THE INFLATION PRESSURE AS A PARAMETER TO THE CORRECT OPERATION OF THE VEHICLE

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Establishing and maintaining optimum tire pressure in a car is an important operational task not only for drivers but also for manufacturers and designers involved in automotive industry. The manufacturer specifies the limiting parameters of the average pressure in the tires, which can not be neglected. Operation of the vehicle associated with changes in external environmental parameters, and therefore the problem is highlighted in a separate factor in controlling and maintaining the required optimum inflation pressure that is directly related to its operation is technically correct. The author raises questions about the effects on the environment, emergency and technical characteristics of the operation of the vehicle when regulating the air pressure in the tire. An important issue is the measurement of pressure and signal the driver when changing a tire, what has succeeded in large automobile concerns. For Russia, the problem of pressure change and its optimization are particularly relevant because of poor quality roads, distances, climatic factors affect the change, which leads not only to an increase in accidents, premature tire wear, impact on the environmental parameters.

Keywords: inflation pressure, parameter, tire pressure in a car, the vehicle

Man in the era of high technology too relies on always functioning equipment. What tires and require constant maintenance and care are fully forgotten the majority of drivers. The tire is almost a trifle.

Prof. Dr. Hans Eberspeher, University of Heidelberg [7]

The main parameters of the tire are its size and the internal air pressure. Low-pressure tires have greater contact area with the road surface is more easily overcome some minor bumps, causing a lower risk of slipping and provide better throughput. High-pressure tires provide less wear and cause a smaller loss on rolling on roads covered with asphalt. When operating a vehicle to make sure that the internal tire pressure was maintained within the established norms. In addition, each of the TO-1 and TO-2 pressure should be measured and if necessary, to pump up the tire. At constant weather conditions the pressure test procedure is carried out about once a month or 203,000 miles. If the temperature changes dramatically, check the pressure must be at once. Typically, when cold it falls through the denser air, and in hot weather – increases by several tens of percent. The value of inflation pressure indicated on the sidewall is not recommended. This is the maximum permissible inflation pressure. The recommended air pressure indicated:

- manual for the car;
- on a sticker located in the doorway next to the driver's seat;
- in the glove compartment next to the driver's seat;
- on the inner side of the hatch fuel filler.

The argument in favor of the choice of tire pressure, which indicates the manufacturer of the car is that the manufacturer specifies it in such a way as to match the claimed stopping distance control. At the same time, the manufacturer specifies the parameters averaged for all makes of cars. And the settings are limiting, and then there are those who can not cross. Typically, the manufacturer specifies the optimum air pressure in car tires for partial and full load. If you specify only one value, the pressure in the tires on a fully loaded car must be increased to 0,3–0,5 atm. By the same amount is to increase the pressure before a long trip on the freeway. Must take into account the fact that the pressure that is specified in the service book your car or on the information plate is recommended for cold tires. This means that it must be checked in the morning, before the trip, and before the sun or rising temperatures will warm bus

Air – a gaseous substance, it expands when heated and contracts when cooled. When the temperature of the ambient air at 8 °C, the tire pressure will change by about 0,1 atm. (Increase with increasing temperature and falls with decreasing). In most parts of Russia the difference between average summer and winter temperature is around 28 °C, so with the establishment of winter temperatures on the pressure drops by about 0,35 atm. A lack of 0,35 atm. have a significant effect on the handling, traction and wear! In addition, the difference between a cold night temperatures and warm day in most parts of the country is about 11 °C. This means that the pressure is set in the morning, at noon, will be about 0,13 atm. above (if the car is parked in the shade). In the inflated a hot afternoon on the following morning the wheel pressure is 0,13 atm. below, and if the car is parked in the sun, then the pressure will rise artificially short time under the influence of his heat.

The most important condition for the correct operation of the tire is to maintain an optimum internal air pressure. When selecting the internal pressure are guided by the value of the load, in some cases, the speed, as well as on

road conditions. In this regard, the pressure of air in the tires of road transport is a key parameter of the safe and proper use of car tires and the car itself, so the control of the state of the pressure becomes an important issue in the automotive industry. The importance is emphasized by the fact that road transport is the backbone of the state's economy, and the pressure that does not match the standards leads to many adverse outcomes, such as: increased energy costs for freight and passenger transportation, as a result, cost overruns lubricants and premature tire wear that will result in additional costs for maintenance. And all of this together will at least increase the cost of the cost of passenger and freight traffic, which will affect the value of goods and services that interact with the motor complex. There is also a reason, which highlights the importance, include the following: deterioration in the overall environmental background due to excessive emissions of harmful substances from exhaust gases, lowering your car at high speeds due to changes in stopping distance and increase the slip.

In addition to pollution wear products, automobile tire in need of further recovery and recycling, which every year becomes more and more urgent problem related to the rapid development of the global automotive industry. Currently, in most cases, recycling of tires is reduced to throwing them to the dump or landfill. This method is environmentally hazardous, since the period of the decomposition of tires in the wild is about one hundred years. During this period there is leaching of toxic substances that enter the soil and atmosphere. According to statistics, in Russia and the CIS is released annually about one million tons of tires. Experts say that only in the Moscow region annually collects approximately 90,000 tonnes of tires consist of the operation. In the operation of buses occurs fixation of atmospheric carbon, a way to combat that has not been invented by scientists. Rates run tires require change tires approximately every 2–3 years. This means that annually enter landfills in the tens of thousands of tons of recycled materials. A correct operation while maintaining the desired air pressure will help reduce the number of car tire wear, increasing their mileage. The following key points that minimize negative impacts on production and operation of automotive tire recycling, using environmentally friendly manufacturing techniques, proper maintenance and repair.

Feeling of social responsibility, tire manufacturers are also introducing cleaner from an environmental point of view of technology. This trend can be traced to the French group MICHELIN, its annual budget for research in ecology of production is about 500–600 million Euros. Improving consumer characteristics and specifications of tires, the company simultaneously improve environmental performance and its products. Thus, engineers and scientists group was significantly reduced rolling resistance characteristics. This automatically leads to lower fuel consumption and reduce harmful emissions into the atmosphere. Constantly introducing new energy-saving technologies, the inorganic components are replaced with natural raw materials, etc.

The main modern types of scrap tires are burning and processing into crumb rubber, or carbon-containing powders that are used in the manufacture of roofing materials, bituminous mastics, cast of rubber asphalt and other materials for road paving, sorbent materials for plugging wells and hydro insulation of pipes in oil and gas industry. But in 2012 in Belarus, tire recycling has reached a new level of technology. Experts from different countries have tried a variety of ways to recycle tires, but the most effective method was developed by Belarusian scientists. They invented the installation of recycling tires in the so-called «light oil» from which you can get different brands of gasoline, diesel and fuel oil. Recycling of tires can only deal with companies that have agreed statement on waste management, and obtained a license to use the third class of danger.

According to the company RoadSnoop Safety System decreased by 10% the pressure changes the car's handling, increase fuel consumption by 4 and 30% reduction in tire life. We should not forget that the rapid wear of rubber causing irreparable damage to nature, both due to recycling of worn-out, and due to the production of new tires.

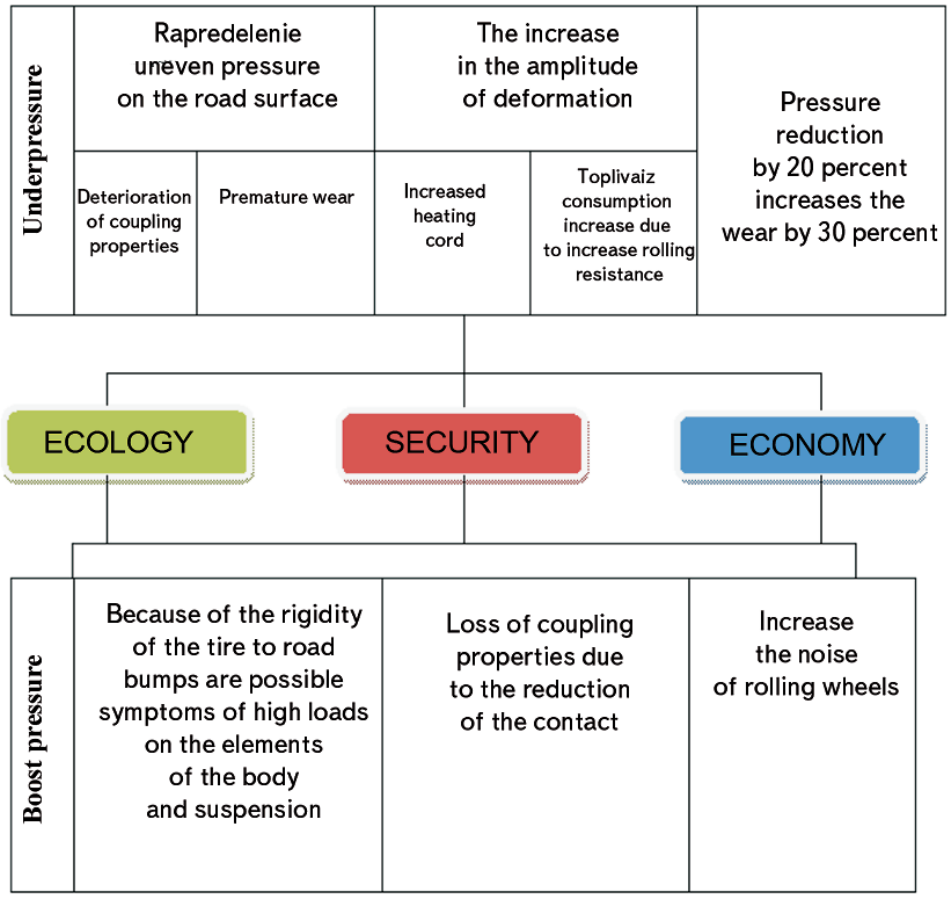
The problem of controlling the air pressure the statistics of accidents. The National Road Safety U.S. claims that 85% of drivers do not check tire pressure, tire pressure does not correspond to normal in more than 50% of passenger cars. As a result, due to accidents associated with abnormal pressure in the tires, die every year up to 660 people and 33,000 people injured. According to U.S. statistics, and in Russia, unfortunately, such calculations are not conducted, and information about the accident is not analyzed, about 1,5% of road accidents is due to low tire pressure. If we convert interest into actual figures, for Russia it will be as follows: 1,5% of the 200,000 traffic accidents occurred during 2010, 3000 will be accidents, which is also quite a lot. The figures for the statistics of our country may be even sadder because of the poor quality of roads, as the poor quality of roads lead to faster wear and deformation of the tire. According to the site www.autonews.ru properly inflated tires in Europe, where well-off enough of the road, cause every sixth car ac-

cident in July and August in the holiday season when families go on vacation by car. The difference in pressure in the tires a few tenths of a bar-to-face is impossible. According to studies the difference in the 0,3–0,4 bar for leading the front wheels, or 0,5–0,7 bar for the rear wheels is critical, that is, with such a difference a driver can not be sure of the reaction of the car on acceleration, braking or change of direction. Improper tire pressure can cause it to explode.

Changing winter tires in summer is usually done in spring when the temperature is about 5 degrees. Summer is the temperature reaches 35 degrees or more. The higher the temperature, the greater the pressure in the tires, that is, if two atmospheric pressure was 2, then 35, it can reach up to 3–4 atm., which depends on the quality of rubber. Improper tire pressure can lead to unnecessary financial spending. Fuel consumption increases by about 1,22 liters per 100 kilometers traveled by the way, that is, with mileage of 20,000 kilometers of gasoline cost overruns of about 240 liters. As a result of improper tire pressure of their service life is reduced by 25–30%, and also wears a vehicle suspension.

Initiators for the introduction of modern control systems pressure tires are American manufacturers. The manufacturer of Firestone tires in the U.S. in the late 1990s, which was associated with more than one hundred deaths from overturning the Clinton administration pushed for adoption of the law. This law stated the need for the use of TPMS (Tire Pressure Monitoring Systems) technology to warn drivers about the serious condition of tires. This law applies to all passenger motor vehicles sold after September 01.2007. Work began in October 2005 by 20% and reached 100% for models manufactured after September 2007. In the U.S. as of 2008 and the EU in 2012, all new vehicles must be equipped with TPMS. There is still controversy about what system to put, whether it is an indirect system, and whether it will be sufficiently accurate tool for achieving security TPMS. European companies also pay great attention to passive safety. Therefore, the TPMS system normally installed on many models of car brands like AUDI, BMW, etc.

The components of the problem need to control the pressure in car tires is schematically represented in Figure.



Components of the problem of choosing the optimum pressure in a car tire

The world's first system of centralized control of air pressure in the tires came to the U.S. on a floating four-wheel drive amphibious truck GMC-DUKv 1944. In the Soviet Union in mid-1953 built the first prototype of the BTR «swap» – VMS-152V («Object 140V»).

In winter 1954 fashion show at VMS 152V (RDVSH system) on the Cuban ground in the presence of the Chief of General GBTU A.M.Sycha machine reduced to 0,5 kg/cm^2 pressure in the tires reliably pass through the pit, covered with snow and deep snow drifts there, which lost twice to compare the mobility of which was started the famous T-34-85. It was the first in the world of wheeled armored vehicle with a serial Ultra High Performance tires adjustable pressure, and in this unconditional and avowed priority of our country. Total inclusive of 1959 was released in 2904 BTR-152V. At the same time went into a series of modifications, and armored personnel carriers to swap – 152E and 152S (in 1955 – 30 and 12 machines). But finally the system was completed in suitable for all structures only in 1957. It was quite technological and without much difficulty was implemented on the machines, «152V1», «485-A», «157». Since then, in addition to RDVSH Russian scientists have proposed various ways to maintain a constant air pressure in the tire.

Patented invention is a device for automatic control of pressure in the pneumatic tires of a moving tractor (RU 2189910 C2), the pump to maintain a constant air pressure in the pneumatic tire (RU 2032551 C1), a device for regulating and visual indications of pressure in the pneumatic tire of the vehicle (RU 2171183 C1) and others.

Of the foreign companies who have made significant contributions to the development of an automatic tire inflation, it is necessary to note the development of companies in the U.S., the Czech Republic and the UK.

On November 1, 2003 in the United States began operating the first phase of implementation of the system pressure check tire (Tire Pressure Monitoring Systems – TPMS). Manufacturers should have provided the first year of the existence of this system in 10% of cars produced in the second – 35% during the third year in 65% of the total production. At this stage, it was required that the system warns the driver if pressure in one or more tires differs by more than 25% of the value specified by the manufacturer.

Since 2005, approximately 90% of the issued in the U.S. passenger car equipped with this system. It is assumed that all vehicles (cars, SUVs, station wagons and small buses) will use the tire pressure monitoring system and notify the driver of your problem, the inclusion of an appropriate indicator of the instrument panel. Such systems are installed, such as car parts Toyota Sienna, Oldsmobile Alero, BMW third and 7 series, Audi A8 (from 2001.), Ford 2002, Nissan / Infiniti in 2000, VW Touareg, etc.

In this regard, the American company proposed to equip the Maxair passenger transport system for the automatic tire pressure ATMI (Automatic Tire Monitoring & Inflation). The introduction of such technology was a logical development now installed on some cars of systems that monitor the condition of tires, signaling the driver when they are down. The system is designed for measuring, correcting and equalizing the pressure in automobile tires to the specified parameters, has a compressor with a reservoir for air controller, connected to each bus separately. In addition, the trail of each wheel has its own shut-off valve with a digital sensor that continuously monitors the pressure. If the required tire pressure decreases, the valve opens, the compressor and electronics. Thus, if the tire is damaged, the pump continues to periodically fill it with air.

The company CODA DEVELOPMENT s.r.o. (Czech Republic) has developed and patented a system of automatic tire inflation SIT (English Self Inflating Tire), the use of which will maintain the optimum tire pressure. Thus, the SIT system provides an effective solution of problems associated with a fall in tire pressure – will increase tread life, reduced fuel consumption and the probability of being in an accident due to the descent of the tires. The new system of SIT – simple and inexpensive solution, based on the principles of the peristaltic pumps. In the wall of the tubular tire is built in camera. When the tire rotates, the camera acts as a pump, forcing air into the tire so long until you reach the desired pressure. Then, the control valve automatically stops further swapping. As a result, tires operate at optimal pressure during the entire operation. The driver of the vehicle is completely relieved from having to manually check the pressure in the tires and swap them. It should be noted that the proposal has many common parts with domestic invention (patent number 2,032,551 RU C1), the proposed by Pahunov A.A.

In 2012, WABCO introduced its concern the latest development in the control of pressure in the tires Integrated Vehicle Tire Pressure Monitoring (IVTM). IVTM system allows the driver to maintain the necessary pressure in the tires, which reduces fuel consumption by 2%, and increases tire life by 20%. IVTM system is suitable for all types of wheels of light, medium and heavy trucks. Mounted on each

wheel sensors constantly measure the tire pressure and wirelessly betray this information to the control unit (ECU). ECU warns the driver about the changes in pressure by easily mounted display in the cabin.

Thus, the information on which improperly inflated tires are a major cause of excessive fuel consumption and give rise to accidents on the roads, is a scientifically proven. Based on all of the above facts, it is necessary to emphasize the importance of the issue of control of the internal pressure of air in the tires and the need for a technical device, whose purpose is the control and optimization of air pressure, which is especially important for Russia, with its varied topography and the composition of soils and climatic factors.

References

1. Vahlamov V.K. Avtomobili. Osnovy konstrukcii. – 5-e izdanie. – M.: Akademija 2010g. – 28s.

2. Grafkina M.V., Mihajlov V.A., Ivanov K.S. Jekologija i jekologicheskaja bezopasnost' avtomobilja. Uchebnik. – M.: FORUM, 2009.

3. Knoroz V.I. Rabota avtomobil'noj shiny. – M.: Transport, 1976. – 238 p.

4. Kolbasov, A.F. Davlenie gazov v avtomobil'nyh shinah i klimaticheskie faktory // Izvestija SGU. – 2012. – №1.

5. http://tpms-pro.ru/52-tpms.html, date of last visit 02/07/2012.

6. http://www.astek-auto.ru/articles/165/, date of last visit 03/07/2012.

7. http://permshina.ru/bezopasnost_shini_v_ekspl.htm date of last visit 07/05/2012.

8. www.autonews.ru date of last visit 07/05/2012.