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Replacing GB 11557-1998

**The stipulation protecting drivers from being injured
by motor vehicle steering mechanism**

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Foreword

Clause 4 of this Standard is mandatory; the rest are recommendatory.

The modification of this Standard adopts ECE R12 *The uniform stipulation protecting drivers from being injured by motor vehicle steering mechanism in the collision of motor vehicles (English version)* (Revision 3 and all subsequent supplements, errata which were released prior to August, 2000).

This Standard was redrafted based on ECE R12. Annex A lists comparison between clause numbers of this Standard and the ones of ECE R12.

Technical differences between this Standard and ECE R12 as well as reasons are as follows:

- this Standard deleted ECE R12's Clause 3 "Certification application", Clause 4 "Certification", Clause 7 "Certification change and expansion of vehicle type and steering control type", Clause 8 "Production consistency", Clause 9 "Production inconsistency penalties", Clause 10 "Instructions on use", Clause 11 "Official discontinued production", Clause 12 "Name and address of the certification testing department and the administrative department", Clause 13 "Transitional provisions" and Annex 1 "Certification notice", Annex 2 "Certification mark layout" because the standard system and the legal system were different and these were content related to "certification procedures and certification mark";
- this Standard deleted ECE R12's 2.1 "Vehicle certification", the term and definition of "Steering control certification" in 2.3 because the standard system and the legal system were different and these were content related to "certification procedures and certification mark";
- this Standard used Annex C of GB 11551-2003 to replace the content of "car riding position H and the actual back rest angle" in Annex 6 of ECE R12, so as to ensure that this Standard was consistent with the content of "the car ride position H and the actual back rest angle" in GB 11551-2003;
- this Standard added the term and definitions of "R point" (see 3.17) in Clause 3 because R point of driver's seat should be used during human body module impact test;
- added the content of "at this time, the determination procedure of the dummy seat riding position H point and the actual seat back angle should be carried out according to Annex C of GB 11551-2003" in Annex B because the installation of the dummy during the test required adjustment of the seat condition;

The stipulation protecting drivers from being injured by motor vehicle steering mechanism

1 Scope

This Standard specifies technical requirements and test methods for driver's injury in the process of frontal collision of vehicle steering mechanism.

This Standard is applicable to vehicles of M₁ category and N₁ vehicles of which the maximum total mass is less than 1500 kg. Other vehicles shall refer to this Standard to carry out the test.

2 Normative references

The following standards contain the provisions which, through reference in this Standard, constitute the provisions of this Standard. For dated references, subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, the parties who enter into agreement based on this Standard are encouraged to investigate whether the latest versions of these documents are applicable. For undated reference documents, the latest versions apply to this Standard.

GB 11551-2003 *The protection of the occupant in the event of a frontal collision for passenger car*

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

GB/T 20913-2007 *The protection of the occupants in the event of an off-set frontal collision for passenger car*

ISO 6487:2002 *Road vehicles -- Measurement techniques in impact tests -- Instrumentation*

3 Terms and definitions

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

3.1 vehicle type

same type of vehicles having no differences in the following aspects:

- structure, dimensions, profile and material of the front of the vehicle associated with the steering control;
- unladen kerb mass as defined in 3.16.

3.2 steering control type

same type of steering control having no differences in structure, dimensions, profile, structural material, manufacturer

3.3 steering control

a steering wheel operated by the driver for controlling the direction of travel of the vehicle

3.4 general steering control

steering control which can be installed in a variety of certified vehicle types of which the difference between this steering control and steering column connection does not affect its collision characteristics

3.5 air-bag

a flexible bag used for filling high pressure gas

- it is used to prevent or mitigate the injuries to vehicle driver by steering control during the frontal collision;
- it is inflated in the process of vehicle collision by some device.

3.6 steering control rim

the circular part of steering wheel which is directly operated by the driver's hand

3.7 spoke

a stem structure connecting the wheel hub and the steering wheel rim

3.8 boss

the part located in the center of steering control, used to:

- connect the steering control and the steering shaft;
- transmit the steering moment on the steering device to steering shaft.

3.9 centre of the steering control boss

the point on the hub surface at the central axis of the steering shaft

be disregarded. For a protrusion mounted on a rigid support, if its surface material is non-rigid material of which Shore (A) hardness is less than 50, it shall only apply to the rigid support part.

4.4.2 The design, construction and installation of steering control should ensure that during normal driving, there are no components which may hook the driver's clothing or other dressings and affect driver's normal driving.

4.4.3 If it only inspects steering control, it shall carry out the test according to the provisions of C.2.1.3 and D.2.3 and meet requirements of 4.2 and 4.3.

4.4.4 For general steering control, it shall meet the following requirements:

- the steering column shall meet the requirements at all angular positions, the test shall be carried out at least when the steering column is at the maximum angle and minimum angular position of all vehicles permitted to be installed;
- when the test is carried out at all positions of the impactor and the human body module corresponding to the steering control, it shall be carried out at least in the worst position of which the steering control is mounted on the vehicle.

4.4.5 In order to facilitate the steering control connected with the steering column, it can use transition pieces; however, it should ensure the use of transition pieces has no effect on the energy absorption of the entire system. All tests can use the transition pieces of same type.

5 Test methods

5.1 In order to verify the compliance with the requirements of Clause 4, it shall carry out the tests according to the test methods specified in Annex B, Annex C and Annex D. All measurement should be conducted according to ISO 6487:2002.

5.2 An equivalent test approved by the relevant regulatory authority may be used. A test report including the test methods used and test results should be attached at the same time.

Annex B

(Normative)

Frontal fixed barrier impact test

B.1 Purpose

This test is to verify if the vehicle meets requirements of 4.1.

B.2 Installation, program and measuring instrument

B.2.1 Test site

The test site shall be large enough to accommodate runways, fixed barriers and technical equipment necessary for testing. The runway within at least 5 m long range from fixed barrier should be horizontal (the slope is less than 3% per 1m length), flat and smooth.

B.2.2 Fixed barrier

It is made of reinforced concrete. The front width shall not be less than 3 m, the height not less than 1.5 m; barrier thickness should ensure that its quality is not less than 7×104 kg. Its front surface should be smooth, vertical and orthogonal to the runway and the surface should cover (19 ± 1) mm thick quality plywood. In the middle of the reinforced concrete structure and plywood, it can also be placed with a steel plate of at least 25 mm thickness. It can use other collision barriers to replace of which the collision surface is larger than the front collision surface of the test vehicle and has no affects to test result.

B.2.3 Traction of test vehicle

Test vehicle in the moment before the collision shall not be subjected to any action from the steering control or traction means. The test vehicle route shall be orthogonal to the collision surface of the barrier. The vertical deviation between the vertical line passing through the midpoint of the front of the vehicle and the vertical line in the collision surface of the barrier shall not exceed 300 mm.

B.2.4 Vehicle conditions

B.2.4.1 The test vehicle shall include all components normally installed and all equipment included in the calculation of unladen kerb mass.

A dummy can be installed on the test vehicle according to the manufacturer's requirements. At this point the dummy riding position H and the determination

vehicle, measure the distance change of vehicle steering column apex corresponding to some point not affected by the impact inside the vehicle during the collision. The measured maximum distance variation shall be the amount of rearward and upward movement of the steering column and steering shaft of the vehicle.

B.3.2 The damage to the vehicle after the test should be recorded in the report. At least one photo of each of the following parts should be provided.

- a) side (left and right);
- b) front;
- c) bottom;
- d) passenger compartment area affected;

B.4 Correction factor

B.4.1 Notes

v : recorded speed, at km/h;

m_0 : sample vehicle mass under the conditions specified in B.2.4, in kg;

m_1 : sample vehicle mass equipped with test equipment, in kg;

D_0 : distance change specified in B.3.1 during collision, in mm;

D_1 : distance change used to determine the final test results, in mm;

K_1 : the greater one between $(48.3/v)^2$ and 0.83;

K_2 : the greater one between (m_0/m_1) and 0.8.

B.4.2 The following formula shall be used to calculate the correction distance change D_1 for determining whether the sample vehicle meets the requirements of this Standard:

$$D_1 = D_0 \times K_1 \times K_2$$

B.4.3 For the vehicle of same type which is same in content specified in 3.2 and same with test vehicle, of which its mass m_1 is greater than the test vehicle m_0 , if m_1 does not exceed 1.25 m_0 , and the corrected distance change D_2 calculated according to $D_2 = (m_1/m_0) \times D_1$ still indicates that this new vehicle meets 4.1 requirements, the barrier impact test may not be performed.

B.5 Equivalent test procedure

to make the part of steering wheel of the smallest rigidity perpendicular to the human body module for the impact test. For adjustable steering control, it shall adjust steering wheel to the middle position to carry out the tests of two parts mentioned above.

C.2.2.2 If steering mechanism equipped with the device which can adjust steering wheel inclination and position, the test shall ensure that steering wheel is in the normal use scope provided by the manufacturer.

C.2.2.3 If steering control is equipped with steering wheel air-bag, the air-bag shall be detonated during the test. According to the manufacture's requirements, the air-bag may not be detonated during the test.

C.2.3 Human body module

Figure C.1 specifies the shape, size, weight and characteristics of human body module.

C.2.4 Force measurement

C.2.4.1 To impact the steering control in a horizontal direction parallel to the longitudinal axis of the vehicle. Measure the maximum horizontal force acted on the human body module.

C.2.4.2 This force can be measured directly or indirectly. It can also be calculated according to the test record value.

C.2.5 Transmission of human body module

C.2.5.1 Any transmission method can be used. As long as the human body module impacts the steering mechanism, it can be completely separated from its launch mechanism. The human body module should horizontally impact steering mechanism along an approximately straight line parallel to the longitudinal axis of the vehicle.

C.2.5.2 During the impact, it should ensure that the H point on the human body module is located in the horizontal plane through the R point of driver's seat provided by the vehicle manufacturer.

C.2.5.3 The relative position of the human body module and the steering mechanism as well as the direction of impact are shown in Figure C.2.

use devices of simulating test (as shown in Figure D.1, Figure D.2) to carry out the test. It should ensure that the minimum space is 100 mm between steering control and simulating test device at any direction. The simulating test device shall be rigidly secured to the test bed to avoid the movement during impactor impact.

According to the manufacturer's requirements, steering control may also be tested as specified in D.2.2. But during the test, it should use the first half body of matching vehicle model.

D.3 Test equipment

D.3.1 Test equipment is a rigid full-oriented linear impactor.

D.3.2 The impactor should be equipped with two acceleration sensors and one speed sensor used to measure collision direction data.

D.3.3 The measuring instrument shall meet the following requirements:

- a) measuring instruments shall meet ISO 6487: 2002 requirements;
- b) acceleration measurement should satisfy: CAC 150 g, CFC 600 Hz;
- c) speed measurement: accuracy should be within $\pm 1\%$;
- d) time recording: the measuring instrument should be able to record the entire process; the recording interval does not surpass 1 ms; it should be able to record the collision starting moment when impactor contacts with steering control for the first time so as to analyze the test results.

D.4 Test procedures

D.4.1 The steering control plane should be orthogonal to the direction of impact.

D.4.2 The maximum number of collision positions for each steering control shall be no more than four, and at least not less than three. A new steering control shall be replaced in each impact test. In order to ensure the continuity of each collision, the axis of the impactor shall be in a straight line with one of the points described below.

D.4.2.1 Steering boss center point

D.4.2.2 The point of the maximum rigidness on steering control rim or the point on the steering control rim that is most connected to the spoke.

D.4.2.3 The point of the minimum rigidness on steering control rim or the midpoint of the weakest area on the steering control rim that is free of spoke.

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