
**Road vehicles — Safety enhancement
in conjunction with tyre inflation
pressure monitoring**

*Véhicules routiers — Renforcement de la sécurité conjointement avec
le contrôle de la pression de gonflage des pneumatiques*

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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 21750 was prepared by Technical Committee ISO/TC 22, *Road vehicles*.

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Introduction

A pneumatic tyre is a flexible component which is deflected when loaded. A tyre needs to be sufficiently inflated in order to be used at a limited deflection adapted to carry the wheel load as part of an axle load at a given speed and to transmit the expected longitudinal and transversal forces. The deflection is at the origin of the fatigue of a pneumatic tyre. Repeated excessive deflection may lead to tyre failure.

In real driving conditions, the physical parameter that most correlates to the tyre deflection is the tyre inflation pressure.

Therefore, the inflation pressure surveillance of pneumatic tyres for road vehicles has been identified as a major way to increase the active safety of the vehicles in service and to reduce the risks for the users.

The inflation pressure of pneumatic tyres for road vehicles shall be set by the vehicle users according to the car manufacturer's recommendations in coherency with the tyre standards which apply. The vehicle user is responsible for setting the correct tyre inflation pressure and its maintenance.

One or more significantly under-inflated tyres reduce the vehicle performances, especially the behaviour related to safety. Tyre pressures outside of the range recommended by the tyre or the vehicle manufacturer for the intended service may permanently alter the tyre characteristics up to a sudden pressure loss.

This International Standard does not imply that the tyre will resist under all circumstances before an alert is delivered by a Tyre Pressure Monitoring System (TPMS) described by this International Standard.

The primary objective of a TPMS is to alert the driver when an unsafe condition related to incorrect tyre inflation pressure is detected.

This International Standard contains proposals for the definition of terms used in both standardization working groups dealing with TPMSs and extended mobility systems.

Both working groups are invited to make comments and proposals, the goal being to finally share these definitions.

Each International Standard should contain the definitions which are typical to its subject and refer to the other International Standards for the other definitions.

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Road vehicles — Safety enhancement in conjunction with tyre inflation pressure monitoring

1 Scope

This International Standard deals with electronic Tyre Pressure Monitoring Systems (TPMS) for tubeless tyres in association or not with an extended mobility system, with a reference pressure lower or equal to 375 kPa, fitted in single formation on four wheeled vehicles. The systems are able to survey all tyres in use but not necessarily those in temporary use and provide information to the driver.

This International Standard establishes overall performance guidelines for the systems and their components, independently of the physical principles and the technological solution which have been selected to monitor the tyre pressure, to compute the difference to the requested level and to deliver a relevant information to the driver if the pressure of one, several or all tyres needs corrective action for the intended service conditions.

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 1000, *SI units and recommendations for the use of their multiples and of certain other units*

ISO 2575, *Road vehicles — Symbols for controls, indicators and tell-tales*

IEC CISPR 22, *Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement*

IEC CISPR 24, *Information technology equipment — Immunity characteristics — Limits and methods of measurement*

ASTM B 117–73, *Standard Method of Salt Spray (Fog) Testing*

European Tyre & Rim Technical Organization, *ETRTO Standards Manual*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

tyre wheel assembly

assembly consisting of a wheel (rim and disc) fitted with a tyre, a valve, etc.

3.2

tyre

flexible component of the tyre wheel assembly made of rubber and reinforcing materials

NOTE Inflating the tyre with compressed gas enables it to carry the wheel load as part of an axle load and to transmit longitudinal and transversal forces. In the unloaded condition, the inflated tyre is essentially toroidal.

**3.3
normal tyre**

tyre designed for use in an inflated state

NOTE "Conventional tyre" under the SAE means is defined by the ETRTO Standards Manual as a synonym of "diagonal tyre" and should not be used in the sense of "usual, standard tyre".

**3.4
spare unit**

tyre wheel assembly intended to be exchanged for a tyre wheel assembly already fitted on the vehicle that has lost some functional efficiency

**3.5
Spare Unit Substitutive Equipment
SUSE**

equipment intended to maintain or restore, not replace, the basic tyre functions of a tyre in case of a tyre wheel assembly failure

**3.6
extended mobility system**

assembly of specified functionally dependent components including, but not limited to, a tyre and a flat tyre warning system, which together provide the specified performance granting "extended mobility" to a vehicle thus equipped

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NOTE A single component or several independent components, functionally interacting with other elements of the vehicle do not in and of themselves constitute an "extended mobility system". In addition, the assembly of components, otherwise suitable to compose a system, but which do not completely follow the specifications of a "systems manager", does not constitute an "extended mobility system".

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**3.7
Tyre Pressure Monitoring System
TPMS**

any system fitted on a vehicle, able to evaluate the pressure of the tyres or the variation of the pressure over time and to transmit corresponding information to the user while the vehicle is running

NOTE A TPMS is functionally composed of:

- sensing devices;
- information channel hardware;
- central information processing unit (CPU); and
- human machine interface (HMI).

**3.8
Tyre Pressure Alerting System
TPAS**

system and process of measuring the tyre inflation pressure and eventually internal temperature, or (a) parameter(s) that directly correlate(s) to the pressure and delivering an information to the driver that a tyre has reached a level of inflation pressure that requires a corrective action

NOTE TPAS may also include a run-flat warning function.

3.9**Tyre Pressure Warning System****TPWS**

TPWS also able to provide useful information, at least the actual relative tyre pressure condition of each tyre, to the driver

3.10**Tyre Leak Alerting System****TLAS**

system and process for detecting that the inflation pressure of one of the tyres in service has significantly changed in comparison to the others and to the initial state, requiring a corrective action

3.11**Intelligent Tyre Pressure Management System****ITPMS**

system which is able to monitor the pressure and the internal temperature of the tyre, to adapt the pressure by increasing or decreasing the actual pressure in dependence on the real service conditions and to restore the correct pressure in case of pressure loss

3.12**false information**

information provided to the user which is not consistent with the system's specifications

3.13**learning phase**

working condition where necessary values for TPMS/TLAS (data, parameter) are recognized, measured, and respectively verified to a sufficient statistical probability

NOTE The learning phase can include active and passive sections. During the learning phase the alerting/warning sensibility increases from "zero" to target.

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3.14**inflated mode**

normal working state of a tyre, inflated at the cold inflation pressure recommended by the vehicle (or the tyre) manufacturer for the intended service

3.15**flat tyre running mode**

state of a tyre, part of an extended mobility system operating at an inflation pressure lower than 70 kPa

3.16**cold tyre inflation pressure**

tyre pressure at ambient temperature, in absence of any pressure build-up due to tyre usage

3.17**minimum cold tyre inflation pressure**

minimum cold tyre inflation pressure, specified by the tyre standardization bodies for given service conditions

3.18**recommended cold tyre inflation pressure**

P_{rec}

pressure recommended for each tyre position by the vehicle and/or the tyre manufacturer for the intended service conditions of the given vehicle

NOTE

P_{rec} is the same or higher than the minimum cold tyre inflation pressure.

3.19**set of recommended cold tyre inflation pressure**

recommended cold tyre inflation pressure for the tyres of the front and the rear axle of a vehicle

3.20

pressure reserve

difference, for each tyre position, between the recommended cold tyre inflation pressure and the minimum cold tyre inflation pressure

3.21

normal load on a tyre

load applied on an individual tyre by distributing to each axle its share of “kerb mass”, “accessory mass” and the “normal occupant mass”

3.22

maximum vehicle load on a tyre

share of the maximum axle load allowed by the vehicle manufacturer which applies on an individual tyre

3.23

tyre load reserve

for a given tyre at a given pressure, the difference between the maximum load allowed by the tyre manufacturer’s standards and the maximum vehicle load on the tyre

3.24

warning

any indication to the driver to inform him that one element of the vehicle is no longer within the normal service conditions, and that a corrective action is recommended

3.25

alarm

any indication to the driver to inform him that one element of the vehicle is now in a situation where an immediate corrective action is necessary

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3.26

nuisance status indication

justified status indication that occurs at a frequency that distracts or annoys the vehicle operator and which could cause the vehicle operator not to take action when necessary

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3.27

false warning or alarm

anomaly of the system leading to an unjustified warning or alarm

3.28

tyre intended service conditions

maximum expected load, speed and camber of a tyre in service for a given vehicle

3.29

wheel fitted component

WFC

enclosed device that measures physical parameters and conveys information to (downlink) a central unit fitted in the car body

NOTE A WFC may also be equipped with an uplink channel which could carry the pressure on demand inputs or elsewhere.

3.30

external car body fitted component

EFC

enclosed device mounted on the body structure of the vehicle outside of the passenger compartment or boot which supports specific features of a TPMS and exchange information with WFC and/or IFC

NOTE EFC may perform signal processing.

3.31**internal car body fitted component****IFC**

enclosed device mounted on the car body structure of the vehicle inside the passenger compartment or boot which supports specific features of a TPMS and exchanges information with WFC and/or EFC

NOTE IFC may perform signal processing.

3.32**run-flat warning function**

possible additional function for a TLAS allowing it to warn the driver in the case where the vehicle is fitted with an **extended mobility system** (see 3.6) and this system is in the extended mobility mode

4 Symbols and abbreviations

CPU — Central Processing Unit

EFC — External car body Fitted Component

EMC — Electro-Magnetic Compatibility

FS — Full Scale

HMI — Human Machine Interface

IFC — Internal car body Fitted Component

ITPMS — Intelligent Tyre Pressure Management System

RF — Radio Frequency

TLAS — Tyre Leak Alerting System

TPAS — Tyre Pressure Alerting System

TPMS — Tyre Pressure Monitoring System

TPWS — Tyre Pressure Warning System

WFC — Wheel Fitted Component

5 Technical requirements and test procedures for system**5.1 General**

Any of the mentioned TPMS shall monitor the tyre pressures at speeds exceeding 25 km/h after a successful learning phase if it does exist.

This learning phase will have a maximum duration of 30 min of cumulative driving above 25 km/h. In the case it is not successful, the driver shall be warned by the malfunction tell-tale or optical indicator.

The learning phase shall be activated only after the system reset (new tyre fitting, pressure adjustment).

For all the tests, the TPMS shall be in their normal working state.