INTERNATIONAL STANDARD

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Road vehicles — Test of braking systems on vehicles with a maximum authorized total mass of over 3,5 t using a roller brake tester

Part 1: Pneumatic braking systems

Véhicules routiers — Essai des systèmes de freinage des véhicules ayant une masse totale maximale autorisée supérieure à 3,5 t effectué sur banc d'essai de freinage à rouleaux

Partie 1: Systèmes de freinage pneumatique

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

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 21069-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 2, *Braking systems and equipment*.

ISO 21069 consists of the following parts, under the general title *Road vehicles — Test of braking systems on vehicles with a maximum authorized total mass of over 3,5 t using a roller brake tester*:

— *Part 1: Pneumatic braking systems*

Air-over-hydraulic braking systems and hydraulic braking systems are to form the subjects of future parts 2 and 3.

Introduction

The present ECE Regulation No. 13 covers only some aspects of the periodic technical inspection of vehicles in use. In order to fulfil the requirements of section 5.1.4 of Regulation 13, ISO 21069 has been conceived to cover the periodic measurement of braking performance of vehicles in service.

Road vehicles — Test of braking systems on vehicles with a maximum authorized total mass of over 3,5 t using a roller brake tester

Part 1: Pneumatic braking systems

1 Scope

This part ISO 21069 specifies a roller brake test for determining the braking efficiency of road vehicles having a maximum authorized total mass (Code ISO-MO8) as defined in ISO 1176 of more than 3,5 t, being of categories M2, M3, N2, N3, O3 and O4 as defined in UNECE R.E.3 and equipped with full power air (pneumatic) braking systems. Also applicable to electronic braking systems (EBS), its purpose is to ensure comparable measurement results from different testers, leading to reliable assessment of the efficiency of service braking systems wherever roller brake tests are performed.

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 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 3833, *Road vehicles — Types — Terms and definitions*

ECE Regulation No. 13:1996, *Uniform Provisions Concerning the Approval of Vehicles of Categories M, N and O with regard to braking*, incorporating supplements 1 to 5 to the 09 series of amendments

UNECE [1)] R.E.3:1997, *Consolidated Resolution on the Construction of Vehicles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 611, ISO 1176, ISO 3833 and the following apply.

3.1
braking force
force between the tyre and the rotating roller, produced at the circumference of the tyre during braking, which opposes the force generated at that interface by the roller brake tester in order to cause a rotation of the wheel

1) United Nations Economic Commission for Europe.

3.2
reference braking force
braking force of one axle generated at the circumference of the tyre on a roller brake tester, relative to brake actuator pressure

NOTE 1 Reference braking forces are stated by the manufacturer covering the performance of vehicle brakes for the purpose of technical inspection and declared at the time of type approval.

NOTE 2 This information is provided in tabular or graphical form, beginning at a brake actuator pressure of 100 kPa (1 bar) and increasing in increments of no more than 100 kPa up to the pressure generated to meet Type O laden conditions for each axle.

3.3
braking force imbalance
difference in the braking forces, measured with running wheels, between brakes on an axle

NOTE It is expressed as a percentage of the higher force.

3.4
braking force variation
difference between the maximum and minimum values of the braking force, measured over a single wheel revolution with a constant actuation force

NOTE It is expressed as a percentage of the mean braking force.

3.5
roller brake tester
measuring machine consisting of two pairs of powered rollers used for the assessment of a vehicle's braking performance

NOTE The assessment is made by measuring the braking forces between the tyres and the drive rollers for each wheel/twin wheel, either simultaneously or independently, while the wheels of the vehicle axle are being driven and supported by rollers.

4 Symbols

Symbol	Meaning	Unit
F_{Bi}	Extrapolated braking forces at brake actuator pressure $p_{Alad\ i}$	N
ΣF_{Bi}	Sum of all F_{Bi} on all axles	N
F_{Hi}	Braking force at the circumference of tyres on axle i at brake actuator pressure p_{Ahi}	N
F_i	Braking force at the circumference of tyres on axle i	N
F_{Li}	Braking force at the circumference of tyres on axle i at brake actuator pressure p_{Ali}	N
F_M	Total normal static reaction of road surface on all wheels of the individual motor vehicle or F_M corresponding to F_i	N
$F_{M\ max}$	Maximum permissible F_M	N
F_R	Total normal static reaction of road surface on all wheels of the individual trailer vehicle	N
$F_{R\ max}$	Maximum permissible normal static reaction of fully laden trailer vehicle	N
p_{Ai}	Brake actuator pressure on axle i	kPa [a]
p_{AHi}	High applicable brake actuator pressure on axle i	kPa [a]
$p_{A\ lad\ i}$	Minimum design brake actuator pressure of laden vehicle on axle i (for extrapolation purposes)	kPa [a]
$p_{AL\ i}$	Low brake actuator pressure on axle i	kPa [a]
z	Braking rate	—
$z_{M\ lad}$	Braking rate of laden motor vehicle	—
$z_{R\ lad}$	Braking rate of laden trailer vehicle	—

NOTE 1 All measurements are made with the vehicle stationary.
NOTE 2 Subscript i indicates axle Nos. 1, 2, 3, ... n.

[a] 1 kPa = 0,01 bar; 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

5 Test conditions and evaluations

5.1 General

The characteristics of roller brake testers are specified in Annex A.

The efficiency test for braking systems shall be carried out with reference to

— legal requirements,

— the vehicle manufacturer's data, and

— the instruction manual of the roller brake tester.

5.2 Preparation of vehicle and roller brake tester

5.2.1 Rollers and tyres shall be clean.

5.2.2 Tyre pressure shall be adjusted in accordance with the vehicle manufacturer's recommendations.

5.2.3 Additional instrumentation may be used to measure the static axle loading without the rollers running.

5.2.4 Braking testing, for the purposes of official vehicle inspection, shall be carried out on a roller brake tester certified by the technical services. Vehicle data and the measured values shall be recorded with the wheels rotating in the forward direction.

5.2.5 Permanent multiple-axle drive systems shall be assessed on special roller brake testers which have the features for the testing axles of such systems.

5.3 Calculation and evaluation of test data

5.3.1 Braking efficiency calculation

The recorded measurements of braking forces are used to calculate the vehicle braking rate, taking into account the parameters of the vehicle and the maximum load at which it is permitted to operate.

The braking test may be made in the fully laden state or in a lightly laden condition at lower actuation pressures on the assumption that braking forces increase predictably with increasing pressure.

The actuator pressure and brake force shall be determined simultaneously and in real time.

Extrapolation of brake output forces may be used to predict the laden braking rate. This may be achieved by following one of the extrapolation methods given in 5.3.3.

The most reliable means of measuring the braking forces is with the vehicle in the fully laden condition. Where this is not practical, a prediction of the laden performance may be made using the multi-point, two-point or one-point measurement method. In such cases, the following important prerequisites shall be taken into consideration.

— A minimum of 30 % of the design brake actuator pressure shall be achieved by suitable loading, dead weight of the axle or by load simulation.

— The measurement points (first point at beginning and the cut off point) should be as far as possible away from each other (multi-point and two point method) to ensure the right gradient of the function of the graph (pressure vs. force).

— If one of these methods is not applicable, the use of the one-point method is permitted with the following additional prerequisite: the starting point, fixed at 40 kPa, shall not deviate in the direction of higher values, because this would assume an increase in error source; this starting point shall be checked in advance of the measuring.

If it is prescribed in the relevant national requirements, the rolling resistance may be treated accordingly.