

Method of test for

Lateral stability of passenger car/trailer combinations

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Committees responsible for this British Standard

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- Association of Trailer Manufacturers
- Caravan Club
- Department of Transport
- Metropolitan Police
- Motor Industry Research Association
- National Caravan Council Limited
- Society of Motor Manufacturers and Traders Limited

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National foreword

This British Standard has been prepared under the direction of the Automobile Standards Policy Committee. It is identical with ISO 9815:1992 *Passenger car/trailer combinations — Lateral stability test* published by the International Organization for Standardization (ISO).

Cross-references

International standard	Corresponding British Standard
ISO 4138:1982	BS AU 189:1983 <i>Method of test for steady state concerning behaviour for road vehicles</i> (Identical)
ISO 8855:1991	BS AU 244:1992 <i>Glossary of terms for road vehicle dynamics and road holding ability</i> (Identical)

The Technical Committee has reviewed the provisions of ISO 1176, ISO 2416, ISO 3833 and ISO 4114 to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

The dynamic behaviour of a passenger car/trailer combination is a most important part of active vehicle safety. Any given passenger car/trailer combination, together with its driver and the prevailing environment, forms a unique closed loop system. The task of evaluating dynamic behaviour is therefore very difficult because of the significant interaction of these

driver/car/trailer-combination/road elements, each of which is in itself complex. A complete and accurate description of the behaviour of passenger car/trailer combinations must necessarily involve information obtained from a number of tests of different types.

Because they quantify only one small part of the whole handling field, the results of this test can only be considered significant for a correspondingly small part of the overall handling behaviour of passenger car/trailer combinations.

In addition, the results obtained from this test will apply only for combinations of the same type of car drawing the same type of trailer under the same loading and operating conditions. The results will not describe the behaviour of either the car or the trailer separately.

Moreover, insufficient knowledge is available concerning the relationship between overall vehicle dynamic properties and accident avoidance. A large 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 this test in particular. Therefore, it is not possible to use this procedure and test results for regulation purposes.

1 Scope

This International Standard specifies a test procedure to determine the damping characteristic of trailer oscillation excited by a defined steering impulse.

The passenger car/trailer combination is initially driven in a straight line and its response to a specified steering input is then measured. After applying the steering input, the steering-wheel is held fixed in the straight ahead position. Tests are conducted at several constant speeds, which shall be increased in discrete intervals.

Thus it is necessary to measure:

- steering-wheel angle;
- forward velocity;
- lateral acceleration of the trailer;

— articulation angle between towing vehicle and trailer.

It is desirable to measure:

- yaw velocity of the towing vehicle;
- yaw velocity of the trailer.

NOTE 1 These variables are not intended to comprise a complete list.

This International Standard applies to passenger car/trailer combinations, vehicles as defined in ISO 3833.

If non-periodic instability is of interest, a steady-state circular test may be performed in accordance with Annex C.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1176:1990, *Road vehicles — Masses — Vocabulary and codes*.

ISO 2416:1992, *Passenger cars — Mass distribution*.

ISO 3833:1977, *Road vehicles — Types — Terms and definitions*.

ISO 4114:—, *Road vehicles — Static load on ball couplings of caravans and light trailers*¹⁾.

ISO 4138:1982, *Road vehicles — Steady state circular test procedure*.

ISO 8855:1991, *Road vehicles — Vehicle dynamics and road-holding ability — Vocabulary*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 8855 and the following definition apply.

3.1

trailer axis system (x , y , z)

right-hand orthogonal axis system fixed in the trailer such that its origin is in the centre of gravity of the empty trailer. The x -axis is in the longitudinal direction, the y -axis in the lateral direction and the z -axis is vertical

¹⁾ To be published. (Revision of ISO/TR 4114:1979)

4 Measuring equipment

4.1 Description

Those of the variables listed in the scope which are selected for test purposes shall be monitored using appropriate transducers, and the data recorded on a multi-channel recorder having a time base. The typical operating range and recommended maximum error of the transducer/recording system are as shown in Table 1.

The minimum overall bandwidth of the entire measurement system including transducers and recorder should be 8 Hz.

4.2 Installation

Transducer installation and orientation will vary according to the type of instrumentation used. However, if a transducer does not measure the required variable directly, appropriate corrections for linear and angular displacement shall be made to its signals so as to obtain the required level of accuracy.

4.2.1 Steering-wheel angle

A transducer shall be installed as specified by the manufacturer to obtain steering-wheel angle relative to the sprung mass.

4.2.2 Forward velocity

A velocity transducer shall be installed as specified by the manufacturer. If it is not aligned so as to operate in the x - z plane, and parallel to the test track surface, its output shall be corrected for any linear or angular displacement therefrom.

4.2.3 Lateral acceleration of trailer

An accelerometer shall be installed as specified by the manufacturer and mounted either

- a) on the sprung mass at the whole trailer centre of gravity and aligned with the trailer y -axis. In this case, it will measure “lateral acceleration”; or

- b) on the sprung mass at any position and aligned parallel to the trailer y -axis. In this case, its output shall be corrected for its position relative to the centre of gravity, which will give “lateral acceleration”.

4.2.4 Articulation angle of trailer

A transducer shall be installed as specified by the manufacturer so as to measure the angle between the vehicle x -axis and the trailer x -axis in the horizontal plane.

4.2.5 Yaw velocity

A transducer shall be installed as specified by the manufacturer with its axis aligned with or parallel to the vehicle z -axis.

4.2.6 Steering-wheel stop

A steering-wheel stop or marking may be used. The use of a steering machine is optional.

5 Test conditions

5.1 Test track

All tests shall be carried out on a uniform hard surface which is free of contaminants and has no more than 2 % gradient, as measured over the full width of the track laterally and over a distance of at least 50 m longitudinally. For a standard test condition, a smooth dry pavement of asphalt or cement concrete or a high-friction test surface is recommended. The test surface shall be maintained over a track of 8 m minimum width. It is recommended that increased runoff area be provided in addition to the specified test surface.

5.2 Wind velocity

The wind velocity shall not exceed 2,5 m/s and shall be recorded in the test report.

Table 1 — Variables, operating ranges and recommended maximum errors

Variable	Typical operating range	Recommended maximum error of combined transducer/recorder system
Steering-wheel angle	$\pm 360^\circ$ ^a	$\pm 2^\circ$ for angles $<180^\circ$ $\pm 4^\circ$ for angles $\geq 180^\circ$
Forward velocity	0 to 40 m/s	$\pm 0,4$ m/s
Lateral acceleration of trailer	± 15 m/s ²	$\pm 0,15$ m/s ²
Articulation angle	$\pm 20^\circ$	$\pm 0,2^\circ$
Yaw velocity of towing vehicle	$\pm 50^\circ/\text{s}$	$\pm 0,5^\circ/\text{s}$
Yaw velocity of trailer	$\pm 50^\circ/\text{s}$	$\pm 0,5^\circ/\text{s}$
NOTE These values are tentative and provisional until more experience is available.		
^a Assuming conventional steering system.		