

AUTOMOTIVE INDUSTRY STANDARD

**TYPE APPROVAL REQUIREMENTS
FOR VEHICLES WITH REGARD TO
THEIR TYRE PRESSURE
MONITORING SYSTEMS (TPMS)**

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ON BEHALF OF
AUTOMOTIVE INDUSTRY STANDARDS COMMITTEE

UNDER
CENTRAL MOTOR VEHICLE RULES – TECHNICAL STANDING COMMITTEE

SET-UP BY
MINISTRY OF ROAD TRANSPORT & HIGHWAYS
(DEPARTMENT OF ROAD TRANSPORT & HIGHWAYS)
GOVERNMENT OF INDIA

May 2018

Status chart of the Standard to be used by the purchaser for updating the record

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| General remarks : | | | | | | |

INTRODUCTION

The Government of India felt the need for a permanent agency to expedite the publication of standards and development of test facilities in parallel when the work on the preparation of the standards is going on, as the development of improved safety critical parts can be undertaken only after the publication of the standard and commissioning of test facilities. To this end, the erstwhile Ministry of Surface Transport (MoST) has constituted a permanent Automotive Industry Standards Committee (AISC) vide order No. RT-11028/11/97-MVL dated September 15, 1997. The standards prepared by AISC will be approved by the permanent CMVR Technical Standing Committee (CTSC). After approval, the Automotive Research Association of India (ARAI), Pune, being the secretariat of the AIS Committee, would publish this standard. For better dissemination of this information ARAI may publish this standard on their Web site.

This standard addresses the performance evaluation requirements for Tyre Pressure Monitoring Systems (TPMS). The standard is aligned with UN R 141. The ambient temperature conditions for the test are specified as 0 to 50 degree centigrade as against 0 to 40 degree centigrade in UN R 141.

The AISC panel and the Automotive Industry Standards Committee (AISC) responsible for preparation of this standard are given in Annex-B and Annex-C respectively.

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Type Approval Requirements for Vehicles with Regard to Their Tyre Pressure Monitoring Systems (TPMS)

1.0 SCOPE

This standard applies to the approval of vehicles of category M1 up to a maximum mass of 3,500 kg and N1, when equipped with a tyre pressure monitoring system, except for vehicles fitted with dual wheels on an axle.

2.0 DEFINITIONS

For the purposes of this Standard:

- 2.1. **"Approval of a vehicle"** means the approval of a vehicle type with regard to its tyre pressure monitoring system.
- 2.2. **"Vehicle type"** means vehicles which do not differ significantly in such essential aspects as:
 - (a) The manufacturer's trade name or mark;
 - (b) Vehicle features which significantly influence the performances of the tyre pressure monitoring system;
 - (c) The design of the tyre pressure monitoring system.
- 2.3. **"Wheel"** means a complete wheel consisting of a rim and a wheel disc;
- 2.4. **"Tyre"** means a pneumatic tyre, being a reinforced flexible envelope that is provided with, or forms in conjunction with the wheel on which it is mounted, a continuous, essentially toroidal, closed chamber containing a gas (usually air) or a gas and liquid, that is intended normally to be used at a pressure greater than atmospheric pressure;
- 2.5. **"Maximum mass"** means the maximum value of the vehicle stated by the manufacturer to be technically permissible (this mass may be higher than the "permissible maximum mass" laid down by the national administration);
- 2.6. **"Maximum axle load"** means the maximum value, as indicated by the manufacturer, of the total vertical force between the contact surfaces of the tyres or tracks of one axle and the ground and resulting from the part of the vehicle mass supported by that axle; this load may be higher than the "authorized axle load" laid down by the national administration. The sum of the axle loads may be greater than the value corresponding to the total mass of the vehicle;
- 2.7. **"Tyre Pressure Monitoring System (TPMS)"** means a system fitted on a vehicle, able to perform a function to evaluate the inflation pressure of the tyres or the variation of this inflation pressure over time and to transmit corresponding information to the user while the vehicle is running;

- 2.8. **"Cold tyre inflation pressure"** means the tyre pressure at ambient temperature, in the absence of any pressure build-up due to tyre usage;
- 2.9. **"Recommended cold inflation pressure (P_{rec})"** means the pressure recommended for each tyre position by the vehicle manufacturer, for the intended service conditions (e.g. speed and load) of the given vehicle, as defined on the vehicle placard and/or the vehicle owner's manual;
- 2.10. **"In service operating pressure (P_{warm})"** means the inflation pressure for each tyre position elevated from the cold pressure (P_{rec}) by temperature effects during vehicle usage;
- 2.11. **"Test Pressure (P_{test})"** means the actual pressure of the tyre(s) selected for each tyre position after deflation during the test procedure.

3.0 APPLICATION FOR APPROVAL

- 3.1. The application for approval of a vehicle type with regard to its tyre pressure monitoring system shall be submitted to the Testing Agency by the vehicle manufacturer or by his duly authorized representative;
- 3.2. It shall be accompanied, by a description of the vehicle type with regard to the items specified in application:
- 3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Testing Agency responsible for conducting the approval tests.

4.0 APPROVAL

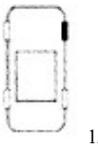
- 4.1. If the vehicle submitted for approval pursuant to this Standard meets all the requirements of paragraph 5, below, approval of that vehicle type shall be granted.

5.0 SPECIFICATIONS AND TESTS

5.1. General

- 5.1.1. Any vehicle of categories M1 up to 3,500 kg and N1, in both cases with all axles equipped with single tyres, and fitted with a tyre pressure monitoring system complying with the definition of paragraph 2.7. shall meet the performance requirements contained in paragraphs 5.1.2. to 5.5.5. of this Standard over a wide range of road and environmental conditions encountered within the country.
- 5.1.2. The effectiveness of the tyre pressure monitoring system fitted on a vehicle shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by fulfilling the technical requirements as per AIS-004 (Part 3).
- 5.1.3. The system shall operate from a speed of 40 km/h or below, up to the vehicle's maximum design speed.
- 5.1.4. The vehicle shall fulfil the tests (puncture, diffusion and malfunction) as specified in Annex 1.
- 5.2. Tyre pressure detection for incident-related pressure loss

- 5.2.1. The TPMS shall illuminate the warning signal described in paragraph 5.5. within not more than ten minutes of cumulative driving time after the in service operating pressure in one of the vehicle's tyres has been reduced by twenty per cent or it is at a minimum pressure of 150 kPa, whatever is higher.
- 5.3. Detection for a tyre pressure level significantly below the recommended pressure for optimum performance including fuel consumption and safety.
 - 5.3.1. The TPMS shall illuminate the warning signal described in paragraph 5.5. within not more than sixty minutes of cumulative driving time after the in-service operating pressure in any of the vehicle's tyres, up to a total of four tyres, has been reduced by twenty per cent or it is at a minimum pressure of 150 kPa, whatever is higher.
- 5.4. Malfunction detection
 - 5.4.1. The TPMS shall illuminate the warning signal described in paragraph 5.5. not more than 10 minutes after the occurrence of a malfunction that affects the generation or transmission of control or response signals in the vehicle's tyre pressure monitoring system.
- 5.5. Warning indication.
 - 5.5.1. The warning indication shall be by means of an optical warning signal conforming to either of the following warning symbol.

| Item | Symbol | Function | Illumination | Colour |
|---|---|-----------|--------------|--------|
| Low tyre pressure (including malfunction) |  | Tell-tale | Yes | Yellow |
| Low tyre pressure (including malfunction) that identifies affected tyre |  1/ | Tell-tale | Yes | Yellow |

Note:

1/ The vehicle outline shown is not intended to be restrictive, but is the recommended outline. Alternative vehicle outlines may be used in order to better represent the actual outline of a given vehicle.

- 5.5.2. The warning signal shall be activated when the ignition (start) switch is in the "on" (run) position (bulb check). This requirement does not apply to tell-tales shown in a common space.
- 5.5.3. The warning signal must be visible even by daylight; the satisfactory condition of the signal must be easily verifiable by the driver from the driver's seat.
- 5.5.4. The malfunction indication may be the same warning signal as the one used to indicate under-inflation. If the warning signal described in paragraph 5.5.1. is used to indicate both under-inflation and a malfunction of the TPMS, the following shall apply: with the ignition (start) switch in the "on" (run) position the warning signal shall flash to indicate a malfunction. After a short period of time the warning signal shall remain continuously illuminated as long as the malfunction exists and the ignition (start) switch is in the "on" (run) position. The flashing and illumination sequence shall be repeated each time the ignition (start) switch is in the "on" (run) position until the malfunction has been corrected.
- 5.5.5. The tell-tale of the warning described in paragraph 5.5.1. may be used in a flashing mode in order to provide information about the reset status of the tyre pressure monitoring system in accordance with the owner's manual of the vehicle.

6.0 SUPPLEMENTARY INFORMATION

- 6.1. The owner's manual, if any, of the vehicle shall contain at least the following information:
 - 6.1.1. A statement that the vehicle is equipped with such a system (and information how to reset the system, if the actual system includes such a feature).
 - 6.1.2. An image of the tell-tale symbol described in paragraph 5.5.1. (and an image of the malfunction tell-tale symbol, if a dedicated tell-tale is used for this function).
 - 6.1.3. Additional information about the significance of the low tyre pressure warning tell-tale illuminating and a description of the corrective action to be undertaken if this happens.
- 6.2. If no owner's manual is supplied with the vehicle, the information required in paragraph 6.1. above shall be displayed in a prominent place on the vehicle.

7.0 MODIFICATIONS AND EXTENSION OF APPROVAL OF THE VEHICLE TYPE

- 7.1. Every modification of the vehicle type as defined in paragraph 2.2. of this Standard shall be notified to the Testing Agency which approved the vehicle type. The Type Approval Authority may then either:
 - 7.1.1. Consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;
 - 7.1.2. Consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.

ANNEX A
TESTS FOR TYRE PRESSURE MONITORING SYSTEMS (TPMS)

1.0 Test conditions

1.1. Ambient temperature.

The ambient temperature shall be between 0 °C and 50 °C.

1.2. Road test surface.

The road shall have a surface affording good adhesion. The road surface shall be dry during testing.

1.3. The tests shall be conducted in an environment free of interferences from radio wave.

1.4. Vehicle conditions.

1.4.1. Test weight.

The vehicle may be tested at any condition of load, the distribution of the mass among the axles being that stated by the vehicle manufacturer without exceeding any of the maximum permissible mass for each axle.

However, in the case where there is no possibility to set or reset the system, the vehicle shall be unladen. There may be, in addition to the driver, a second person on the front seat who is responsible for noting the results of the tests. The load condition shall not be modified during the test.

1.4.2. **Vehicle speed**

The TPMS shall be calibrated and tested:

(a) In a speed range from 40 km/h and 120 km/h or the vehicle's maximum design speed if it is less than 120 km/h for the puncture test to verify the requirements of paragraph 5.2. to this Standard; and

(b) In a speed range from 40 km/h and 100 km for the diffusion test to verify the requirements of paragraph 5.3 to this Standard and for the malfunction test to verify the requirements of paragraph 5.4. to this Standard.

The whole speed range shall be covered during the test.

For vehicles equipped with cruise control, the cruise control shall not be engaged during testing.

1.4.3. Rim position

The vehicle rims may be positioned at any wheel position, consistent with any related instructions or limitations from the vehicle's manufacturer.

1.4.5. Brake pedal application

Driving time shall not accumulate during service brake application while the vehicle is moving.

1.4.6. Tyres

The vehicle shall be tested with the tyres installed on the vehicle according to the vehicle manufacturer's recommendation. However, the spare tyre may be utilized for testing TPMS malfunction.

1.5. Accuracy of pressure measurement equipment.

Pressure measurement equipment to be used for the tests contained in this annex shall be accurate to at least +/- 3 kPa.

2.0 Test procedure

The test shall be performed at a test speed within the range in accordance with paragraph 1.4.2. to this annex, at least once for the test case according to paragraph 2.6.1. to this annex ("puncture test"), and at least once for each test case according to paragraph 2.6.2. to this annex ("diffusion test").

- 2.1. Before inflating the vehicle's tyres, leave the vehicle stationary outside at ambient temperature with the engine off shaded from direct sunlight and not exposed to wind or other heating or chilling influences for at least one hour. Inflate the vehicle's tyres to the vehicle manufacturer's recommended cold inflation pressure (P_{rec}), in accordance with the vehicle manufacturer's recommendation for the speed and load conditions, and tyre positions. All pressure measurements shall be carried out using the same test equipment.
- 2.2. With the vehicle stationary and the ignition locking system in the "Lock" or "Off" position, activate the ignition locking system to the "On" or "Run" position. The tyre pressure monitoring system shall perform a check of lamp function for the low tyre pressure tell-tale as specified in paragraph 5.5.2. of this Standard. This last requirement does not apply to tell-tales shown in a common space.
- 2.3. If applicable, set or reset the tyre pressure monitoring system in accordance with the vehicle manufacturer's recommendations.
- 2.4. Learning phase.
 - 2.4.1. Drive the vehicle for a minimum of twenty minutes within the speed range in paragraph 1.4.2. to this annex, and with an average speed of 80 km/h (± 10 km/h). It is allowed to be outside the speed range for a maximum cumulative time of two minutes during the learning phase.
 - 2.4.2. At the discretion of the Testing Agency, where the driving test is undertaken on a track (circle/oval) with only turns in a single direction, then the driving test in paragraph 2.4.1. above should be equally split (± 2 minutes) in both directions.
 - 2.4.3. Within the five minutes of completing the learning phase, measure the warm pressure of the tyre(s) to be deflated. The warm pressure shall be taken as the value P_{warm} . This value will be used for subsequent operations.

2.5. Deflation phase.

- 2.5.1. Procedure for the puncture test to verify the requirements of paragraph 5.2. to this Standard.

Deflate one of the vehicle's tyres within five minutes of measuring the warm pressure as described in paragraph 2.4.3. above, until it is at $P_{\text{warm}} - 20$ per cent, or it is at a minimum pressure of 150 kPa, whichever is higher, namely P_{test} . Following a stabilization period of between two and five minutes the pressure P_{test} shall be rechecked and adjusted if necessary.

- 2.5.2. Procedure for the diffusion test to verify the requirements of paragraph 5.3. to this Standard.

Deflate all four tyres within five minutes of measuring the warm pressure as described in paragraph 2.4.3. above, until the deflated tyres are at $P_{\text{warm}} - 20$ per cent plus a further deflation of 7 kPa, namely P_{test} . Following a stabilization period of between two and five minutes the pressure P_{test} shall be rechecked and adjusted if necessary.

2.6. Low tyre pressure detection phase.

- 2.6.1. Procedure for the puncture test to verify the requirements of paragraph 5.2. to this Standard.

- 2.6.1.1. Drive the vehicle along any portion of the test course (not necessarily continuously). The sum of the total cumulative drive time shall be the lesser of 10 minutes or the time at which the low tyre pressure tell-tale illuminates.

- 2.6.2. Procedure for the diffusion test to verify the requirements of paragraph 5.3. to this Standard.

- 2.6.2.1. Drive the vehicle along any portion of the test course. After not less than twenty (20) minutes and not more than forty (40) minutes bring the vehicle to a complete standstill with the engine switched off and the ignition key removed for not less than one (1) minute or more than three (3) minutes. Resume the test. The sum of the total cumulative drive time shall be the lesser of sixty (60) minutes of cumulative driving under the conditions set out in paragraph 1.4.2. above or the time at which the low tyre pressure tell-tale illuminates.

- 2.6.3. If the low tyre pressure signal did not illuminate, discontinue the test.

- 2.7. If the low tyre pressure tell-tale illuminated during the procedure in paragraph 2.6. above, deactivate the ignition locking system to the "Off" or "Lock" position. After a five minutes period, reactivate the vehicle's ignition locking system to the "On" ("Run") position. The tell-tale must illuminate and remain illuminated as long as the ignition locking system is in the "On" ("Run") position.

2.8. Inflate all of the vehicle's tyres to the vehicle manufacturer's recommended cold inflation pressure. Reset the system in accordance with the instructions of the vehicle manufacturer. Determine whether the tell-tale has extinguished. If necessary, drive the vehicle until the tell-tale has been extinguished. If the tell-tale does not extinguish, discontinue the test.

2.9. **Repetition of the deflation phase.**

The test may be repeated, at the same or different loads, using the relevant test procedures in paragraphs 2.1. to 2.8. above, with the relevant tyre(s) on the vehicle under-inflated, in accordance with the provisions of paragraph 5.2. or 5.3. to this Standard, whichever is relevant.

3.0 TPMS malfunction detection

3.1. Simulate a TPMS malfunction, for example, by disconnecting the power source to any TPMS component, disconnecting any electrical connection between TPMS components, or installing a tyre or wheel on the vehicle that is incompatible with the TPMS. When simulating a TPMS malfunction, the electrical connections for the tell-tale lamps shall not be disconnected.

3.2. Drive the vehicle for up to ten minutes of cumulative time (not necessarily continuously) along any portion of the test course.

3.3. The sum of the total cumulative drive time under paragraph 3.2. shall be the lesser of ten minutes or the time at which the TPMS malfunction tell-tale illuminates.

3.4. If the TPMS malfunction indicator did not illuminate in accordance with paragraph 5.4. to this Standard, as required, discontinue the test.

3.5. If the TPMS malfunction indicator is illuminated or illuminates during the procedure in paragraphs 3.1 to 3.3 above, deactivate the ignition locking system to the "Off" or "Lock" position. After five minutes, reactivate the vehicle's ignition locking system to the "On" ("Run") position. The TPMS malfunction indicator shall again signal a malfunction and remain illuminated as long as the ignition locking system is in the "On" ("Run") position.

3.6. Restore the TPMS to normal operation. If necessary, drive the vehicle until the warning signal has extinguished. If the warning lamp has not extinguished, discontinue the test.

3.7. The test may be repeated using the test procedures in paragraphs 3.1. to 3.6. above, with each such test limited to simulation of a single malfunction.

ANNEX- B
(See Introduction)

**COMPOSITION OF AISC PANEL ON TYPE APPROVAL
REQUIREMENTS FOR VEHICLES WITH REGARD TO THEIR TYRE
PRESSURE MONITORING SYSTEMS (TPMS)***

| | |
|-----------------------|---|
| Convener | |
| Mr. A. A. Badusha | The Automotive Research Association of India (ARAI) |
| Members | Representing |
| Mr. K. B. Patil | The Automotive Research Association of India (ARAI) |
| Mr. Tagad Nilesh | Central Institute for Road Transport (CIRT) |
| Mr. Gavendra Singh | International Centre for Automotive Technology (ICAT) |
| Mr. S. Ravishankar | SIAM (Ashok Leyland Ltd.) |
| Mr. V. Faustino | SIAM (Ashok Leyland Ltd.) |
| Mr. Shailesh Kulkarni | SIAM (Mahindra & Mahindra Ltd.) |
| Mr. Rajesh Vyas | SIAM (Maruti Suzuki India Ltd.) |
| Mr. Gururaj Ravi | SIAM (Maruti Suzuki India Ltd.) |
| Mr. Rajkumar Diwedi | SIAM (Maruti Suzuki India Ltd.) |
| Mr. Vijeth Gatty | SIAM (Toyota Kirloskar Motor Pvt. Ltd.) |
| Mr. Uday Harite | ACMA |

* At the time of approval of this Automotive Industry Standard (AIS)

ANNEX- C
(See Introduction)
COMMITTEE COMPOSITION*
Automotive Industry Standards Committee

| | |
|--------------------------|--|
| Chairperson | |
| Mrs. Rashmi Urdhwareshe | Director The Automotive Research Association of India, Pune |
| Members | Representing |
| Representative from | Ministry of Road Transport and Highways (Dept. of Road Transport and Highways), New Delhi |
| Representative from | Ministry of Heavy Industries and Public Enterprises (Department of Heavy Industry), New Delhi |
| Shri S. M. Ahuja | Office of the Development Commissioner, MSME, Ministry of Micro, Small and Medium Enterprises, New Delhi |
| Shri Shrikant R. Marathe | Former Chairman, AISC |
| Shri R.R. Singh | Bureau of Indian Standards, New Delhi |
| Director | Central Institute of Road Transport, Pune |
| Director | Global Automotive Research Centre, Chennai |
| Director | International Centre for Automotive Technology, Manesar |
| Director | Indian Institute of Petroleum, Dehra Dun |
| Director | Vehicles Research and Development Establishment, Ahmednagar |
| Director | Indian Rubber Manufacturers Research Association |
| Representatives from | Society of Indian Automobile Manufacturers |
| Shri R. P. Vasudevan | Tractor Manufacturers Association, New Delhi |
| Shri Uday Harite | Automotive Components Manufacturers Association of India, New Delhi |

Member Secretary
Shri Vikram Tandon
Dy. General Manager
The Automotive Research Association of India, Pune

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