
Powered industrial trucks and tractors — Brake performance — Determination of measurement procedures

*Chariots de manutention et tracteurs industriels automoteurs —
Capacité de freinage — Détermination des modes opératoires de
mesure*



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Contents

Page

Foreword	iv
Introduction.....	v
1 Scope.....	1
2 Normative references	1
3 Terms and definitions	1
4 Technical considerations	2
4.1 General	2
4.2 Research.....	2
4.3 Determination of formulas	6
5 Conclusion	10
Annex A (informative) Timing responses during stopping (from ISO 611).....	11
Annex B (informative) Truck deceleration against velocity (from ISO 6292:1996).....	12
Annex C (informative) Truck deceleration — Group C.....	13
Bibliography.....	14

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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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 29944 was prepared by Technical Committee ISO/TC 110, *Industrial trucks*, Subcommittee SC 2, *Safety of powered industrial trucks*.

Introduction

The first edition of ISO 6292, published in 1996, defined two types of measurement method for verifying the brake performance of an industrial truck:

- drawbar drag measurement (DBD);
- truck deceleration measurement.

DBD is specified in the US standard ANSI/ITSDF B56.1 ^[1] and the Australian standard AS 2359-1 ^[2].

Both measurement methods verify braking force, each method differently. Both have inherent disadvantages, insofar as neither caters for brake system features that extend the stopping distance, i.e. initial response time and braking force build-up time, or state-of-the-art such as regenerative braking systems or other systems with a significant relationship between velocity of the truck and brake force.

ISO 6292:1996 also allowed for other methods or procedures for the assessment of brake performance, including the use of an accelerometer and chassis dynamometer, provided they gave equivalent accuracy. Nevertheless, it provided no further guidance or specification in relation to these. The first edition of ISO 6292 also permitted the use of stopping distance as a measurement method; however, it did not define any further basis for using that method.

International Standards such as ISO 3450 ^[3] and national/regional regulations such as EU Directive 71/320/EEC ^[4] describe the measurement of stopping distance as a means of verifying the braking performance of the vehicle. While ANSI/ITSDF B56.1 does specify a formula for determining stopping distance, it does not take into account the brake system reaction time.

In light of the above, an ad-hoc group was established within ISO/TC 110/SC 2/WG 7 to revise ISO 6292 with the objective of establishing stopping distance as a further measurement method. It was recognized that the determination of stopping distance needs to include the brake system reaction time, but not the human reaction time. In order to ensure widespread acceptance of the revised International Standard, it was also decided that the drawbar drag method should be maintained, subject to that method's ability to reproduce results of equivalent accuracy.

This Technical Report analyses the above-mentioned methods and explains the determination of the values used in the second edition, ISO 6296:2008, to calculate stopping distance and drawbar drag. Because a detailed description of all aspects within that International Standard was not possible, for the purposes of this Technical Report it was decided to summarize the determination of ISO 6292 requirements.

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1 Scope

This Technical Report describes the selection and calculation of the stopping distance and braking force used in the application of ISO 6292.

It does not cover test procedures, control forces or component strengths.

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 611, *Road vehicles — Braking of automotive vehicles and their trailers — Vocabulary*

ISO 6292:2008, *Powered industrial trucks and tractors — Brake performance and component strength*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 611 and the following apply.

3.1 stopping distance

s_0

distance travelled by the truck during the total braking time, from the instant when the driver begins to actuate the control device until the instant when the truck stops

3.2 brake reaction distance

s_r

distance travelled by the truck during the time from the instant when the driver begins to actuate the control device until the instant when the two vehicle speed straight lines (truck velocity while travelling and decreasing velocity while braking with mean fully deceleration) intersect

3.3 braking distance

s_b

distance travelled by the truck during the time from the instant when the two vehicle speed straight lines (truck velocity while travelling, and decreasing velocity while braking with mean full deceleration) intersect until the instant when the truck stops