PUBLICLY AVAILABLE SPECIFICATION

ISO/PAS 5101

First edition
2021-10

Road vehicles — Field load specification for brake actuation and modulation systems

Véhicules routiers — Spécification de la charge pour les systèmes d'actionnement et de modulation des freins

Reference number
ISO/PAS 5101:2021(E)

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Published in Switzerland

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Foreword

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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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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.

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Introduction

Vehicle development programs tend to grow in complexity and integration of the braking system with chassis dynamics and mechatronics, demanding more robust and comprehensive evaluation programs. Also, to remain competitive, braking systems and their components' functionality and application across multiple vehicle architectures and platforms are increased.

The proper selection and adaptation of field load spectra and profiles to the specific program ensure functionality, reliability and braking system availability. This document defines a library of field load schedules to help developing simulation and testing programs tailored to the vehicle or system specification and requirements. Specific cycles and load collectives including the main functions associated with everyday driving and operation and exceptional load cases are described to ensure safe braking behaviour. This document's field load was typically derived from analysing field data collected from almost 1 million vehicles having driven more than 45 billion km. Several vehicle and brake system suppliers from vehicles used in different regions worldwide contributed to this field data collection. In addition, data from driving studies with specific measurement equipment was used. Wherever the data available from field or studies was not sufficient, existing specifications or expert judgement served to derive conservative assumptions.

This document provides field loads independent of the vehicle technology, vehicle specification, intended use and field usage. It remains the manufacturer's responsibility to include and adapt the field loads to the specific vehicle configuration. The adaptation includes at least:

— define sampling and testing plans, including vehicle configuration(s), road conditions selection of the specific profiles and load spectra of this document;

— define level of evaluation and integration of simulation, Hardware-in-the-Loop, physical testing methods, along with other components and software functions part of the testing program;

— agree on performance and reliability criteria (including statistical tools and metrics);

— reflect specific system architectures and control technologies for the unit(s) under testing.

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Road vehicles — Field load specification for brake actuation and modulation systems

1 Scope

This document specifies expected field loads for functions provided by the braking system actuator and modulator and applies to passenger cars and light commercial vehicles (classes M1 and N1, according to UNECE).

Functions addressed in this document are:

— dynamic stability functions (e.g. electronic stability control);

— brake torque optimizing functions (e.g. electronic brake force distribution);

— brake assistance functions (e.g. hill start assist).

This document only covers functions where data of appropriate maturity are available. There are additional functions of a braking system, which are not covered by this document.

By describing the expected field loads, this document specifies representative manoeuvres and occurrences for different functions. These serve as an orientation for the derivation of test procedures.

This document applies to vehicles up to conditional automation (SAE J 3016 level 3) with a maximum of 30 % automated brake operations.

NOTE Field loads for automation levels above level 3 are under consideration for future editions.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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
brake booster
part of the actuation unit, excluding master cylinder, in systems with separate actuator and modulator

Note 1 to entry: A brake booster is not part of braking systems with integrated actuator and modulator (see Figure 1).

3.2
fading
decrease of braking torque as a function of temperature or vehicle speed at constant application force

Note 1 to entry: Amongst others, the decrease of the friction by the temperature is the most important effect.

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[SOURCE: ISO 611:2003, 7.1.7, modified — The original term was "brake fade", the word “vehicle” and Note 1 to entry were added, and the examples were removed.]

3.3
brake friction coefficient
ratio between the tangential force and the normal force, acting between linings and drum or disc

[SOURCE: ISO 611:2003, 9.19.1, modified — The symbols and formula were removed, the original term was "coefficient of friction".]

3.4
coefficient of adhesion
μ
ratio between the tangential force transmitted to the road by a tyre and the normal force

[SOURCE: ISO 611:2003, 9.19.2, modified — "k" was changed to "μ", the symbols, formula and note were removed.]

3.5
control time
duration the braking system is controlling the pressure

3.6
fully active brake operation
deceleration intended by the driver and automatically initiated and operated by the braking system

3.7
nominal runout pressure
lowest master cylinder pressure where maximum support from the actuator is reached in quasi-static operation

Note 1 to entry: Only applies to separated actuator and modulator.

Note 2 to entry: For vacuum-based actuation systems, the nominal runout pressure refers to sea level.

Note 3 to entry: Above this pressure, only the unsupported pressure increase is possible.

3.8
partially active brake operation
deceleration initiated by the driver and supported by the modulation of the wheel brake pressure

3.9
standstill
stopping situation during a trip in which the vehicle is not moving

EXAMPLE Stopping at traffic lights or in heavy traffic situations.

Note 1 to entry: Standstill does not include parking situations.

3.10
steering angle
mean value of angle of left and right front wheel relative to the longitudinal axis of the vehicle

Note 1 to entry: Rear-wheel steering is not considered in this document.

4 General

This document describes use cases represented by manoeuvres and their occurrences for various functions of the braking system to describe the expected field loads for a braking system. Unless otherwise specified, these manoeuvres and occurrences are derived from empirical values and collected field data.

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