, $\bar{a}_{wy}$, and $\bar{a}_{wz}$ to represent the weighted root-mean-square acceleration of the back-to-chest, right side to left side and foot-to-head vibrations. The vibration of human body and the floor on which the feet are supported can also be represented by the integrated total weighted root-mean-square acceleration $\bar{a}_v$. The vibration of the goods vehicle is evaluated by the root-mean-square acceleration.

Refer to Appendix A for the meaning and calculation of the evaluation index of the random input running test.

For the vehicle random input ride comfort, use the relationship curve between the evaluation index and the vehicle speed as the basic evaluation method.

According to needs, the random input ride comfort can also be evaluated by using only the evaluation index of common vehicle speed.

7 Data collection and processing

An anti-aliasing filter shall be used in the segmented data collection process; a window function must be used if the power spectral density needs to be calculated during the data processing process. The sampling time interval, frequency resolution, and number of independent samples involved in data processing need to be determined on the basis of satisfying the sampling theorem and considering the actual anti-aliasing filter performance indicators and actual engineering needs.

The following parameters are recommended for data collection and data processing:

a) Cut-off frequency: f_c ≥90 Hz;

b) Frequency resolution Δf and the number of independent samples q: Δf ≤0.2 Hz, the number of independent samples for random input running q ≥25;

c) The Hanning window function is used in the calculation of the power spectral density;

d) The sampling time interval is determined according to the performance index of the anti-aliasing filter used in the data collection process on the basis of meeting the cut-off frequency.

8 Test report

The test report shall include the following:

-- Vehicle model, engine number, chassis number, manufacturer;

-- Test date;

-- Vehicle parameters:

1) Maximum design total mass;

2) Tire model and axle load of each axle;

3) Tire inflation pressure;

4) Wheelbase;

5) Suspension type;

6) Seat type;

-- Human body parameters:

1) Gender;

2) Weight;

3) Height;

-- Test instrument model and performance index;

-- Frequency resolution and sampling time interval;

-- Description of test site, road surface and climatic conditions;

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