
Passenger cars — Power-off reaction of a vehicle in a turn — Open-loop test method

*Voitures particulières — Réponse d'un véhicule à un lever de pied en
virage — Méthode d'essai en boucle ouverte*





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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives.

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#).

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 33, *Vehicle dynamics and chassis components*.

This third edition of ISO 9816 cancels and replaces the second edition (ISO 9816:2006) which has been technically revised. The main changes compared to the previous edition are as follows:

- an update was made regarding alternative powertrain systems.

Introduction

The main purpose of this document 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. If this test method is used for regulation purposes, the correlation between test results and accident statistics should be checked.

Passenger cars — Power-off reaction of a vehicle in a turn — Open-loop test method

1 Scope

This document specifies open-loop test methods to determine the reactions of a vehicle in a turn to a sudden drop in motive power resulting from release of the accelerator pedal. It applies to passenger cars as defined in ISO 3833.

The open-loop manoeuvre specified in this test method is not representative of real driving conditions, but is useful to obtain measures of a vehicle's power-off behaviour resulting from specific types of control inputs under closely controlled test conditions.

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.

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

ISO 15037-1:2018¹⁾, *Road vehicles — Vehicle dynamics test methods — Part 1: General conditions for passenger cars*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8855, ISO 15037-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

For the purposes of this document, the terms and definitions given in the general conditions given in, and the following terms and definitions shall apply.

3.1

power-off

vehicle operating condition where the vehicle is in gear and the accelerator pedal is fully released, especially when initiated by a sudden release of the accelerator pedal

3.2

instant of power-off initiation

t_0

moment in time when a rapid release of the accelerator pedal is initiated

1) Under preparation. Stage at time of publication: ISO/DIS.

4 Principle

The purpose of this test procedure is to determine the effect of a sudden initiation of a power-off condition on the course holding and directional behaviour of a vehicle, initially operating in steady-state circular motion.

The initial conditions are defined by constant longitudinal velocity and by a circular path with a given radius. The power-off disturbance is introduced by a sudden release of the accelerator pedal. The steering-wheel angle required for the steady-state circular run is then constantly maintained during the entire test. During the test, the driver input and the vehicle response are measured and recorded. From the recorded signals characteristic values are calculated.

The test may be performed using two alternative test methods:

1. A constant-radius test method, where the initial conditions are defined by driving on a fixed-radius circular path and lateral acceleration is incrementally increased in the test runs by increasing the initial test speed;
2. A constant-speed test method, where the initial conditions are defined by a constant test speed and lateral acceleration is incrementally increased in the test runs by increasing the initial steer angle, resulting in operation on successively smaller initial path radii.

The constant-radius test method has the advantage of requiring only one test arc, and therefore demands less testing space than the constant-speed test. The test course is similar to curves on rural roads or exit ramps from high-speed roadways. The test method includes varying initial engine speed, and thus, varying deceleration due to engine braking. For both test methods, the initial steering-wheel angle will change as lateral acceleration increases. The constant-radius test method demands some driver skill, as the test driver must establish initial steady-state cornering conditions, while following the fixed-radius path.

The constant-speed test method maintains a constant initial engine speed, and thus, a constant deceleration due to engine braking at power-off. The deceleration achieved in practice depends on the test conditions and car properties: among others, the combination of engine speed and gear needed for the chosen longitudinal velocity. This test method may be performed using either a series of fixed-radius arcs or a series of fixed steering-wheel angles, with no constraint on vehicle path. The unconstrained-path method places low demands on driver skill, as the requirement to maintain a fixed initial path is not present. The disadvantage of this test method is that a large test surface is required, particularly if high initial test speeds are to be evaluated.

The test results from the two test methods are not comparable, except for the same combination of initial path radius and speed.

5 Variables

5.1 Reference system

The reference system specified in ISO 15037-1 shall apply.

5.2 Variables to be measured

The following variables shall be determined:

- instant of power-off initiation, t_0 ;
- steering-wheel angle, δ_H ;
- yaw angle, ψ , or yaw velocity, $\dot{\psi}$;
- longitudinal velocity, v_X ;

- lateral acceleration; a_Y ;
- sideslip angle, β , or lateral velocity, v_Y .

In addition, the following variables may be determined:

- longitudinal acceleration, a_X .

The variables are defined in ISO 8855, except the instant of accelerator pedal release t_0 , which is the instant at which the accelerator pedal is released (see 8.3). The variables are not intended to comprise a complete list.

6 Measuring equipment

6.1 Description

The variables selected for test purposes shall be measured by means of appropriate transducers. Their time histories shall be recorded by a multi-channel recording system having a time base. Typical operating ranges and recommended maximum errors of the transducer and recording system are as specified in ISO 15037-1:2006 and Table 1. In the context of this document, these values should be considered as provisional until more experience and data are available.

6.2 Transducers installations

The requirements of ISO 15037-1 shall apply.

6.3 Data processing

The requirements and specifications of ISO 15037-1 shall be followed.

7 Test conditions

Limits and specifications for the ambient and the vehicle test conditions established in ISO 15037-1 shall be followed.

In addition, for standard test conditions, the adjustment and condition of the engine and drive train (especially the differentials, clutches, locks, free-wheel shifts, engine idle-calibration) shall correspond to the vehicle manufacturer's specifications.

Table 1 — Typical operating ranges and recommended maximum errors for recorded variables — Additions and exceptions to ISO 15037-1

Variable	Typical operating range	Recommended maximum error of the combined transducer and recorder system
Instant of power-off initiation	—	0,05 s
Yaw angle	-180° to 180°	±2°

NOTE Increased measuring accuracy be desirable for computation of some of the characteristic values given in Clause 9.

8 Test method

8.1 Warm-up

The procedure specified in ISO 15037-1 shall be followed to warm up the tyres and other vehicle components prior to the test.