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**General condition of vehicle dynamics test for passenger cars**

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## Table of Contents

|                                                                                                |    |
|------------------------------------------------------------------------------------------------|----|
| Foreword .....                                                                                 | 3  |
| 1 Scope .....                                                                                  | 5  |
| 2 Normative references .....                                                                   | 5  |
| 3 Terms and definitions .....                                                                  | 5  |
| 4 Reference coordinate system .....                                                            | 5  |
| 5 Measurement .....                                                                            | 6  |
| 6 Test conditions .....                                                                        | 10 |
| 7 Test preparation .....                                                                       | 12 |
| Annex A (informative) Structural changes of this Standard compared with ISO 15037-1:2019 ..... | 15 |
| Annex B (normative) Test report -- General data .....                                          | 17 |
| Annex C (informative) Sensor and its installation .....                                        | 20 |
| Annex D (informative) Analog signal filtering: Butterworth filter .....                        | 26 |
| Annex E (normative) Test conditions .....                                                      | 28 |

### 1 Scope

This Standard specifies general condition of vehicle dynamics test for passenger cars.

This Standard is applicable to M1, M2 and N1 vehicles whose maximum design total mass does not exceed 3.5t.

### 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 12549-2013, Terms and definitions for vehicle controllability and stability (ISO 8855:2011, NEQ)

### 3 Terms and definitions

There are no terms and definitions that need to be defined in this document.

#### 4.1 Reference coordinate system

The motion variables recorded in the test shall meet the coordinate system definition in GB/T 12549-2013. The origin of the coordinates is usually taken at the center of mass of the vehicle. It can also be taken at other locations, but it shall be recorded in the test report, see Annex B.

#### **4.2 Variables that shall be determined**

The main variables of driver input and vehicle response description related to vehicle handling and stability are as follows:

- Steering wheel angle,  $\delta H$ ;

recommended to use the digital signal processing method described in 5.3.3.

##### **5.3.3.1 The preparations for analog signal processing include: selecting the**

sampling frequency to avoid aliasing errors, the filter amplitude attenuation characteristics, and the filter's phase lag and time delay characteristics.

##### **5.3.3.2 What shall be considered for sampling and digitization:**

- a) The pre-sampling magnification rate that guarantees the smallest digitization error;
- b) The number of bits per sampling;
- c) The number of samples per cycle;
- d) Sampling and hold amplifier;
- e) Sample space;
- f) For other digital filters without phase shift, the choice of passband, stopband, attenuation, allowable ripple, and correction of the filter phase lag shall be considered.

##### **5.3.3.3 To achieve a collection accuracy of $\pm 0.5\%$ for the overall data, the**

above-mentioned influencing factors shall be considered comprehensively.

##### **5.3.3.4 See Annex D for the attenuation and phase shift information of the**

Butterworth filter. Avoid uncorrectable aliasing errors. The analog signal shall be properly filtered before sampling and digitizing. The filter order and its passband shall be selected according to the frequency range of interest and the signal flatness requirements at the corresponding sampling frequency. The minimum filtering characteristics and minimum sampling frequency shall meet:

- a) In the frequency range of  $0\text{Hz} \sim f_{\text{max}}$  ( $f_{\text{max}}=5\text{Hz}$ ), the maximum attenuation of the analog signal shall be less than the resolution of signal digitization;

b) At half the sampling frequency (i.e., the Nyquist frequency or folding frequency), the size of all frequency components of the signal and noise shall be reduced to less than the digital resolution.

Example: For a resolution of 0.05%, the amplitude attenuation of the filter in the range of 5 Hz is less than 0.05%. For all frequencies above half of the sampling frequency, the amplitude attenuation is greater than 99.95%.

## **Annex D. braking, rapid acceleration, sharp turns, road shoulders. After running-in, the**

tire shall be kept in the same position for testing.

**6.5.2 The tire tread depth (including the entire width of the tire contacting the ground and the entire tire surface)** shall be more than 90% of the initial tire tread depth.

6.5.3 The production date of the tire shall be recorded in the test conditions, see Annex E. The test tire shall not exceed one year from the date of production.

### **6.5.4 The tires shall be inflated according to the pressure of the test**

environment temperature specified by the car manufacturer. For tire pressure less than or equal to 250kPa, the error of cold inflation pressure is  $\pm 5$  kPa. When the tire pressure exceeds 250kPa, the error does not exceed 2%.

### **6.5.5 The tire pressure and the depth of the tire tread pattern before warm-up**

shall be recorded in the test report, see Annex E.

### **6.5.6 In addition to the basic tire conditions, tests can also be carried out under**

other conditions. The specific details shall be recorded in the test report (see

### **6.5.7 When the tire tread depth or uneven wear has a significant impact on the**

test results, it is recommended to consider this factor when comparing performance between cars or tires.

## **6.6 Key components**

The model and type of key components that affect the performance test of the entire vehicle and the design parameters that affect the test (such as shock absorber parameters and suspension geometric parameters) shall meet the manufacturer's instructions. Any data that deviates from the manufacturer's instructions shall be recorded in the basic information, see Annex B.

#### **6.7.1 The total test mass shall be between the vehicle's curb weight and the**

maximum allowable total mass. The maximum axle load shall not exceed the allowable value.

#### **6.7.2 It shall be ensured that the position of the center of gravity and the inertia**

have the smallest deviation from the normal load conditions. The wheel load shall be measured and recorded in the test report, see Annex B.

### **6.8 Power transmission state**

For vehicles with regenerative braking capability, the specific settings of the vehicle can change the dynamic behavior of the vehicle when the accelerator pedal is released and/or the brake pedal is depressed. For this type of vehicle, the dynamic behavior of the vehicle shall be tested with or without active regenerative braking during the test. The selected regenerative braking capability level and shift lever position shall be recorded in the test report.

### **6.9 Active system**

For vehicles with active systems that affect test results such as active steering, electronic stability control or active suspension, the impact of different system modes on the dynamic behavior of the vehicle shall be considered during the test. If the driver can choose a different mode, such as "sports/comfort" mode, the selected mode shall be recorded in the test report.

## **7.1 Warm up**

Before the start of the test, all relevant parts of the car shall be preheated so that its temperature can reach a temperature representative of normal driving conditions. The tires shall also be preheated to reach a balanced temperature and pressure that can represent normal driving conditions. The car is driven at a test speed of 10km or 500m with a lateral acceleration of  $3\text{m/s}^2$  (including turning to the left and turning to the right) to warm up the tires.

**7.2.1.1 The initial driving state of the vehicle handling and stability test is steady-state straight-line driving or steady-state circular driving.**

**7.2.1.2** If there is no special requirement in the test standard, during the test, for manual transmissions, the highest applicable gear shall be selected for multiple gears; for automatic transmissions, gear D shall be used. The shift lever position and the selected driving mode shall be recorded in the test report, see Annex E.