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SURFACE VEHICLE RECOMMENDED PRACTICE

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Tire Pressure Systems - Management (CTIS) Type For Medium and Heavy Duty Highway Vehicles

RATIONALE

Within the medium and heavy-duty vehicle industry, the equipment supplier community has responded to the need to manage inflation pressure for greater vehicle operational performance when transitioning from improved roadways to unimproved roadways and back, by developing onboard adjustable tire pressure systems. The central tire inflation system (CTIS) is one such system. Through a CTIS, the vehicle driver from the cab position is capable of selecting a pressure level based on the ground flotation conditions, and the vehicle load, for uninterrupted operations. Because operators will expect these systems to provide the selected level of pressure and to maintain that level of pressure especially as the vehicle returns to highway operations, it is important that all marketed systems respond with a minimum level of performance to assure continued in-service safety.

In the "off-road" or unimproved roadway environment, the driver typically will operate at a reduced vehicle speed and may choose a reduced tire inflation pressure. Under these conditions, it is important to maintain a balance between the tire's flotation performance at high deflection and the tire's durability. These characteristics are particular to each tire manufacturer's product, and therefore it is not practical to define one universal set of operating criteria nor a singular limiting threshold for the off-road environment. At the same time, when these vehicles return to highway operations, it is expected that tire pressure systems of this category, having survived the harsh environments to which they were exposed, will be able to bring the tire's inflation pressure back to the specified highway pressure level, and maintain it.

For both SAE document SAE J2848/1 and SAE J2848/2, the system performance and communications to the driver functions have been made coherent and consistent. Under this document, it is essential that the driver communications and performance thresholds, especially when operating to highways conditions, also be consistent with the document series. Each management system must still keep the driver informed of the status of the pressure level and make him aware when the system installed is no longer performing its intended function. This document captures the attributes of pressure management systems while retaining the alerts and warnings so vitally important to the driver.

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1. SCOPE

This SAE recommended practice defines the system and component functions, measurement metrics, testing methodologies for evaluating the functionality and performance of ground vehicle CTIS. Systems of this type allow the driver to select the operational tire pressure set point (TPSP) based on off-highway conditions, and, upon returning to highway operations, maintain the inflation pressure to the vehicle specified level.

These systems are recommended to address all serviceable tires as originally installed on a vehicle by the OEM and/or specialty vehicle manufacturer, and, for the aftermarket (including replacement or spare parts) are recommended (but optional) to address all tire/rim combinations installed after initial vehicle sale or in-use dates.

Systems for use by military and some other very rigorous off-road applications require such extreme performance requirements, particularly at very high and low temperature and other combat-based extremes that such applications may fall outside the recommended parameters of the subject document. In those cases, it's the responsibility of the procuring customer, vehicle OEM, and applicable component(s) OEM to determine what compromises might be required, and the suitability of design and performance solutions that may be outside of those recommended here.

This document is applicable to all axle and all wheel combinations for the following vehicle types, but does not preclude it's use on other vehicle types - single unit powered vehicles exceeding 7257 kg (16,000 US lbs) gross vehicle weight rating (GVWR), and multi-unit vehicle combinations, up to three (3) towed units, which use an SAE J560 connector for power and/or communication, or equivalent successor connector technology. For combination vehicles including two or more trailers, the dolly axles are also included. The included vehicles can be newly manufactured vehicles or existing vehicles, fitted with air or hydraulic braking systems.

Special Note: Equipment known as 'dual tire equalizers' are commonly used with this category of vehicles. When installing a CTIS system, dual tire equalizers systems are not recommended as they run counter to the purpose of the management system.

NOTE: The following systems are not being addressed in this edition of the subject document.

1. Tire Pressure Monitoring Systems - these systems have been addressed under SAE J2848-1.

2. Tire Pressure Maintenance Systems - these systems have been addressed under SAE J2848-2.

2. PURPOSE

2.1 Purpose

The installed systems for the management of tire inflation pressure defined herein are on-board vehicle systems only. The management type systems described herein may be controlled mechanically, electronically, and/or a combination of both, and should include sensing, restoring, and indicating/ communicating, and recording (when specified by the OEM or user) capabilities. The design approach taken is expected to support the purpose and performance objectives of a management type system, and to function within the intended operating environment and design configuration of the vehicle itself.

Tire pressure systems of the management type (CTIS) are intended to -

1. Allow the driver to select the operational pressure level for off-highway operations, based on the operational conditions, within the defined constraints,

2. Maintain the operational TPSP level for the typical range of ambient conditions,

3. Return all tire/wheel assemblies to the vehicle's SSP level upon returning to highway conditions, and to maintain this specified pressure level within the acceptable operating pressure range (AOPR),

4. Provide the driver with indications of system malfunctions and uncorrected pressure levels.

3. REFERENCES

3.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

3.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J2848-1 Tire Pressure Monitoring Systems - For Medium and Heavy Duty Highway Vehicles

SAE J2848-2 Tire Pressure Systems - Maintenance (ATIS) Type For Medium and Heavy Duty Highway Vehicles

SAE J560 Primary and Auxiliary Seven Conductor Electrical Connector for Truck-Trailer Jumper Cable

SAE J1455 Recommended Environmental Practices for Electronic Equipment Design in Heavy-Duty Vehicle Applications

SAE J2721 Recommended Corrosion Test Methods for Commercial Vehicle Components

3.1.2 ATA Publication

Available from American Trucking Associations Headquarters, 950 North Glebe Rd., Suite 210, Arlington, VA 22203-4181, Tel: 703-838-1700, www.truckline.com

ATA/ TMC RP-235A Guidelines for Tire Inflation Pressure Maintenance (2008)

3.1.3 FEDERAL PUBLICATIONS

Available from the National Archives and Records Administration, 8601 Adelphi Road, College Park, MD 20740-6001 http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR

Title 49 Code of Federal Regulations Federal Motor Vehicle Safety Standards – Part 571

FMVSS 121 Air Brake Systems

Available from Federal Motor Carrier Safety Administration, United States Department of Transportation, 1200 New Jersey Avenue – SE, Washington , DC 20590, Tel: 1-800-832-5660, www.fmcsa.dot.gov:

49 CFR Part 393 Federal Motor Carrier Safety Administration - Parts and Accessories Necessary for Safe Operation

3.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

3.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J1211 Handbook for Robustness Validation of Automotive Electrical/ Electronic Modules

SAE J1939 Serial Control and Communications Heavy Duty Vehicle Network - Top Level Document

SAE J2334 Laboratory Cyclic Corrosion Test

SAE J2402 Road Vehicles - Symbols for Controls, Indicators, and Tell-Tales

SAE J1609 Air Reservoir Capacity Performance Guide - Trucks & Buses

3.2.2 ASTM International Publication

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM B117-09 Standard Practice for Operating Salt Spray (Fog) Apparatus

3.2.3 Federal Publications

Available from Federal Motor Carrier Safety Administration, United States Department of Transportation, 1200 New Jersey Avenue – SE, Washington , DC 20590, Tel: 1-800-832-5660, www.fmcsa.dot.gov:

Commercial Vehicle Tire Condition Sensors (FMCSA -Dec. 2003)

Tire Pressure Monitoring and Maintenance Systems Performance Report (FMCSA – Jan. 2007)

Available from Federal Communications Commission, 445 12th Street SW, Washington, DC 20554, Tel: 888-225-5322, www.fcc.gov

47 CFR Part 15 Telecommunications - Federal Communications Commission - Radio Frequency Devices

Available from the National Archives and Records Administration, 8601 Adelphi Road, College Park, MD 20740-6001 http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR

Title 49 Code of Federal Regulations Federal Motor Vehicle Safety Standards - Part 571

FMVSS 101 Controls and Displays

FMVSS 120 Tire Selection and Rims - Tire selection and rims for motor vehicles with a GVWR of more than 4,536 kilograms (10,000 pounds).

3.2.4 Tire and Rim Association Publication

Available from The TIRE and RIM ASSOCIATION, INC., 175 Montrose West Avenue, Suite 150, Copley, OH 44321, Tel: 330-666-8121, www.us-tra.org

Tire and Rim Year Book

3.2.5 ETRTO Publication

Available from European Tyre and Rim Technical Organization, Secretariat, Avenue Brugmann, 32/2, B.–1060 Bruxelles, Belgium, Tel: +32-2-344-40-59, www.etrto.org

ETRTO Standards Manual

3.2.6 JATMA Publication

Available from the Japanese Automobile Tire Manufacturers Association, Inc., No. 33 Mori Bldg. 8th Floor, 3-8-21 Toranomon, Minato-Ku, Tokyo, Japan 105-0001, Tel: 81-3-3435-9094, www.jatma.or.jp

JATMA Year Book

3.2.7 ISO PUBLICATION

Available from ANSI, 25 West 43rd Street, 4th Floor, New York, NY 10036-8002, Tel: 212-642-4900, www.iso.org

ISO/IEC 2575:2004 Road vehicles. Symbols for controls, indicators and tell-tales

4. DEFINITIONS

4.1 BASELINE TEMPERATURE

The temperature condition when the tire's contained air, the tire's interior structure, and the adjacent ambient air temperature are the same.

4.2 STANDARD TIRE MOUNTING

The action of assembling a tire and its specified wheel by button-holing the tire's beads over the wheel's flanges using a mechanized, rotating bead bar, or manual mounting tools.

4.3 SPECIFIED SERVICE PRESSURE (SSP)

The 'cold' pressure level for a tire/wheel assembly defined by the vehicle manufacturer or tire manufacturer for the intended service conditions (load, speed, etc.) of a given vehicle.

4.4 OPERATIONAL SERVICE PRESSURE (OSP)

The actual pressure level of the tire/wheel assembly at any point during service whether at ambient or at elevated temperature due to rolling under load.

4.5 TIRE PRESSURE SET POINT (TPSP)

The intended operational service pressure level for a particular set of vehicle operational conditions used as the pressure system's reference value for the system function.

4.6 SELF DIAGNOSTIC

A device function by which an analysis of system readiness can occur resulting in a positive or negative outcome.

4.7 TIRE PRESSURE SYSTEM

A group of interacting components whose purpose is to measure, directly or through other parameters which correlate to pressure, the pressure level of the tire/wheel assembly.

4.8 CENTRAL TIRE INFLATION SYSTEM (CTIS)

A generic term for tire pressure systems of the management type.

4.9 MINIMUM ACTIVATION PRESSURE (MAP)

The maximum pressure drop indicated by a gauge pressure reading reduction below the SSP or below a selected TPSP which serves as a trigger for activating the installed tire pressure system's maintenance function

4.10 Human Machine Interface (HMI)

The device(s) which serve to bring about an understanding or communication between a human and a machine concerning the status of the monitored parameter(s).

4.11 COLD TIRE INFLATION PRESSURE

Tire pressure at the prevailing ambient temperature, in the absence of any pressure build-up due to tire usage.

4.12 GROSS VEHICLE WEIGHT RATING (GVWR)

The value specified by the manufacturer as the loaded weight of a single motor vehicle.

4.13 GROSS COMBINATION WEIGHT RATING (GCWR)

The value specified by the manufacturer as the maximum loaded weight of a combination (articulated) motor vehicle.

4.14 LOCKOUT

System function whereby the re-inflate system is isolated from the brake pressure supply reservoir preventing a further reduction in the pressure level of this reservoir.

5. SYMBOLS AND ABBREVIATIONS

5.1 DUT - Device Under Test

5.2 CTIS - Central Tire Inflation System

5.3 TPMS - Tire Pressure Monitoring System

5.4 SSP - Specified Service Pressure

5.5 OSP - Operational Service Pressure

5.6 HMI - Human Machine Interface

5.7 MAP - Minimum Activation Pressure

5.8 FMVSS - Federal Motor Vehicle Safety Standards

5.9 FMCSA - Federal Motor Carrier Safety Administration

5.10 TPSP - Tire Pressure Set Point

5.11 AOPR - Acceptable Operating Pressure Range

6. TIRE PRESSURE SYSTEMS – MANAGEMENT (CTIS) TYPE

6.1 Applications & Support Requirements

6.1.1 The CTIS, when installed on any one of the following vehicle types - single unit powered vehicles exceeding 7257 kg (16 000 US lbs) gross vehicle weight rating (GVWR), and/ or trailers (with dolly axles as applicable) which use an SAE J560 connector for inter-vehicular power and/or communication, or equivalent successor inter-vehicular connector technology, should be capable of inflating/ deflating and maintaining all axle and all wheel combinations.

6.1.2 The vehicle compressed air supply which is used to re-inflate the tire/wheel assembly must supply ‘clean, dry’ air to the CTIS, and each tire/wheel assembly must be free of desiccant, lubes or other contaminants to assure system reliable operation whether inflating or deflating.

6.1.3 The vehicle compressed air supply will have sufficient capacity and capability to operate the CTIS as intended by the system manufacturer and to support the volume demand of the fitted tire/wheel assemblies. (On legacy vehicles, a pressure step-up or booster pressure unit may be required.)

6.1.4 With regard to a system’s function, the tire pressure system manufacturer should specify accuracy, nominal level / reading, and normal operational range for included components and make such information available for all users. Ultimately, the accuracy of the system components should be sufficient to keep the inflation pressure within the specified pressure range.

6.1.5 The tire pressure system sampling rates and sensor capabilities should be sufficient to support the communication requirements at the human machine interface (HMI). (See Section 7.1)

6.1.6 The typical operational conditions and configurations for which CTIS should function properly (during either the sensing, inflate/deflate, or maintenance re-inflate mode) are outlined below:

a) Speed - The tire pressure system should function installed in a vehicle while rolling at any vehicle design speed when sufficient air pressure is available, or while resting stationary.

b) Road Surfaces - The tire pressure system should function installed in vehicles operating off-road on unimproved or soft surfaces or on-road with paved surfaces.

c) Maneuvers - The tire pressure system should function during all safe driving maneuvers.

d) Loading - The tire pressure system should function properly across the full loading range of the powered vehicle, and the full loading range of the trailer unit(s) per the vehicle manufacturers' recommended limits.

e) Temperature - The tire pressure system should function when properly installed and used as intended on vehicles specified under Section 6.1.1 operating in ambient temperatures ranging from -40 °C (-40 °F) to 55 °C (131 °F), and under the full range of system operating temperatures when supplied with clean, dry air.

6.1.7 The CTIS should have the flexibility of design such that the removal or replacement of a tire/wheel assembly can be accomplished in a safe manner and will not render the system inoperative.

6.1.8 For operators who use nitrogen inflation upon initially filling each tire, it is acceptable to top-off such assemblies using compressed air from the CTIS.

6.1.9 Even with a CTIS installed, one must still be able to manually check, inflate, or deflate each tire/wheel assembly, and have access to the inflation valves without the use of non-traditional tools, and certainly not specialty tools, or adapters; the necessary clearance must be available to install chains to each tire/wheel assembly.

6.1.10 If used, the wired or wireless communication link between a power unit and trailer(s), should perform to the guidelines delineated in SAE J2848-1.

6.1.11 If used, the link between a wireless pressure sensor and its receiving module should perform to the guidelines of SAE J2848-1.

6.1.12 The vehicle SSP, or reference pressure, is determined in cooperation with the vehicle OEM or specialty manufacturer and the tire manufacturer, based on the vehicle capacity, the maximum applied axle or wheel position loads, and operating conditions. For reference purposes only, an industry accepted method for determining the appropriate specified service pressure has been documented in the American Trucking Association's TMC RP-235: Guidelines for Tire Inflation Pressure Maintenance.

6.1.13 The minimum service pressure is determined in cooperation with the vehicle operator, the tire pressure system manufacturer, and the tire manufacturer, based on the tire's and/or wheel's capacity to perform under the reduced pressure conditions. Custom settings may be required for each application due to differences in tire sizes, loading, absence/presence of "bead locks" (or similar), and sidewall flexibility. Bead locks or similar features are highly recommended, but not mandatory.

6.2 General System Requirements

6.2.1 Management Function

6.2.1.1 The CTIS is a vehicle installed system 1) which can be initialized and managed by the vehicle driver for its operational pressure set point in support of an array of off-highway operational conditions, vehicle stationary or rolling, and 2) which monitors and maintains the tire inflation pressure to the pressure set point while operating off-highway and to the vehicle SSP while operating on-highway. The system is therefore one which has inflate and deflate capabilities, as well as maintenance capabilities.

6.2.1.2 For CTIS, the management of the TPSP can be achieved using either mechanical or electronic controller(s).

6.2.1.3 With the CTIS, different combinations of vehicle load, speed, and tire pressure can be realized outside the acceptable norms for the vehicle configuration under highway operations. Accordingly, the CTIS must be capable of automatically defaulting back to the appropriate TPSP whenever a service threshold has been exceeded (i.e., vehicle speed), and must be capable of defaulting back to the vehicle's minimum TPSP should the operator erroneously call for a lower pressure value.

6.2.1.4 The CTIS should be capable of deflating or inflating each tire/wheel assembly by axle grouping – steer, drive, lift, dolly, or trailer – to the selected inflation pressure set point, without negative effects to any other air-powered systems or accessories on each vehicle so equipped.

6.2.1.5 System safeguards must be included in the system design with regard to the controller and/or sensors to prevent the operator or unauthorized personnel from reducing pressure below the specified minimum pressure, or disengaging the system's ability to select and restore pressure to an appropriate pressure set point. Should the inflate/deflate function be altered or the maintenance functions be disabled by error or through tampering, the CTIS should provide to the driver an indication that the system thresholds have been exceeded.

6.2.1.6 The CTIS should contain a valve(s) - 1) which, by wheel position, are capable of isolating the CTIS function from a rapid pressure loss assembly, and from a tire/wheel assembly during the action of tire/wheel change-out, 2) which can be cycled during the change of the TPSP to facilitate deflation, 3) which is capable of isolating the air brake system reservoir (where appropriate) from the CTIS function to meet the criteria of 49 CFR Part 393-Subpart C, 49 CFR Part 571.121, and 49 CFR Part 393.207(f), and 4) with sufficient safeguards to prevent back flow into the applicable truck or bus, prime mover (tractor), and/or trailer vehicle air system.

6.2.2 Maintenance Function

6.2.2.1 The CTIS is a system, once the operational pressure set point has been established and the system enters the maintenance mode, which is sensor activated by a demand for compressed air, vehicle rolling or vehicle stationary.

6.2.2.2 The CTIS automatically maintains the tire's inflation pressure by axle set (steer, drive, lift, dolly, or trailer) without the intervention or input of the operator, to the selected inflation pressure set point, governed by the system's defined thresholds.

6.2.2.3 The CTIS when functioning at the vehicle SSP level, will maintain the tire inflation pressure to the SSP defined for each axle set.

6.2.2.4 The CTIS should be capable of maintaining the pressure level relative to the selected TPSP.

6.3 Advanced System Requirements

Should the installed CTIS be a full featured electronic system (sensor within every wheel assembly initiating a re-inflation action, communication on the dashboard of the ongoing status of the monitoring system, wireless communications, etc.), refer to SAE J2848/1 for the associated system functions, measurement metrics, and testing methodologies.

6.4 Component Performance Requirements – Valves, Sensors, Regulators, Control Modules, etc.

6.4.1 ENVIRONMENTAL

It is the intent that electronic device(s) and mechanical components that are mounted in/on the tire/wheel components or on the vehicle should be sufficiently robust, with typical design safety factors, and 'hardened' by design to be capable of successfully completing all the tests – thermal cycling, thermal shock, humidity, altitude, mechanical shock, drop, mechanical vibration, and combinations of these conditions.

The recommended test method for these conditions is defined in SAE J1455. The functionality of the device(s) under test (DUT) should be verified before and after testing. Additionally, each DUT should be visually inspected for damage before and after testing. Unless otherwise specified, each DUT must be at ambient atmospheric pressure, relative humidity, and temperature for each test.

As these systems are inflate/ deflate capable, that is expelling compressed air and drawing in atmospheric air for compression and transfer throughout the system, the quality of the air is critical to the longevity and reliability of a tire pressure management system. The quality of the air must be considered during both cycles – during intake, moisture content, and solids content are critical; during evacuation, the backwash of oils or lubricants, moisture, and desiccants must be eliminated. Therefore the following support systems must be included -

a) Use of an air filter/separator is obligatory in that ambient air-borne and compressor oil blow-by contaminates must be eliminated or at least minimized.

b) Not only moisture/water and the "normal" airborne pollution must be presumed present, but considerations must be made for seasonal contaminates, such as anti-icing agents, pressurized vehicle washing solutions, as well as contaminates observed from roadside and on-site construction activities.

c) Position all vent port(s) above any anticipated water levels and avoid direct splashing.

6.4.2 CORROSION

The identification of potential physical contaminates, and the mitigation/ elimination of their corrosive effects is critical to both performance and longevity of all tire pressure systems and related hardware. For inflate/ deflate systems, the introduction of these contaminates almost assures subsequent TPMS component and/or system failures due to corrosion and/or clogging of air lines, valves, and ports.

Depending on system type, the design and performance of the system components must be addressed in regards to potential system contaminants: for example, power connections; sensing units; component attachment points/locations; inflation supply and source, and check valves.

The recommended test methodology for physical contaminates is to apply the laboratory conditions for corrosive events and cycles, and the chemical mixtures (solutions) as defined in SAE J2721 - Recommended Corrosion Test Methods for Commercial Vehicle Components.

6.4.3 System Design Pressure Capacity

The CTIS & components should be tested for proof pressures in accordance with federal regulatory requirements and/or industry adopted standards, as appropriate. Testing of the system and components must be made without tires for safety reasons.

7. TIRE PRESSURE MANAGEMENT SYSTEM - HMI COMMUNICATIONS & PERFORMANCE THRESHOLDS

Each tire pressure management system should employ a design-for-use approach to make its operation self-directed. In other words, the human-machine-interface envelope should require as little operator inputs as may be economically viable within state-of-the-art technology, in order to mitigate or eliminate the potential for intentional and unintentional errors and/or vehicle operator/maintainer-induced damage.

7.1 System HMI Characteristics

7.1.1 TPSP communication: The CTIS must be capable of indicating to the driver the TPSP reference which the system is holding on a continuing basis, as well as an indication that the system is transitioning from one TPSP to another. These communications must be made on the dash board, in full view of the driver, visible both day and night.

7.1.2 Low Pressure Warnings communication: The CTIS should be capable of communicating to the driver, and continue to communicate this warning until the TPSP has been restored following a low pressure condition.

7.1.3 Malfunction Warning communication: The CTIS should be capable of communicating to the driver a warning that the system is no longer capable of responding to set point changes, nor able to restore lost inflation gas in low pressure assemblies.

7.1.4 A single driver warning device is desirable for power unit and trailer(s), however, lacking such an arrangement, each additional unit (trailer or dolly) should have at least an external warning device visible to the driver.

7.1.5 The minimum configuration of the device for communicating an indication to the driver or a warning to the driver should be a panel with optical telltale(s). The function, sequence, and position of these telltales on a display panel should be determined by the system manufacturer, and documented in the operator's manual. Regardless of the design solution, the telltale must illuminate whenever the system is not at rest, i.e., flowing or attempting to flow compressed air to a tire/wheel assembly.

7.1.6 The indicator panel should always be available for the driver's viewing. Whether available on the dashboard or other location within the cab, or on the exterior of the trailer, the location is optional.

7.1.6.1 If a dashboard display option is selected, this communication must be marked appropriately for the system installed, and carry different action (manual) instructions than that of a tire pressure monitoring system.

7.1.6.2 If a trailer display option is selected, this communication must be visibly available to the driver/operator for each trailer pulled, even if multiple trailers are involved.

7.2 System Performance Thresholds

The response thresholds for a tire pressure system of the management type are defined as follows.

7.2.1 Maintenance Response Thresholds :

a) The minimum activation pressure (MAP) threshold for the maintenance re-inflate function should be based on the TPSP value less 3% or less 6.9 kPa (1 psi), which ever reduction is greater.

b) The re-inflate function should de-activate no later than the pressure level associated with the OSP in its operational state. (OSP curve)

c) The time required to achieve a maintenance re-inflate cycle will be defined by the vehicle and subsystem manufacturers.