Tire Pressure Monitoring System (TPMS): Extension of use to vehicle categories M, N & O.

Carriage of passengers (M)
Carriage of goods (N)
Trailers (O)

The following list of documents* are motivating the extension of use of TPMS to the vehicle categories M, N & O.

* please see appendix for details

1. 'Work programm on automotive and mobility industries 2018-2019' (*DG GROW*)

5. UNECE

5.3. Other Safety Items

5.3.9. Tyre Pressure Monitoring System TPMS (GRRF)

'Amendment to introduce requirements for all M, N and O categories in UNECE Regulation No 141, linked to revision of Regulation 661/2009'.

Target date: Q4/2019

2. Inception impact assessment (DG Grow, 14/7/2017)

- *Tyre Pressure Monitoring Systems (TPMS) are mandatory on passenger vehicles since Nov. 2014*
- *Improved road safety.*
- *Positive environmental impact (compliant with EU targets on climate action: CO2 emission)*

3. Position paper from the European Tyre Industry on the Revision of the General Safety Regulation and Low-Emission mobility with regards to TPMS.

Tyre/Rim is not a fully sealed assembly

Tyre faces outside road conditions

Tyre deflates

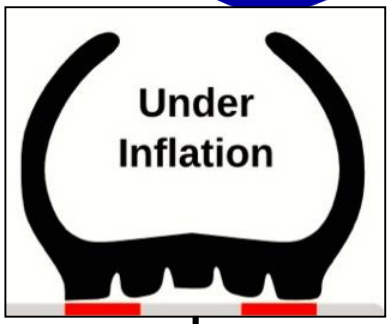
Underinflated Tyre Impact

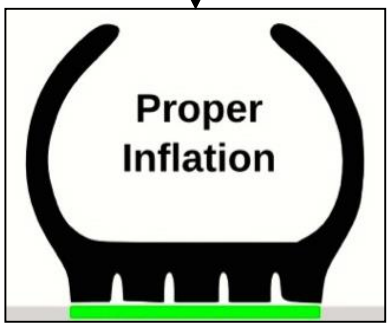
Road Safety

Fuel consumption

Tyre wear

necessity of a system that informs about under-inflation : **TPMS**





TPMS definition / How it works

The Tire Pressure Monitoring System (TPMS) is defined as a system on a vehicle, able to

***A*) perform a function to evaluate the inflation pressure of the tyres**

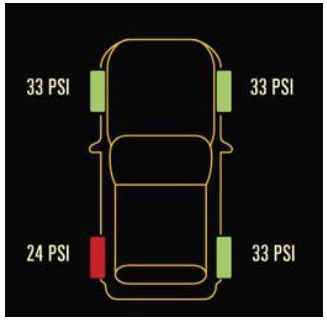
or

***B*) the variation of this inflation pressure over time**

C) and transmit the corresponding information to the user

while the vehicle is running.

The system reports real-time tire-pressure information to the driver of the vehicle, either via a gauge, a pictogram display, or a simple low-pressure warning light.



The TPMS system will warn the user in case it detects a drop in inflation pressure below the system-defined threshold limits.

Finally, the system has to be able to carry this detection in a reasonable timeframe (TPMS detection time)

ETRTO Approach:

ETRTO proposes to use the same approach as defined in UN R141 (and EU R661/2009) for light and heavy duty commercial vehicles, i.e. taking the P_{warm} value as reference, and defining relative deflation thresholds.
ETRTO makes the conscious choice to define the TPMS alert threshold values & detection time from the tyre perspective.

Definitions:

P_{warm} :	means the inflation pressure for each tyre position elevated from the cold pressure (Prec) by temperature effects during vehicle usage (UN Regulation 141, 2.10)
$P_{measured}$	In service operating pressure
P_{rec} :	The recommended cold inflation pressure for each tyre position by the vehicle manufacturer
P_{min} :	The absolute minimum inflation pressure for the intended service condition (load / speed)
Relative deflation threshold:	A prefixed percentage drop of **$P_{measured}$** compared to **P_{warm}**
Detection time:	Cumulative driving time from the moment the pressure has dropped below the relative deflation threshold and the alert
Deflation gradient:	Pressure drop versus time

ETRTO proposal for Commercial Vehicle TPMS thresholds and detection time

Two (2) warning levels for light and heavy duty Commercial Vehicle TPMS are proposed:

Warning Levels	Maintenance		Alert	
Purpose	- fuel consumption - tyre life - vehicle behavior		Safety	
Event description	Slow underinflation	Cumulative underinflation willl lead to alert	Fast leakage	
Trigger level	Relative deflation in %, comparing $P_{measured}$ to P_{warm} is superior to the proposed threshold value	Maximum cumulative driving distance or driving time under 'Maintenance' level before a change to 'Alert' warning level occurs	Relative deflation in %, comparing to P_{warm} is superior to the proposed threshold value Or $P_{measured}$ drops below the proposed absolute minimum value P_{min}	Deflation gradient is superior to the threshold gradient value defined
Required action	No immediate action from the driver is required, however, he should adjust inflation pressure at the closest maintenance facility		Immediate action from the driver is required: 1. Reduce vehicle speed 2. Stop safely the vehicle 3. Check tyre condition* 4. Repair or change tyre 5. Inflate tyre*	

* calibrated Tyre Pressure Gauges as described in EN 12645

ETRTO proposal for Commercial Vehicle TPMS thresholds and detection time

	Vehicle category	Maintenance		Alert	
Trigger level		Relative deflation in %, comparing $P_{measured}$ to P_{warm} is superior to the proposed threshold value	Maximum cumulative driving distance or driving time under 'Maintenance' level before a change to 'Alert' warning level occurs	Relative deflation in %, comparing $P_{measured}$ to P_{warm} is superior to the proposed threshold value Or $P_{measured}$ below the proposed absolute minimum value P_{min}	Deflation gradient is superior to the threshold gradient value defined
Threshold	**M1 and N1 (dual fitment), M2, O1, O2**	10%	500 km or 12 hours (whatever is occuring first)	20% (or 220 kPa whatever is occuring first)	> 120 kPa/min
	N2, N3, M3, O3, O4	8%	1000 km or 12 hours (whatever is occuring first)	16%	> 120 kPa/min
Detection time	**All**	1 hour	1 hour	5 minutes	2 minutes

Summary

A tyre pressure monitoring system (TPMS) is an additional tool to reduce the underinflation of the tyres in practical use. The correct choice of warning thresholds helps to keep the inflation pressure at the required level for optimum performance criteria and reduce fuel consumption / CO2 emissions. Any kind of TPMS does not exonerate the driver from regular pressure checks. In particular, if the inflation pressure at the point of illumination of the telltale is below the pressure required to carry the load of the vehicle according to tyre industry standards, the vehicle manufacturer must advise the customer that he/she still needs to check the tyre pressure regularly.

Recommendation

ETRTO recommends to include all the above mentioned vehicle classes in the EU TPMS regulation.

and that a EC regulatory framework is in place to assure a periodic Tyre Pressure Gauges maintenance.

APPENDIX

Inception impact assessment (DG Grow, 14/7/2017)

"The current initiative is expected to have positive environmental impacts. Some of the proposed technologies can help contribute to the reduction of CO2 emissions and therefore to comply with the EU targets on climate action and to the objectives of the Energy Union. For instance, tyre pressure monitoring affects the wear rate of the tyre and the braking and handling performance of the vehicle increasing vehicle safety. However, proper tyre pressure also reduces rolling resistance and thus saves fuel and reduces CO2 emissions19. Tyre pressure monitoring has been mandatory for all new passenger cars sold since November 2014, but light and heavy commercial vehicles as well as buses are currently not subject to tyre pressure monitoring requirements"

In the experience of the tyre industry, there are other two fundamental elements to ensure the translation of the regulation R661 and R1222 in improved road safety (ETRMA 20 October 2017)

1. Better vehicle and tyre maintenance: despite the development and production of high performing tyres, certain usage conditions risk to compromise those intended tyre performances. These conditions include:

a. wrong tyres for the road conditions,
b. the wrong inflation,
c. tread depth below the legal limit,
d. misalignment of vehicle wheels and axles

Amongst these conditions, tyre under inflation is one that the introduction of new vehicle safety features can help preventing and rectifying. For this reason, Tyre Industry supports a better implementation of TPMS stage 1. Furthermore, mandatory TPMS on light duty and commercial vehicles should complete stage 1. Tyre Industry also considers it important that the legislator mandates TPMS not only on new vehicles, but also for the entire vehicle life through periodic roadworthiness legislation and roadside inspections.

2- Tyre Pressure Gauges are an essential tool to ensure a safe drive, when faced with underinflated tyres. However, these gauges are not subject to periodic verification in a harmonised way across the EU. Verification is left to the discretion of each Member State. Therefore, there is the need to check these tools through periodic calibration verifications in order to ensure the accuracy of the indicated pressure values used to refill the tyres Currently, pressure gauges are not well calibrated, a factor which negatively affects the user's capability to monitor tyre pressure.

The European Tyre Industry Position on the Revision of the General Safety Regulation and Low-Emission mobility with regards to TPMS

TPMS is one parameter mentioned in the European tyre industry position on what the tyre industry and regulators can do to further contribute to the EU low emission mobility agenda (ETRMA 14 November 2016)

Tyre Pressure Monitoring System (TMPS) on all vehicle categories:
TPMS is necessary to ensure that tyre pressure is optimal in order to fully benefit from the contribution of low rolling resistance tyres to the vehicle's CO2 emissions reduction and lower fuel consumption. Regulation 661/2009 requests that all new passenger cars sold after November 2014 are equipped with TPMS. For Commercial Vehicles, this is not yet the case. A TPMS fitment as of 2020 will need to be mandatory to support the driver in ensuring that his tyres are in optimal service conditions and draw the full potential of low rolling resistance tyre-technology. Otherwise the benefits will be partly lost.

reducing tire rolling resistance -> saving fuel -
> reducing CO2 emissions