
**Road vehicles — Heavy commercial
vehicles and buses – Mass moment of
inertia measurement**

*Véhicules routiers — Véhicules utilitaires lourds et autobus — Mesure
du moment d'inertie de masse*



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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 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Methods are presented for determining the roll (I_{xx}), pitch (I_{yy}), and yaw (I_{zz}) mass moments of inertia (MOI) and roll-yaw (I_{xz}) product of inertia (POI) of an individual vehicle unit about the vehicle unit axis system and centre of gravity reference point. I_{xx} , I_{yy} , I_{zz} , and I_{xz} are fundamental mass properties that provide information on a vehicle's mass distribution and rotational acceleration responses to applied forces. The I_{xy} and I_{yz} components of the inertia tensor are less significant to vehicle dynamics and are not addressed in this document. The MOIs are determined using a pendulum device with measurements of oscillation period and reaction forces. The location of the vehicle unit's centre of gravity (CG) reference point is required beforehand. Knowledge of a vehicle unit's mass moments of inertia supports vehicle modelling work, design validation, and planning for other dynamic tests yet to be performed.

Performing measurements for MOI determination of heavy commercial vehicles and buses may be challenging in practice due to the wide variety of vehicles that vary significantly in terms of weight, size, and number of axles. Adaptability of a heavy vehicle MOI facility's layout is an important attribute.

Road vehicles — Heavy commercial vehicles and buses – Mass moment of inertia measurement

1 Scope

This document provides standard methods for determining a vehicle's roll, pitch, and yaw mass moments of inertia (MOI) and roll-yaw product of inertia (POI). It applies to heavy vehicles, that is commercial vehicles and buses as defined in ISO 3833 (trucks and trailers with maximum weight above 3,5 tons and buses and articulated buses with maximum weight above 5 tons, according to ECE and EC vehicle classification, categories M3, N2, N3, O3 and O4). Mass moment of inertia measurements are performed separately for each single unit.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 612, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*

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

ISO 15037-2, *Road vehicles — Vehicle dynamics test methods — Part 2: General conditions for heavy vehicles and buses*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8855, ISO 15037-2 and the following apply.

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

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

3.1

stable pendulum

pendulum apparatus for supporting a vehicle on a nominally planar surface where the combined vehicle and pendulum CG height is below the pivot point

3.2

unstable pendulum

pendulum apparatus for supporting a vehicle on a nominally planar surface where the combined vehicle and pendulum CG height is above the pivot point

3.3

torsional pendulum

pendulum apparatus where the restoring force is torsion

3.4

multi-filar torsional pendulum

torsional pendulum (3.3) with multiple vertical wires, cables or chains supporting the vehicle and test platform (3.5) where the torsional restoring force is due to gravity and spring force in twisting cables