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Road vehicles — Test method for the quantification of on-centre handling —

Part 2: Transition test

Véhicules routiers — Méthode d'essai pour la quantification du centrage —

Partie 2: Essai de la transition

[Revision of first edition (ISO 13674-2:2006)]

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 13674-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 9, *Vehicle dynamics and road-holding ability*.

This second edition cancels and replaces the first edition (ISO 13674-2:2006), which has been technically revised.

ISO 13674 consists of the following parts, under the general title *Road vehicles — Test method for the quantification of on-centre handling*:

- *Part 1: Weave test*
- *Part 2: Transition test*

Introduction

The main purpose of this Standard is to provide repeatable and discriminatory test results.

The dynamic behaviour of a road vehicle is a very important aspect of active vehicle safety. Any given vehicle, together with its driver and the prevailing environment, constitutes a closed-loop system that is unique. The task of evaluating the dynamic behaviour is therefore very difficult since the significant interaction of these driver-vehicle-environment elements are each complex in themselves. A complete and accurate description of the behaviour of the road vehicle must necessarily involve information obtained from a number of different tests.

Since this test method quantifies only one small part of the complete vehicle handling characteristics, the results of these tests can only be considered significant for a correspondingly small part of the overall dynamic behaviour.

Moreover, insufficient knowledge is available concerning the relationship between overall vehicle dynamic properties and accident avoidance. A substantial amount of work is necessary to acquire sufficient and reliable data on the correlation between accident avoidance and vehicle dynamic properties in general and the results of these tests in particular. Consequently, any application of this test method for regulation purposes will require proven correlation between test results and accident statistics.

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Road vehicles — Test method for the quantification of on-centre handling — Part 2: Transition test

1 Scope

This part of ISO 13674 specifies a test schedule that addresses a particular aspect of the transition test, the on-centre handling characteristics of a vehicle. It is applicable to passenger cars in accordance with ISO 3833, and to light trucks.

NOTE The manoeuvre specified in this test method is not representative of real driving conditions, but is useful for obtaining measures of vehicle on-centre handling behaviour in response to a specific type of steering input under closely controlled test conditions. Other aspects of on-centre handling are addressed in the companion ISO 13674-1 and ISO/TS 20119.

2 Normative references

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

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 2416, *Passenger cars — Mass distribution*

ISO 3833, *Road vehicles — Types — Terms and definitions*

ISO 8855, *Road vehicles — Vehicle dynamics and road-holding ability — Vocabulary*

ISO 15037-1, *Road vehicles — Vehicle dynamics test methods — Part 1: General conditions for passenger cars*

3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols of ISO 1176, ISO 2416, ISO 3833, ISO 8855 and the following apply.

3.1

on-centre handling

description of the steering “feel” and steering precision of a vehicle during nominally straight-line driving and in negotiating large radius bends at high speeds but low lateral accelerations

3.2

ordinate threshold

value of a parameter plotted as the ordinate on a graph and defined as the minimum threshold of human perception

3.3

abscissa deadband

horizontal separation between the pair of straight-line fits at ordinate threshold values

**3.4
gradient**

ratio of change in the ordinate with respect to a unit change in the abscissa, for a straight-line fit to a pair of recorded variables plotted one against the other on Cartesian coordinates

4 Principle

On-centre handling represents that part of the straight-line directional stability characteristics of the vehicle existing at low lateral acceleration levels, typically no greater than 1 m/s^2 . On-centre handling is concerned primarily with features that directly influence the driver's steering input, such as steering system and tyre characteristics. Thus, test schedules for the evaluation of on-centre handling behaviour seek to minimize other factors that influence the wider aspects of straight line directional stability, such as disturbance inputs due to ambient winds and road irregularities.

This part of ISO 13674 defines test schedules that involve driving the vehicle in a nominally straight line at a constant forward speed. During the tests, driver inputs and vehicle responses are measured and recorded. From the recorded signals, characteristic values are calculated.

5 Variables

5.1 Reference system

The variables of motion used to describe vehicle behaviour in a test-specific driving situation shall be related to the intermediate axis system (X, Y, Z) (see ISO 8855).

The location of the origin of the vehicle axis system (X_V, Y_V, Z_V) is the reference point and therefore should be independent of the loading condition. The origin is therefore fixed in the longitudinal plane of symmetry at half-wheelbase and at the same height above ground as the centre of gravity of the vehicle at complete vehicle kerb mass (see ISO 1176).

5.2 Variables to be measured

When using this test method, the following variables shall be measured:

- steering-wheel angle, δ_H ;
- steering-wheel torque, M_H ;
- yaw velocity, $d\psi/dt$;
- longitudinal velocity, v_x ;
- lateral acceleration, a_y (see the NOTE to 6.2).

The following variables should be measured:

- steering-wheel angular velocity, $d\delta_H/dt$.

The variables are defined in ISO 8855.

In order to acquire a deeper understanding of the vehicle behaviour, it may be desirable to determine motions of various components within the steering system, especially for vehicles with more than one steering axle.

6 Measuring equipment

6.1 Description

The measuring equipment shall be in accordance with ISO 15037-1:2006.

Typical operating ranges and recommended maximum errors of the combined transducer and recording system are shown in Table 1.

NOTE It is advisable that care be taken to ensure that friction or inertia added to the system by steering robot or steering transducers does not improperly influence the measurement of steering-wheel torque.

Table 1 — Variables, typical operating ranges and recommended maximum errors

Variable	Typical operating range ^a	Recommended maximum error of the combined transducer and recorder system ^b
Steering-wheel angle	$\pm 50^\circ$	$\pm 0,1^\circ$
Steering-wheel torque	$\pm 10 \text{ Nm}$	$\pm 0,1 \text{ Nm}$
Yaw velocity	$\pm 10 \text{ }^\circ/\text{s}$	$\pm 0,1 \text{ }^\circ/\text{s}$
Longitudinal velocity	0 - 50 m/s	$\pm 0,5 \text{ m/s}$
Lateral acceleration	$\pm 5 \text{ m/s}^2$	$\pm 0,1 \text{ m/s}^2$
Steering-wheel angular velocity	$\pm 100 \text{ }^\circ/\text{s}$	$\pm 1 \text{ }^\circ/\text{s}$

Transducers for measuring some of the listed variables are not widely available and are not in general use. Many such instruments are developed by users. If any system error exceeds the recommended maximum value, this and the actual maximum error shall be stated in the test report (ISO 15037-1:2006, Annex A).

^a These transducer ranges are appropriate for the standard test conditions and may not be suitable for non-standard test conditions.

^b The values for maximum errors are provisional until more experience and data are available.

6.2 Transducer installations

The transducers shall be installed according to the manufacturers' instructions where such instructions exist, so that the variables corresponding to the terms and definitions of ISO 8855 can be determined.

If a transducer does not measure a variable directly, appropriate transformations into the specified reference system shall be carried out.

NOTE Lateral acceleration, as defined, is measured in the intermediate XY plane. However, for the purpose of this test procedure, measurement of "sideways" acceleration in the vehicle $X_v Y_v$ plane (i.e. corrupted by vehicle roll) is typically adequate, provided that the roll angle versus lateral acceleration characteristic for the vehicle is known and an appropriate correction in respect of roll angle can be made to the "sideways" acceleration.

6.3 Data processing

See ISO 15037-1:2006: 4.3.

7 Test conditions

7.1 General

General comments relating to test conditions are given in ISO 15037-1:2006, Clause 5.