APPROVED BY
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Supersedes:
Catalogue of Operational defects of automobile tires (Revision 4)

CATALOGUE

Operational defects of automobile tires.

Recommendations on the operation of automobile tires.

Contents

Defect classification according to severity rating

Table 1 - Defects classification according to severity rating

Defect classification	Definition
A (critical)	Defect affecting consumer **safety**. High risk of accident (instant failure). **The operation is prohibited.**
B (major)	Tire defects that have a significant impact on the reduction of operational **reliability and durability** but are not category A (critical) defects. **Short-term use is allowed (to the tire center or tire fitting station).** The defective tire needs to be replaced.
C (minor)	Defect that does not affect safety and durability. Reduced **comfort and serviceability** for the consumer. **The operation is allowed.**

Introduction

The first step when carrying out work on tires is to check the availability of mandatory inscriptions applied to the tire and their compliance with the requirements of regulatory documentation. Tire marking shall comply with GOST 4754 Pneumatic tires for passenger cars, trailers for them, light-duty trucks and buses of especially small capacity, GOST 5513 Pneumatic tires for trucks, trailers for them, buses and trolleybuses, GOST 13298 Pneumatic tires with adjustable pressure, GOST 7463 Pneumatic tires for tractors and agricultural machinery, GOST R 52899 Pneumatic tires for truck power-driven vehicles and trailers, UN Regulations No. 30, 54, 117, 106. For reference information on tire marking, see Appendix A.

When selecting tires for a vehicle, it is necessary first of all to take into account the requirements of laws, technical regulations and GOST, as well as strictly adhere to the regulatory documentation of the vehicle manufacturer and tire manufacturer (tire size, load index, speed category, type of design, tubed/tubeless type, etc.).

In order for the tire performance expectations to be met, the impact of the various conditions under which the tires will be used must also be taken into account (climate, terrain, transportation distance, type of road surface, etc.)

Tire durability and serviceability depend not only on the quality of their manufacture, but also on the proper operation, storage and timely repair of tires.

On the effect of certain factors on the performance of tires, see Appendix B.

To avoid the occurrence of operational defects during pneumatic tires operation, it is necessary to be guided by the regulatory documentation and recommendations of the tire manufacturer. For the recommendations on the operation of automobile tires, see Appendix Б.

If any defects are detected within the guaranteed service life of automobile tire, the consumer may submit a claim (reclamation) to the seller (the manufacturing plant). The reclamation procedure is available in Appendix Г. For the tire manufacturers' guarantee, see Appendix E.

The present catalogue is intended to be used to classify the operational defects of pneumatic tires. The catalogue contains several groups of defects:

1. Defects in the tire tread area.
2. Defects in the tire carcass.
3. Defects in the tire sidewall.
4. Defects in the tire bead area.
5. Tire uniformity.
6. Defects of the inner tubes.

1. Defects in the tread area

1.1 Accelerated uniform wear over the entire tread cap surface

C	**Causes of the defect**	1. Long-term operation at high speed. 2. Long-term operation on roads with high abrasive coating. 3. Frequent acceleration, braking and maneuvering.
	Recommendations for the prevention of defects	1. Avoid long-term operation at high speed and on roads with abrasive coating. 2. Avoid excessive acceleration and hard braking. 3. Timely monitoring of tread pattern wear indicators.
	Recommendations for further operation	**The operation is allowed.**

1.2 Accelerated tread pattern wear on the tread cap edges

C	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Vehicle malfunction due to wheel alignment angle noncompliance with the specified values. 4. High-speed movement, sharp cornering.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Camber and toe adjustment on the vehicle suspension system. 3. Use tires and rims according to the recommendations of the vehicle manufacturer. 4. Avoid high speed cornering. 5. Timely monitoring of tread pattern wear indicators.
	Recommendations for further operation	**The operation is allowed.**

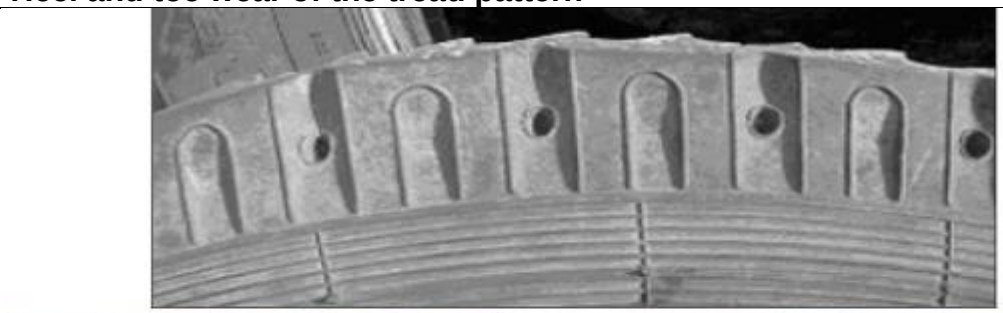
1.3 Accelerated tread pattern wear in the tread cap center

C	**Causes of the defect**	1. Operating a tire with high inflation pressure. 2. Operating a tire without load.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 3. Timely monitoring of tread pattern wear indicators.
	Recommendations for further operation	**The operation is allowed.**

1.4 One-sided wear of tire tread pattern

<table>
<tr><td colspan="2">  </td><td>  </td></tr>
<tr><td rowspan="3">C</td><td>Causes of the defect</td><td>1. Vehicle malfunction due to wheel alignment angle noncompliance with the specified values.
2. Axle deflection under load (accelerated wear on the inside of the tread. There is more wear on the inner tire of dual tires).
3. Axle overload.
4. Malfunction of vehicle suspension elements.
5. Tire operation with inappropriate inflation pressure.</td></tr>
<tr><td>Recommendations for the prevention of defects</td><td>1. Reinstall the wheels in a timely manner according to the vehicle manufacturer's recommendations.
2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
3. Monitor the vehicle’s technical condition.</td></tr>
<tr><td>Recommendations for further operation</td><td>The operation is allowed.</td></tr>
</table>

1.5 Heel and toe wear of the tread pattern



C	**Causes of the defect**	1. Uneven distribution of vehicle load. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Different inflation pressure in dual tires. 4. Malfunction of vehicle suspension elements. 5. Vehicle (dampers, brakes, play in hub bearing) failure. 6. Driving a vehicle with "slippage" on the driving axles. 7. Uneven wheel rotation on parallel axles. 8. Using tires that do not comply with the vehicle manufacturer's recommendations. 9. Dynamic imbalance and/or excessive runout of the wheel assembly.
	Recommendations for the prevention of defects	1. Smooth acceleration and avoid slippage at high speed. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 3. Use tires that comply with the vehicle manufacturer's recommendations. 4. Conduct systematic diagnostics of wheel balance. Monitor the vehicle’s technical condition.
	Recommendations for further operation	**The operation is allowed.**

1.6 River wear of the tread pattern

<table>
<tr><td colspan="3">   </td></tr>
<tr><td rowspan="3">C</td><td>Causes of the defect</td><td>1. Tire operation with low inflation pressure.
2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer.
3. Untimely interchanging of tires.</td></tr>
<tr><td>Recommendations for the prevention of defects</td><td>1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
2. Interchange the tires in a timely manner.</td></tr>
<tr><td>Recommendations for further operation</td><td>The operation is allowed.</td></tr>
</table>

1.7 Spot wear of the tread pattern

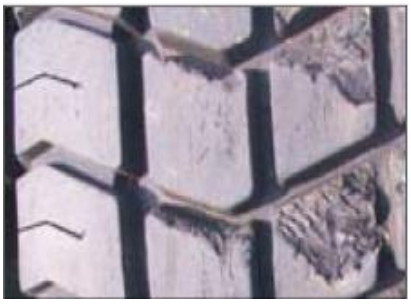
C	**Causes of the defect**	1. Dynamic imbalance and/or excessive runout of the wheel assembly. 2. Malfunction of vehicle suspension elements. 3. Tire operation with inappropriate inflation pressure and/or overload. 4. High lateral and longitudinal vibrations of vehicle suspension system.
	Recommendations for the prevention of defects	1. Conduct systematic diagnostics of wheel balance. Monitor the vehicle's technical condition. 2. Choose appropriate tires and rims. 3. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**The operation is allowed.**

1.8 Local wear of the tread pattern

		
B	**Causes of the defect**	1. Faulty vehicle brake system. 2. Hard braking and acceleration. 3. Braking and skidding. 4. Dynamic imbalance and/or excessive runout of the wheel assembly.
	Recommendations for the prevention of defects	1. Avoid hard heavy braking. 2. Conduct systematic diagnostics of wheel balance. Monitor the vehicle's technical condition. 3. Check the braking system of the vehicle.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

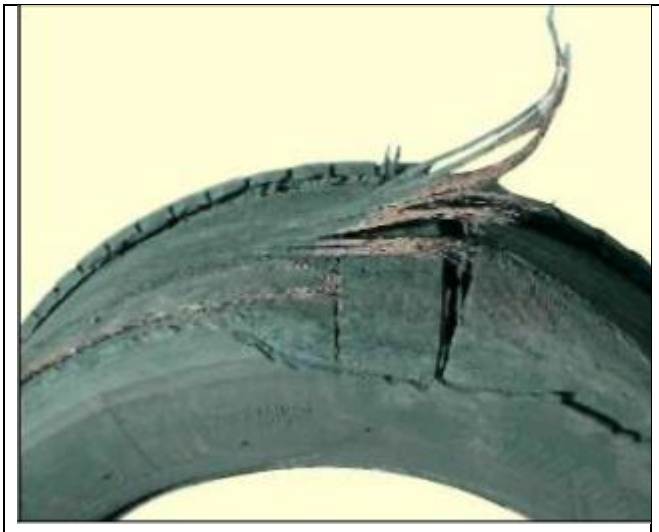
1.9 Mechanical damage of tread (cuts, chipping, chunking)




C	**Causes of the defect**	1. Tire operation on coarse road surface. 2. Wheel spin or hard braking on coarse road surface. 3. Hard shoulder running. 4. Selection of tires that do not meet the specific operating conditions.
	Recommendations for the prevention of defects	1. Remove stones/foreign objects trapped in the grooves of the tread pattern. 2. Avoid operation at high speed on coarse road surface. 3. Avoid hard shoulder running. 4. Use tires that comply with the vehicle manufacturer's recommendations.
	Recommendations for further operation	**The operation is allowed.**

1.10 Impact break of tread



A	**Causes of the defect**	1. Driving over road obstacles at high speed. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Tire operation with inappropriate inflation pressure. 4. High driving speed on a bad road surface.
	Recommendations for the prevention of defects	1. Reduce speed when driving on bad road surfaces. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**The operation is prohibited.**

1.11 Puncture in the tread cap

B	**Causes of the defect**	1. Damage in the tread cap caused by a puncture due to driving over foreign objects.
	Recommendations for the prevention of defects	1. Avoid driving over foreign objects. 2. Remove foreign objects trapped in the grooves of the tread pattern.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

1.12 Chipped/loose tread pattern elements



B	**Causes of the defect**	1. Tire operation on coarse road surface. 2. Wheel spin, hard braking on coarse road surface. 3. Driving over road obstacles. 4. Moisture penetration when operating a tire with unrepaired damages. 5. High driving speed on a bad road surface. 6. Damage in the tread cap caused by a puncture due to driving over foreign objects.
	Recommendations for the prevention of defects	1. Avoid operation at high speed on coarse road surface. 2. Avoid hard shoulder running. 3. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 4. Avoid abrupt impact of the wheels on sharp metal and other protruding objects.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

1.13 Cutting/cracking on the tread edge

B	**Causes of the defect**	1. Tire damage caused by protruding parts of the vehicle (body, suspension). 2. Tire mechanical damage caused by foreign objects during wheel slipping. 3. Tire operation with inappropriate inflation pressure and/or overload. 4. High-speed movement, sharp cornering. 5. Stones, foreign objects trapped between dual tires. 6. Running over the curbstone or sharp-edged foreign object.
	Recommendations for the prevention of defects	1. Avoid operation at high speed. 2. Avoid operation on coarse road surface and hard shoulder running. 3. Avoid running over the curbs and other road obstacles. 4. Inspect the vehicle for body/suspension damage. 5. Inspect for foreign objects in the tire tread area. 6. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

1.14 Tread/lug base cracking



C	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Tire operation on coarse road surface. 3. Running over the curbstone or sharp-edged foreign object. 4. Effect of side forces due to sharp cornering and excessive maneuvering. 5. Vehicle malfunction due to wheel alignment angle noncompliance with the specified values. 6. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer.
	Recommendations for the prevention of defects	1. Avoid operation on coarse road surface. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 3. Adjust the wheel alignment of the vehicle suspension.
	Recommendations for further operation	**The operation is allowed.**

1.15 Tread damage caused by corrosion environment

B	**Causes of the defect**	1. Tire contact with petroleum products (POL). 2. Tire contact with corrosive liquids.
	Recommendations for the prevention of defects	1. Avoid stopping the vehicle at the points of spillage/leakage of corrosive liquids.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

1.16 Tread cracking and tear around the antiskid studs

C	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Studded tires operation on roads without snow and ice. 4. Studded tires operation in summer season. 5. Studded tires operation on coarse road surface.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Avoid long-term operation of tires on roads without snow and ice and observe winter speed limit. 3. Observe temperature conditions and select tires according to season. 4. Avoid operation on coarse road surface.
	Recommendations for further operation	**The operation is allowed.**

Winter tire operational features are described in Appendix Д.

1.17 Antiskid studs "sinking" into the tire tread

B	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Studded tires operation in summer season.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Avoid long-term operation of tires on roads without snow and ice and observe winter speed limit. 3. Observe temperature conditions and select tires according to season.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

Winter tires operational features are described in Appendix Д.

1.18 Loss of anti-skid studs

B	**Causes of the defect**	1. Wheel spin and hard braking on coarse road surface. 2. Tire operation with inappropriate inflation pressure. 3. Studded tires operation on roads without snow and ice. 4. Studded tires operation in summer season. 5. Braking and skidding.
	Recommendations for the prevention of defects	1. Avoid hard heavy braking. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 3. Avoid long-term operation of tires on roads without snow and ice and observe winter speed limit. 4. Observe temperature conditions and select tires according to season. 5. Avoid hard heavy braking.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

Winter tires operational features are described in Appendix Д.

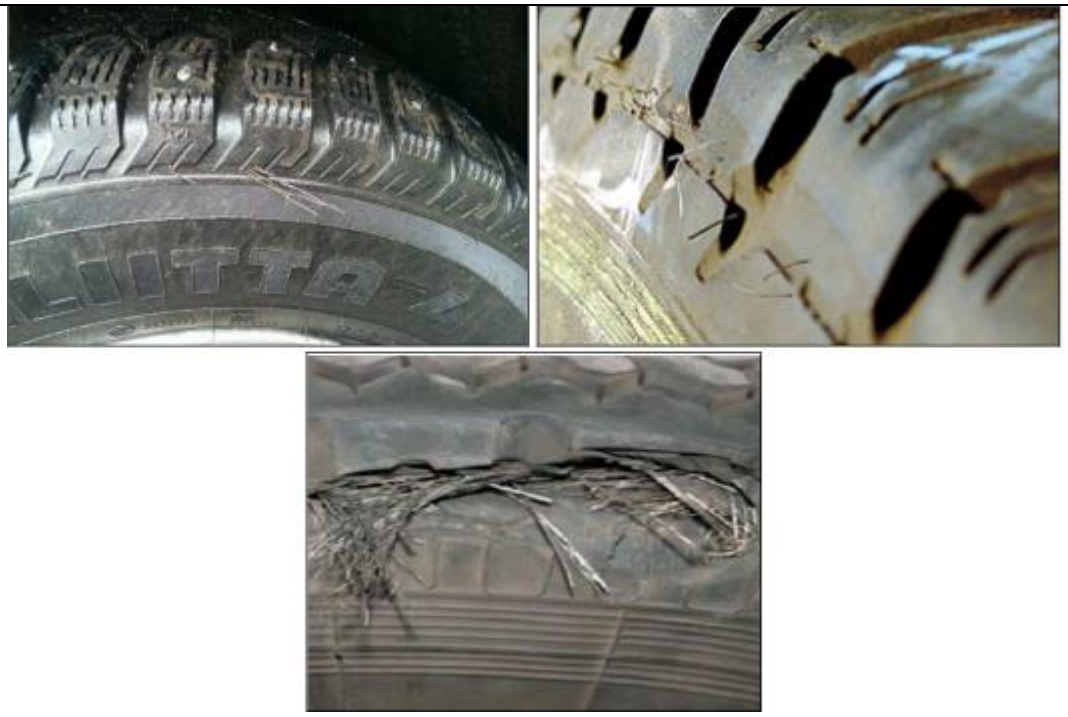
1.19 Antiskid studs punching the tread up to the belt ply

B	**Causes of the defect**	1. Wheel spin and hard braking on coarse road surface. 2. Tire operation with inappropriate inflation pressure. 3. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer.
	Recommendations for the prevention of defects	1. Avoid hard heavy braking. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

Winter tire operational features are described in Appendix Д.

2. Defects in the carcass area

2.1 Broken belt (steel cord exposure)



A	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure and/or vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 2. High-speed movement, sharp cornering on a bad road surface. 3. The impact deformation when driving over road obstacles.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Avoid sharp cornering. 3. Avoid high-speed movement. 4. Avoid driving over potholes and foreign objects.
	Recommendations for further operation	**The operation is prohibited.**

2.2 Carcass fracture

A	**Causes of the defect**	1. Tire operation with lack of pressure (puncture, broken valve, rim damage).
	Recommendations for the prevention of defects	1. Stop immediately if there is a puncture. 2. Avoid operation on coarse road surface and driving over foreign objects. 3. Inspect the wheel for damage. 4. Inspect the valve for damage and check that the valve retaining caps are in place.
	Recommendations for further operation	**The operation is prohibited.**

2.3 Innerliner destruction/damage/cracking

A	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Tire mechanical damage. 3. Running over the road obstacle at high speed. 4. Mechanical damage of tire with zero mileage caused by unqualified installation work.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Avoid running over the road obstacles. 3. Inspect the wheel for damage. 4. Perform installation in specialized workshops.
	Recommendations for further operation	**The operation is prohibited.**

3. Defects in the sidewall area

3.1 Sidewall mechanical damage/side cut

A	**Causes of the defect**	1. Running over the curbstone or sharp-edged foreign object. 2. Stones, foreign objects trapped between dual tires. 3. Mechanical damage with zero mileage, during loading, storage.
	Recommendations for the prevention of defects	1. Avoid running over the curbs and operation on coarse road surface. 2. Inspect the tires before and during operation in order to check the space between the sidewalls of dual tires and to remove any foreign objects that may be stuck. 3. Observe tire storage, transportation and loading conditions.
	Recommendations for further operation	**The operation is prohibited.**

3.2 Carcass cord break

A	**Causes of the defect**	1. Dual tires contact / Tire contact with protruding parts of the vehicle / Foreign objects stuck between dual tires. 2. Tire operation with inappropriate inflation pressure. 3. Running over the curbstone or sharp-edged foreign object. 4. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 5. Improper use of tires.
	Recommendations for the prevention of defects	1. Inspect the tires before and during operation in order to check the space between the sidewalls of dual tires and to remove any foreign objects that may be stuck. 2. Maintain tire inflation pressure. 3. Avoid vehicle overloading. 4. Check that the valve retaining caps are in place to prevent air leakage. 5. Use tires that comply with the vehicle manufacturer's recommendations.
	Recommendations for further operation	**The operation is prohibited.**

3.3 Sidewall separation

A	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Exceeding the permissible speed. 4. Sidewall mechanical damage/side cut. 5. Dual tires contact. 6. Improper use of tires.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Avoid high-speed movement. 3. Avoid operation on coarse road surface and running over curbs, foreign objects. 4. Use tires that comply with the vehicle manufacturer's recommendations.
	Recommendations for further operation	**The operation is prohibited.**

3.4 Sidewall separation with star cracks

A	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Pressure blowout through damaged or exposed carcass cord threads due to abrasion. 4. Running over the road obstacle (curbstone, corrugation, etc.).
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Inspect the wheel for damage. 3. Avoid operation on coarse road surface and running over curbs, foreign objects.
	Recommendations for further operation	**The operation is prohibited.**

3.5 Sidewall blowout

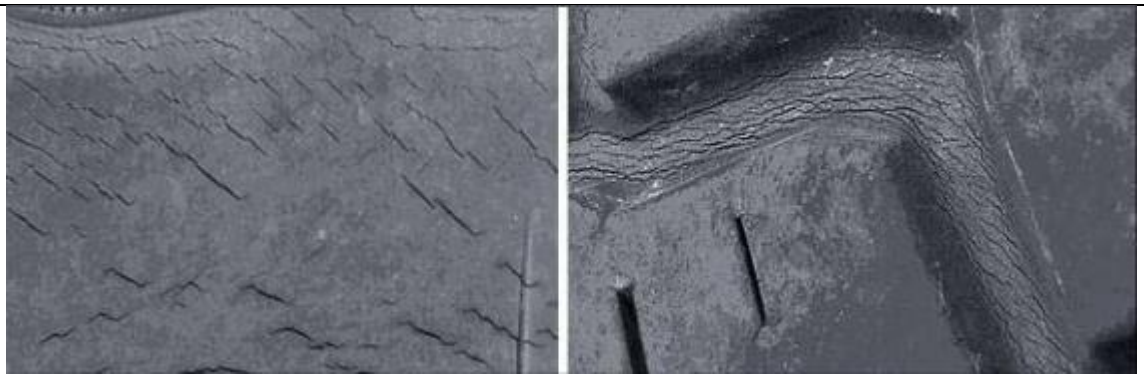
A	**Causes of the defect**	1. Running over the road obstacle (curbstone, corrugation, etc.).
	Recommendations for the prevention of defects	1. Avoid running over curbs and other road obstacles.
	Recommendations for further operation	**The operation is prohibited.**

3.6 Sidewall bulge/multiple sidewall bulges (all steel tires)



A	**Causes of the defect**	1. Running over the road obstacle (curbstone, corrugation, etc.). 2. Tire operation with inappropriate inflation pressure and/or vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Damages in the tire bead area caused by unqualified installation work. 4. Use of inappropriate and/or defective rims (deformations, cracks, sharp edges/burrs, rust). 5. Improper use of tires. 6. Tire sidewall damage caused by rim edge.
	Recommendations for the prevention of defects	1. Avoid running over curbs and other road obstacles. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 3. Perform installation in specialized workshops. 4. Do not allow rims to be mounted if they are found to be defective. 5. Use tires and rims according to the recommendations of the vehicle manufacturer.
	Recommendations for further operation	**The operation is prohibited.**

3.7 Crack network due to ageing



B	**Causes of the defect**	1. Exceeding the guaranteed service life. 2. Violation of rules for storage. 3. Exposure to UV rays. 4. Exposure to closely spaced source of intense heat and ozone (even for several hours). 5. Tire contact with corrosive liquids. 6. Vehicle long-term parking under load.
	Recommendations for the prevention of defects	1. Avoid prolonged storage in direct sunlight and high temperatures. 2. Avoid contact with aggressive environment. 3. Observe the guaranteed service life and storage conditions of tires. 4. Unload the tires during long-term parking of the vehicle.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

3.8 Sidewall cracking

B	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Uneven distribution of vehicle load. 4. Vehicle long-term parking under load.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Unload the tires during long-term parking of the vehicle.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

4. Defects in the bead area

4.1 Torn bead

A	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer. 3. Faulty vehicle brake system. 4. Unqualified tire mounting. 5. Improper fit of a tire to the rim.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Perform installation in specialized workshops. 3. Check the braking system.
	Recommendations for further operation	**The operation is prohibited.**

4.2 Bead ring rapture

A	**Causes of the defect**	1. Unqualified tire mounting. 2. Vehicle overload in excess of the load capacity specified by the vehicle manufacturer.
	Recommendations for the prevention of defects	1. Carry out tire mounting in specialized workshops. 2. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**The operation is prohibited.**

4.3 Destruction/bulges in the above bead area



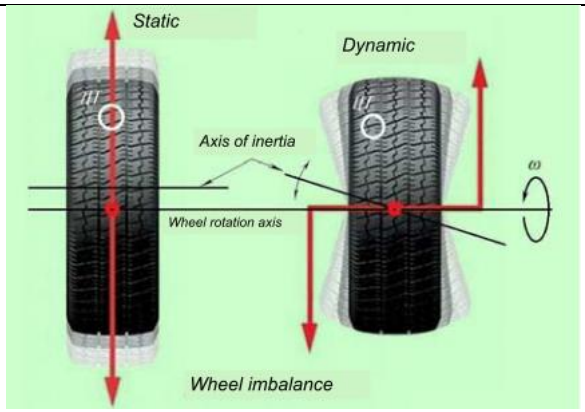
B	**Causes of the defect**	1. Tire operation with inappropriate inflation pressure and/or overload. 2. Separation caused by frequent braking or a faulty brake system. 3. Damages in the tire bead area caused by unqualified installation work. 4. Use of inappropriate and/or defective rims (deformations, cracks, sharp edges/burrs, rust, etc). 5. Tire sidewall damage caused by rim edge. 6. Improper use of tires.
	Recommendations for the prevention of defects	1. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications. 2. Perform installation in specialized workshops. 3. Do not allow rims to be mounted if they are found to be defective. 4. Use tires according to the recommendations of the vehicle manufacturer.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

4.4 Damages in the bead area

B	**Causes of the defect**	1. Unqualified tire mounting. 2. Violation of rules for tire storage/transportation. 3. Bead heel damage caused by tire slip on the rim. 4. Bead heel damage caused by rusted/damaged rim. 5. Bead heel damage caused by wrong size of the rim. 6. Faulty vehicle brake system. 7. Operation with inappropriate inflation pressure and/or overload.
	Recommendations for the prevention of defects	1. Carry out tire mounting/dismounting in specialized workshops. 2. Observe the transportation and storage conditions of tires. 3. Use rims of corresponding dimensions recommended by the vehicle manufacturer. 4. Carry out systematic monitoring of the technical condition of tires and rims. 5. Brake system troubleshooting, system monitoring and adjustment. 6. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

5. Tire uniformity

5.1 Static and dynamic imbalance deviation



B	**Causes of the defect**	1. Continuous driving on roads of poor quality (corrugations, bumps, potholes). 2. Aggressive driving (hard braking, jerking). 3. Operating a tire with uneven tread wear. 4. Operating a wheel on a warped rim. 5. Unqualified tire repair. 6. Failure to balance wheels in a timely manner. 7. Malfunction of vehicle suspension elements. 8. Faulty vehicle brake system. 9. Operating a vehicle with unbalanced wheel assembly at "0" mileage.
	Recommendations for the prevention of defects	1. Avoid continuous driving on roads of poor quality. 2. Avoid unnecessary acceleration and braking. 3. Swap wheels in a timely manner. 4. Carry out systematic monitoring of the technical condition of tires and rims. 5. Carry out tire repair/mounting/dismounting/wheel balancing in specialized workshops. 6. Conduct systematic diagnostics of wheel balance. Monitor the vehicle's technical condition. 7. Carry out balancing of the wheel assembly when fitting tires with "0" mileage. 8. Avoid vehicle operation without prior balancing work when fitting a new tire.
	Recommendations for further operation	**Short-term operation is allowed (to the tire center or tire fitting station).**

6. Inner tube defects

6.1 Mechanical damage of inner tubes (puncture, cut, blowout)

A	**Causes of the defect**	1. Mechanical damage of the inner tube due to tire operation on rough road surface / running over road obstacles at high speed. 2. Puncture in the tread cap. 3. Mechanical damage of tire with “0” mileage caused by unqualified installation work. 4. Mechanical damage with zero mileage, during loading, storage. 5. Operation with inappropriate inflation pressure and/or vehicle overload in excess of the load capacity specified by the vehicle manufacturer.
	Recommendations for the prevention of defects	1. Avoid running over road obstacles and operation on rough road surface at high speed. 2. Avoid running over sharp metal and other protruding objects. 3. Perform installation in specialized workshops. 4. Observe tire storage, transportation and loading conditions. 5. Observe the inflation pressure and load capacity in accordance with the tire manufacturer's and vehicle manufacturer's specifications.
	Recommendations for further operation	**The operation is prohibited.**

6.2 Inner tube valve fracture/breaking/tear




A	**Causes of the defect**	1. Failure to comply with storage, transportation and loading conditions. 2. Unqualified tire mounting/dismounting. 3. Mismatched inner tube and tire sizes.
	Recommendations for the prevention of defects	1. Comply with storage, transportation and loading conditions. 2. Perform installation in specialized workshops. 3. Match the inner tube to the tire size.
	Recommendations for further operation	**The operation is prohibited.**

6.3 Inner tube walls abrasion (porosity)/crack network due to ageing

A	**Causes of the defect**	1. Exceeding the guaranteed service life. 2. Violation of storage conditions and rules (exposure to heat, UV rays, petroleum products and other substances that degrade rubber). 3. Mismatched inner tube and tire sizes.
	Recommendations for the prevention of defects	1. Observe the guaranteed service life and storage conditions of inner tubes. 2. Avoid contact with aggressive environment, exposure to direct sunlight and high temperature. 3. Match the inner tube to the tire size.
	Recommendations for further operation	**The operation is prohibited.**

Appendix A

(Informative)

Tire marking

The following marking shall be applied on each tire:

- tire size;
- brand name (tire model);
- index C - after designation of main dimensions and carcass structure only for passenger car tires, trailers for them, light trucks (maximum gross weight of 3.5 t) and buses of particularly small capacity (number of seats up to 12);
- load index (single/dual tires);
- speed rating;
- pressure index PSI - identifying the test pressure only for tires designed for light trucks and buses of particularly small capacity with the index C in the designation, as well as for truck tires;
- approval mark E showing the approval number of the country issuing the type approval for the pneumatic tire pursuant to UN Regulation No. 117, No. 30 or No. 54;
- country of origin in English;
- trademark and (or) name of tire manufacturer;
- date of manufacture consisting of four digits, where the first two digits indicate the week and the second two the year of manufacture;
- the inscription Radial is applied on radial tires;
- a sign of the direction of rotation (arrow) on tires with a directional tread pattern;
- the inscription Tubeless is applied on tubeless tires;
- the inscription All Steel is applied on all steel tires;
- the inscription Regroovable is applied on tires that provide the ability to deepen the tread pattern by cutting;
- the inscription Reinforced/Extra Load is applied on reinforced tires;
- the sign M+S and/or symbol of snowflake inside a mountain with three peaks  is applied on tires with a winter tread pattern;
- the inscription Studdable is applied on studded tires with winter tread pattern;
- the inscription Studless is applied on non-studded tires with winter tread pattern;
- balance mark is applied on passenger and light truck tires;
- the inscription TWI indicates the location of the tread pattern wear indicators;
- the sign  indicates a certificate of conformity with the Brazilian INMETRO standard;
- the sign  indicates the location of the tread pattern regrooving indicator.

Appendix A.1

(Informative)

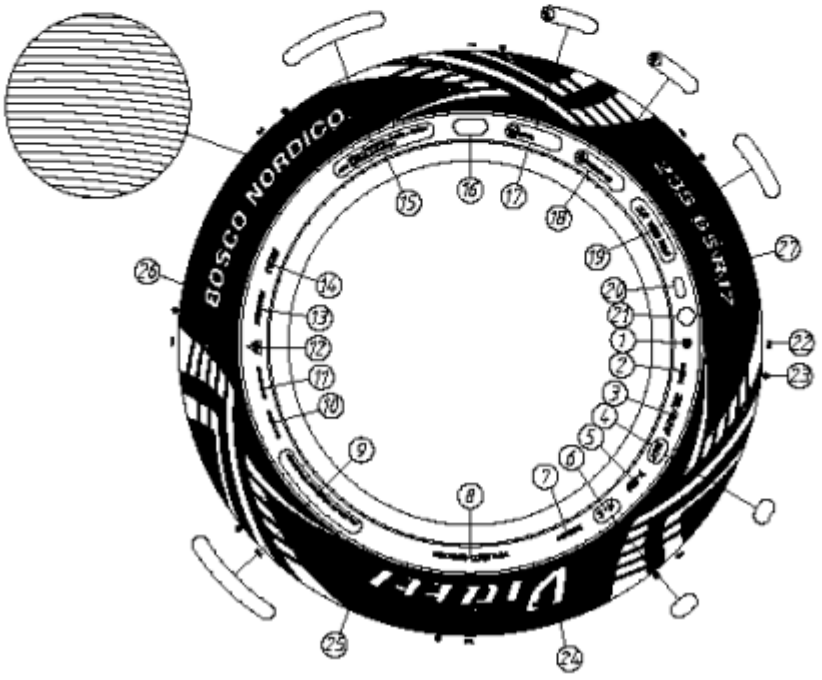
Example of passenger tire marking

235/65R17 V-523

Сторона INSIDE. Зона надписей			
1		12	
2	RADIAL	13	STUDDABLE
3	235/65R17	14	INSIDE
4	1047	15	PLIES: TREAD: 2 POLYESTER+2 STEEL+1 NYLON SIDEWALL: 2 POLYESTER
5	V-523		
6	M+S	16	Пустой жетон
7	TUBELESS	17	
8	www.viatti - tyres.com	18	
9	MAX. LOAD 1984 LBS (900 kg) AT 51 PSI (350 kPa)	19	DOT YUEH F04P
10	Made in Russia	20	Неделя, год изготовления (24 мм)
11	ТУ-2521-119-98358561	21	Цеховой номер пресс-формы
Сторона INSIDE. Зона декора			
22	TWI (в 8-и равнорасположенных местах у канавок индикатора износа)		
23	(в 8-и равнорасположенных местах у канавок зимнего индикатора износа)		
24	Viatti		
25			
26	BOSCO NORDICO		
27	235/65R17		

Component layout

Bottom sidewall of the mold



Appendix A.2

(Informative)

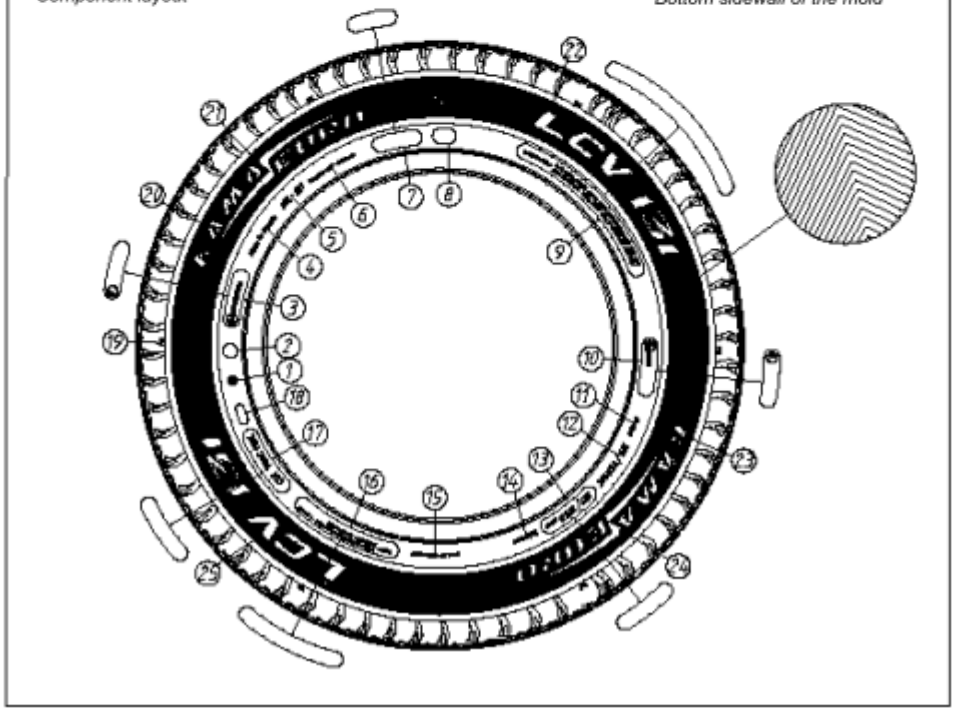
Example of light truck tire marking

195/75R16C НК-131

Зона надписей. Нижняя полуформа			
1		10	
2	Цеховой номер пресс-формы	11	Radial
3		12	195/75R16C
4	Made in Russia	13	107/105 R 70psi
5	НК-131	14	Tubeless
6	ТУ-2521-150-00148990	15	www.td – kama.com
7	Пустой жетон	16	PLIES: TREAD: 2 POLYESTER+2 STEEL+2 NYLON SIDEWALL: 2 POLYESTER
8	Пустой жетон		
9	LOAD RANGE C MAX LOAD SINGLE 975 kg (2150 LBS) AT 4.75 kPa (70 PSI) COLD MAX LOAD DUAL 925 kg (2039 LBS) AT 4.75 kPa (70 PSI) COLD	17	DOT YUAC F01C
		18	Неделя, год изготовления (24 мм)
Зона декора. Нижняя полуформа			
19	TWI (в 6-и равнорасположенных местах у канавок индикатора износа)		
20	KAMA-EURO		
21			
22	LCV 131		
23	KAMA-EURO		
24			
25	LCV 131		

Component layout

Bottom sidewall of the mold



Appendix A.3

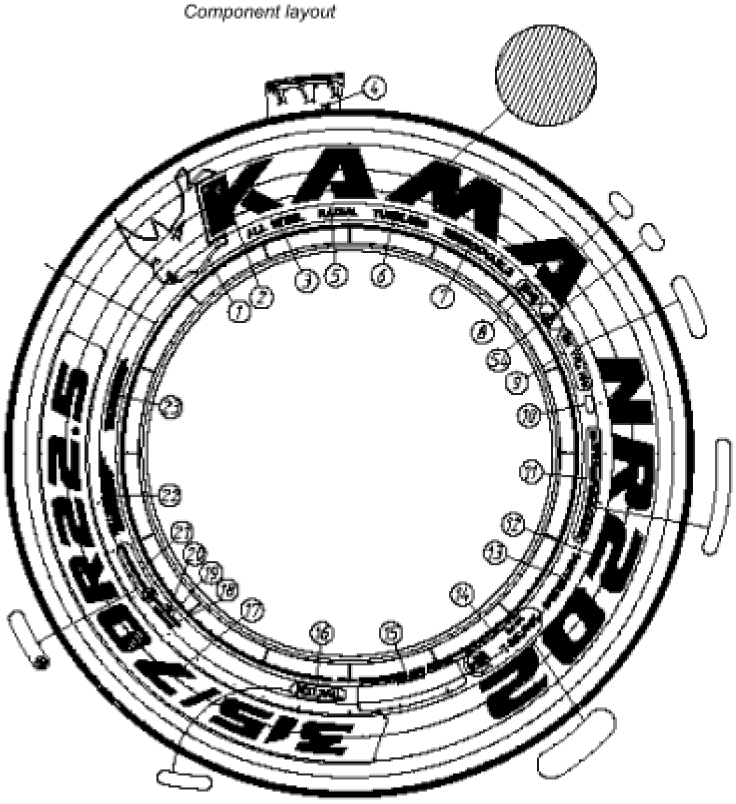
(Informative)

Example of truck tire marking

315/70R22.5 NR202

		в	н			в	н
1	[logo]			14	154/150 L 130 PSI		
2	KAMA			15	BRAND TIRE HERE		
3	ALL STEEL			16	TRACTION		
4	TWI [illegible]			17	315/70R22.5		
5	RADIAL			18	MADE IN RUSSIA		
6	TUBELESS			19	ТУ 2521-018-98358561		
7	REGROOVABLE			20	номер пресс формы		
8	M+S			21	020112 S2WR2 001920		
9	DOT YYSA F01X			22	SAFETY WARNING, SERIOUS INJURY MAY RESULT FROM: *EXPLOSION OF TIRE/RIM ASSEMBLY DUE TO IMPROPER MOUNTING-USE SAFETY CAGE & CLIP-ON EXTENSION AIR HOSE. ONLY SPECIALLY TRAINED PERSONS SHOULD MOUNT TIRES.		
10	Неделя, год изготовления — нижняя полуформа						
11	TREAD: 5 PLIES STEEL MAX. LOAD SINGLE [illegible] SIDEWALL: 1 PLY STEEL MAX. LOAD DUAL [illegible]						
12	NR202			23	*TIRE FAILURE DUE TO MISAPPLICATION/IMPROPER INFLATION/ OVERLOADING-FOLLOW THE MANUFACTURERS INSTRUCTIONS. CHECK INFLATION PRESSURE FREQUENTLY WITH GAUGE.		
13	315/70R22.5						
54	[symbol]						

Component layout



Appendix Б

(Informative)

Recommendations on the operation of automobile tires

1 Recommendations for the transportation of automobile tires

The tires shall be transported by any means of transport in accordance with the goods transportation regulations.

The tires shall be protected from sun and moisture by tarpaulin or polyethylene film when transported on open vehicles and open rolling stock for more than 5 days.

The tires can be transported with or without inner tubes. The inner tube shall be inserted inside the tire and inflated to its internal dimensions.

Tubeless tires shall be placed in vehicles under conditions that exclude deformation of tire bead and sidewalls.

The inner tubes shall be transported rolled up (with the valve facing inwards). The inner tubes are allowed to be transported in stacks without rolling. Care must be taken to ensure that the inner tubes are not damaged by a valve or other objects.

Similar measures should be observed when transporting rim strips.

Tires, tubes, rim strips, transported at temperatures below minus 45ºC, shall be protected from mechanical impact.

2 Recommendations for the storage of automobile tires

In order to prevent premature ageing the tires, tubes and rim strips should be stored in a closed, separate, dry room, protected from sunlight, ozone, organic solvents, mineral oils, fuels and lubricants, petroleum products, acids, alkalis and other substances that degrade rubber, and no closer than 1 m to heating appliances.

The tires should be stored upright on racks, pallets or on a flat floor. In case of long-term storage, the tires should be rotated by changing the contact area every 3 months.

Tires may be stored in an upright position in three tiers maximum. Horizontal storage of tires in stacks is permissible up to a maximum height of 2 m.

Tires can be stored outdoors for up to 1 month in an upright position under a shelter protecting against environmental exposure (sun, rainfall and pollution).

Tubeless tires shall be stored under conditions that exclude deformation of tire bead and sidewalls.

When the tires are stored complete with the tubes, the latter shall be inflated to the inner tire size to avoid their folding.

The tubes shall be kept in a lightly inflated condition on brackets with half-round surfaces or in tires.

The tubes can be stored stacked or rolled up on pallets for up to 3 months. Care must be taken to ensure that the inner tubes are not damaged by a valve or other objects.

The rim strips shall be stored on brackets with half-round surfaces. The rim strips can be stored in packs of 5 to 20 pieces (depending on size).

3 Recommendations for the equipment of vehicles with tires

The selection and equipment of a vehicle with tires according to size, model, carrying capacity (load index), speed, type of tread pattern for each specific brand and model of a vehicle, bus, trolleybus, trailer and semi-trailer, both for newly developed and production vehicles, should be carried out in accordance with the vehicle owner's manual (instruction) in the primary configuration or the tire manufacturer's recommendations for the tires purchased separately from the vehicle.

Tires of different dimension, design (radial, diagonal, tubed, tubeless), model, tread pattern, new and retreaded, new and regrooved shall not be mounted across the same axle of the vehicle.

In case of partial replacement of tires that are out of service, it is recommended to equip the vehicle with tires of the same size and model that were installed as original equipment since tires of the same size but different model may differ in design, tread pattern, rolling radius, adhesion and other performance characteristics.

To ensure normal operation of dual wheel tires, it is recommended to select tires so that the difference in tread wear and the tire diameter is minimum.

It is not allowed to fit retreaded tires on the front axle of a motor vehicle.

The retreaded tubeless tires shall be operated with the inner tubes in case of loss of tightness.

When equipping vehicles with tires with a directional and off-road tread pattern, it is necessary to ensure the wheel rotation in the direction indicated by arrow on the sidewall of tire.

To improve tire grip and vehicle safety on snow-covered and icy road, it is recommended to use tires with anti-skid studs. Tires with anti-skid studs shall be mounted on all wheels (including the spare wheel). Interchanging of studded tires, if necessary, shall be carried out without changing the direction of rotation of the wheel.

Vehicles that operate on soft ground and off-road should be equipped with tires with off-road tread pattern. Long-term operation of these tires on hard surface roads is not recommended.

4 Recommended rules for mounting/dismounting of automobile tires

Tire mounting and dismounting shall be carried out in a specialized tire fitting center using special equipment, fixtures and tools.

In case of performance mounting and dismounting works, tires shall be assembled with the appropriate size rims specific for this vehicle brand.

Only undamaged, clean, dry tires, corresponding in size and type should be fitted.

The tires shall be inspected from the outside and inside using tire spreader or other device prior to mounting. The tires shall not be used for mounting if manufacturing or operational defects are detected. Foreign objects (stones, nails, etc.) must be removed from the tire.

The tire bead and rim seat shall be lubricated before mounting the tire on a rim. The inner tube shall be powdered with talcum powder from the outside. The tubes should be checked for leaks in a bath or other water tank.

Rims and their elements shall not be fitted if the following defects are found: deformations, cracks, sharp edges and burrs, rust at the points of contact with the tire, expansion of mounting holes larger than the dimensions specified in the rim standard for motor vehicles. The surface of the rims shall be free of rust and painted with varnish or paint for metal.

When mounting the tire on the rim the balancing mark on the tire sidewall shall be aligned with the valve stem.

It is recommended that the wheel assembly be balanced after each installation.

Balancing is carried out with the wheels removed from the vehicle or directly on the vehicle using stationary or vehicle-mounted machines. The tires shall be washed and cleaned of dirt and foreign objects before balancing.

When mounting dual-tire wheels on a vehicle axle, the rim windows of both wheels should be aligned to allow access to the tire valve of the inside wheel when measuring inflation pressure or pumping tires without removing the outside wheel.

It is forbidden:

a) to dismount pressurized tires;

b) to correct the position of the bead and lock rings if the tire is pressurized;

c) to dismount one of the dual wheels without using a jack, by running the second dual wheel over a protruding object;

d) to use sledge hammers or similar objects during mounting and dismounting works that may deform wheel parts;

e) to replace the valve cores with plugs of any kind.

The mounting and dismounting procedure is described in more detail in the process specification of tire mounting/dismounting on a rim SP-NKhK-03-2019 (СП–НХК-03 – 2019) (link: http://www.td-kama.com).

5 Recommendations for the maintenance of automobile tires of motor vehicles owners

In order to maximize useful life of automobile tires and reduce operating transport costs, the following recommendations should be followed:

- transportation, storage, assembly, mounting and dismounting work should be carried out in accordance with the tire manufacturer's recommendations and those of the vehicle manufacturer;

- parking areas should be kept free of dirt, petroleum products, oils, chemicals and other substances that degrade rubber. The risk of tire freezing to the road surface due to water accumulation near the vehicle should be eliminated;

- when using covered parking areas, the vehicles shall not be closer than one meter to the heating system;

- avoid keeping parked on the spot of a loaded vehicle for more than two days, unloaded - for more than 10 days. When long-term parking is required the tires should be unloaded using stands or by moving the vehicle;

- vehicles subject to preservation should be placed on stands with the tires fully unloaded; the tires should be coated with chalk or lime water emulsion to protect (in open parking) from direct sunlight;

- the tire inflation pressure should comply with the values specified in the vehicle owner's manual (instruction) or the tire manufacturer's regulations (recommendations). The tire inflation pressure should be monitored regularly (at least once every 2 weeks). The inflation pressure shall be measured when the tires are completely cooled down using a pressure gauge the readings of which must be verified with the readings of the control pressure gauge;

- it is forbidden to park a vehicle on tires with an inflation pressure lower than the prescribed limit;

- carefully monitor the tread cap for wear and if any irregularities are detected they should be analyzed, the causes must be found and eliminated;

- tire maintenance should be performed at each first and second vehicle inspection (TO-1 and TO-2);

- interchanging of tires on the same axle and along the axles of the vehicle should be carried out according to the vehicle manufacturer's recommendations.

Grounds for interchanging of tires may include:

a) the need to match tires along the axle and for dual wheels;

b) the need to mount more reliable tires on the front axle (without mechanical damage, etc.);

c) uneven or severe wear of the tread pattern is detected.

The allowable tread depth shall be determined by the appearance of wear indicators. The allowable minimum remaining tread depth at which the tire must be taken out of service is set at (1.6 + 0.5) mm, the operation of tires in winter is prohibited if the tread depth is less than 4.0 mm.

It is forbidden to operate the vehicle if it is found:

- the size, load capacity and speed rating of mounted tires do not correspond to the vehicle model;

- the diagonal and radial tires, tires with different types of tread pattern mounted on the same axle or dual wheels;

- tire inflation pressure not complying with the established standard;

- replacement of valves cores with caps, plugs or other fittings;

- no valve caps on tire valves;

- the tire tread depth is below the permissible limit;

- unrepaired local tire damage (punctures, cuts through and part through, local tread separation);

- foreign objects (stones, glass, etc.) stuck in the sidewall and tread or trapped between the dual wheels;

- the absence of at least one bolt or nut securing wheels and wheel rims or loosening of their tightening;

- visible defects in the shape and dimensions of the holes in the wheel rims for the fastening elements;

- deformed rims;

- fitting tubeless radial tires with applied decorative sidewalls to a passenger car.

If any tire or rim defects are detected, the vehicle should be taken out of service for adopting corrective measures.

When preparing vehicles for winter or summer operation the full scope of work on the second vehicle maintenance (TO-2) shall be performed.

For vehicles equipped with tires with regulated pressure (internal pressure check tires), all pipes and hoses on the central tire inflation system should be blown through.

6 The drivers' responsibilities for automobile tire maintenance

In order to maximize tire useful life, the driver should observe the following rules for the operation and maintenance of tires:

- equipment of a vehicle with appropriate tires;

- check tire inflation pressure and, if necessary, adjust it to the recommended standard or, in case of spare tire to the maximum permissible pressure for this tire model;

- before release on the road, the driver is obliged to:

a) visually inspect the tires;

b) check the mounting of rims and wheels;

c) in case of tire air loss, identify and eliminate the cause of leakage;

- on the road, the driver is obliged to:

a) pull away smoothly to avoid wheel spin;

b) in case of vehicle drift, stop immediately, identify and eliminate the cause of drift;

c) avoid driving with low tire inflation pressure;

d) monitor the road condition and slow down on rough terrain (track pits, railway crossings, etc.);

e) avoid abrupt braking when approaching a stopping point, at traffic lights, barriers and others;

f) avoid abrupt impacts of the wheels on sharp metal and other protruding objects, do not approach the curb or other protruding objects in order not to damage the tires;

g) if it is necessary to drive with the sides open, secure the latter to prevent damage to the tires;

h) when using anti-skid chains, select them according to tire size and use them only on rough terrain; it is forbidden to use anti-skid chains on paved roads;

i) inspect the tires while parked in order to remove foreign objects (stones, glass, etc.) trapped in the tread, sidewall and between dual tires; if necessary, repair damaged tires using the auto first-aid kit;

j) do not overload the vehicle beyond the specified load capacity, make sure the load is evenly distributed and securely fastened; place small heavy goods in the vehicle body taking into account the uniform load on all tires;

- when operating tires with regulated pressure (internal pressure check tires):

a) monitor the tire inflation pressure and constantly maintain it within the limits defined for this vehicle model;

b) check that all wheels are connected to the central tire inflation system; all tire valves and shut-off valves must be open;

c) driving on underinflated tires is only permitted for passing through rough terrain; when switching to paved roads, the tire inflation pressure must be brought back to the standard tire pressure specified for this vehicle model;

- when operating tires with regulated pressure (internal pressure check tires):

a) monitor the tire inflation pressure and constantly maintain it within the limits defined for this vehicle model;

b) check that all wheels are connected to the central tire inflation system; all tire valves and shut-off valves must be open;

c) driving on underinflated tires is only permitted for passing through rough terrain; when switching to paved roads, the tire inflation pressure must be brought back to the standard tire pressure specified for this vehicle model.

7 Recommendations for motor transport companies on accounting for the operation of automobile tires

For each tire (new, retreaded or regrooved) installed as original equipment or during operation of the vehicle, a card for recording tire operation shall be created in due form (see Appendix Б.1 for the form of a card for recording tire operation).

All fields of the card should be filled in. The card shall be maintained until tire failure.

It is allowed to burn out garage numbers (asset identification numbers) on the tire shoulder area using tire stamping device. The depth of the burnout shall not exceed one millimeter.

The technical condition (defects, the nature and extent of damage) of a tire fitted on a vehicle shall be noted on the tire record card. For used tires, when fitted to another vehicle, their previous mileage shall be recorded. The remaining tread depth shall be measured at the same time in two diametrically opposite sections of the extreme wear on the tread (for the rules for measuring tread depth, see Appendix Ж). The average tread depth shall be recorded in the column on the tire record card.

After repair of local damage, the accounting of tire operation shall be continued on the same card.

Every month, the actual mileage shall be entered into each card.

When replacing a tire on road wheels with a spare or, if necessary, a purchased tire, the driver shall be obliged to inform the person responsible for accounting for the operation of tires, the date of replacement, the plant number of the replaced tire, and the speedometer reading at the time of installation. These data shall be recorded in the record cards of the replacement and spare tires.

The mileage of each tire shall not be determined by dividing the total mileage of tires of road wheels by the number of all tires on a vehicle (including spare tire), as this would result in the mileage being credited to a non-operating spare tire and incorrect determination of the actual mileage of each tire.

To ensure the correct recording of tire mileage, the person responsible for accounting for the operation of tires should carry out quarterly spot check for a match between the tires actually in use on a vehicle and the tires assigned to the vehicle on the record card according to the plant numbers.

The tires shall not be taken out of service, retreaded or scrapped, if they are technically suitable for further use.

If the tire is taken out of service, the tire record card shall state the date of removal, the total run, the reason for removal as determined by the committee, the remaining tread depth (according to the greatest wear) and whether the tire is to be repaired, retreaded, regrooved, scrapped or reclaimed.

When a tire is sent for retreading, regrooving or scrapping, the tire operation record card shall be signed by the members of the committee. In this case, the record card is a write-off act of the tire.

New tire operation record cards shall be issued for tires received after retreading.

The life of a regrooved tire shall start at zero on the tire's previous record card. In case of a general-purpose regrooving, a new record card shall be created.

In order to determine the mileage of tires on private vehicles, the vehicle owners are recommended to record the speedometer reading when fitting and removing tires from service.

Appendix Б.1

(Informative)

Form of a card for recording automobile tire operation

AUTOMOBILE TIRE OPERATION RECORD CARD
(new, retreaded, regrooved, used tire)
(underline as appropriate)

Tire identification (size) _____ Tire model _____ GOST or tire technical specification (TU) _____

Item (plant) number _____ Date of manufacture (week, year) _____

Load index or ply rating _____

Operating (guaranteed) tire life _____

New tire manufacturing plant or tire repair facility _____

Name of motor transport company _____

Make and model of a vehicle (trailer), its number plate	Speedometer reading when the tire is fitted, ths.km	Date		Tire mileage, ths. km (to within 0.1 ths. km)		Tire technical condition when fitted	The reasons to remove tire from service	Remaining tread depth, mm	Driver's signature
		of tire fitting on the road wheel or spare wheel	of tire removal	per month	since placed in service				

Responsible for accounting for the operation of tire _____ Name _____ (signature)

The conclusion of the committee on tire serviceability

(to be retreaded, to be regrooved, to be reclaimed or scrapped).

Chairman of the committee _____ Name _____ (signatures)

Members of the committee

Notice

1. The card shall be created for each tire received by the motor transport company.
2. All fields are mandatory.

Appendix B

(Informative)

The influence of certain factors on the serviceability of automobile tires

1 Inflation pressure

During automobile tire rolling (running) under normal load, both deformation and recovery of tire section occur simultaneously.

Operating a tire underinflated or at decreasing inflation pressure contributes to an increased deformation of tire section height, generation of more heat build-up in tire materials, leading to weakening of bond strength between the structural parts and resulting in tire failure. Maintaining the right inflation pressure is essential for the correct operation of automobile tires.

Defects due to failure to comply with the required operating inflation pressure:

- increased tread wear at the edges of the tread cap due to decreased operating inflation pressure;
- increased tread wear in the center of the tread cap due to increased inflation pressure;
- carcass fracture or complete tire failure due to running underinflated or tire operation under a load exceeding the standard. The following stages can be observed on the inner cavity of tires: innerliner rubber darkening in the shoulder area, innerliner rubber chunking in the shoulder area, carcass cord exposure in the shoulder area, carcass cord snagging in the shoulder area, sidewall destruction (tread separately, sidewall separately);
- failure to maintain the working pressure of dual tires accelerates the failure of one of the tires and can also lead to so-called "spotty wear";
- operating a tire underinflated may lead to the formation of radial cracks in the shoulder area, sidewall detachment, delamination in the above bead area, etc. in the inner cavity of the tire.

2 Tread wear

The tread wear rate depends on the materials used: highly dispersed carbon black, antiaging agents, type of rubber, improved tread patterns, etc.

The following factors affect rapid tread wear:

- driving or acceleration style, including cornering, hard braking, overloading;
- vehicle design features - the influence of traction and brake load on a wheel;
- effect of lateral forces revealed due to wheel toe-in, as well as when driving on winding roads and overtaking due to increased centrifugal forces;
- non-compliance with the tire inflation pressure;
- the presence of imbalance and runout of the wheel assembly;
- condition of the road surface, land topography.

3 Mechanical damage

- tread and sidewall cut due to running over sharp-edged objects;
- reach-through breakdown of tread and sidewall due to running over the road obstacles;
- tread and sidewall damage due to wheel spin and operation on rough roads;
- damages in the tire bead area due to unqualified tire mounting;
- damages to new, unused tires due to violation of rules for storage or transportation.

4 Tire uniformity (mass variation, geometry variation, force variation)

During vehicle movement, the tire and wheel assembly rotate at a certain frequency. Upon reaching a certain speed, this frequency starts to coincide with the internal vibrations of the car body. The internal vibrations increase if the tires have mechanical damage, slight blister or increased local wear. The vibrations are growing even more if there is an excessive tire imbalance, radial and lateral runout or uniformity.

- **Mass variation – static and dynamic imbalance**

There are two types of tire imbalance: static imbalance and dynamic imbalance:

static imbalance is a non-uniform distribution of mass in a tire about its axis of rotation. This imbalance results from a violation of production technology. If the static imbalance is exceeded, it is corrected by applying “heavy” glue to the inner cavity;

dynamic imbalance is a non-uniform distribution of the wheel mass relative to its principle longitudinal rolling plane. Dynamic imbalance is an "operational" value, it is determined when the tire is mounted on a wheel rim and should be eliminated by a corrective mass on each side of the wheel rim in accordance with the indicators specified in GOST 4754 (GOST R 52899) or other regulatory documentation.

It should be noted that the indicators of GOST 4754 (GOST R 52899) or regulatory documentation are set for new tires, i.e. for tires that were not in use, and tire operation starts from the moment of tire mounting on a rim.

A tire, which has been in use, may have uneven tread wear due to braking and dynamic impact perception, improper toe-in adjustment, wheel damage, and may have dynamic imbalance indicators exceeding those of GOST 4754 (GOST R 52899) or regulatory documentation.

- **Geometry variation – radial run out and lateral runout**

The radial and lateral runout of a tire causes vehicle vibration when driving. For new tires the indicators should not exceed those specified in GOST 4754 (GOST R 52899, GOST 5513) or regulatory documentation. If during tire mounting a radial or lateral runout is detected, then such tires should not be allowed for operation.

- **Force variation – radial force variation, lateral force variation, conicity**

This is the tire manufacturing quality assessment indicator. Passenger car, light truck and all steel tires are inspected for radial and lateral force variation and conicity during manufacture at a tire plant.

5 Technical malfunction of a vehicle:

- deviations from the normal camber of the steering wheels or curvature of the axles results in one-sided wear of the tread pattern;
- faulty (damaged) vehicle suspension aggravates local wear (spotty wear);
- faulty dampers, brakes, play in the hub bearings on all axles of the vehicle, deviation from the normal toe-in angle, backlash in the steering on the vehicle steer axles lead to "heel and toe" tread wear;
- tire operation on a deformed rim flange, corroded rim seat and with faulty brakes leads to tire bead destruction;
- the presence of multiple faults: wheel alignment noncompliance with the standards, malfunction of the suspension system, brake system, etc. lead to even more complex types of wear.

6 Unskilled driving

The tire life and serviceability depend largely on the vehicle driving technique as well as the skill and experience of the driver. Here it is necessary to consider:

- starting with a wheel spin;
- hard braking, especially with a wheel spin;
- high-speed cornering and sharp overtaking;
- running over various road obstacles;
- kerbing when approaching sidewalks, crossing of rail tracks at high speed, etc.

When starting abruptly, the load on the drivetrain components increases, the intensity of local wear of the tire tread as a result of a wheel spin increases significantly.

During abrupt braking the protruding tread elements slip on the road surface, leading to increased friction and heating in a contact patch and excessive tread rubber wear. The higher the driving speed during abrupt braking and the harder the braking is performed, the faster the tread wears out. Frequent skidding (wheel sliding) results in local tread wear first, followed by carcass and belt ply destruction. Hard braking of an overloaded vehicle may cause tread separation.

When the vehicle makes a sharp turn at high speed, in addition to the centrifugal forces caused by the rotation of the wheel, the centrifugal forces resulting from the turning of the vehicle also act on the wheel. The combined effect of these forces increases the corresponding reaction force of the road, which tends to tear the tire bead off the rim.

Appendix Г

(Informative)

Reclamation

The order of relations between consumers and manufacturers of products (contractors, sellers) is regulated by the Civil Code of the Russian Federation and the Law of the Russian Federation On Protection of Consumers' Rights enacted by the Resolution of the Supreme Soviet of the Russian Federation No. 2300/1-1 of 07.02.92.

Claims for tires taken out of service due to manufacturing defects can be made within the guaranteed service life and storage period of tires as stipulated in the national standards and technical specifications for tires.

Upon detection of manufacturing defects in tires, the individual vehicle owners have the right to submit a claim to the tire manufacturer or the seller of the store where the tire was purchased.

When contacting the store, the owner of the tire shall fill in the Application for consideration of a claim, accompanied by sales receipt and a copy of vehicle registration document. The application shall specify the name, contact details, vehicle model, tire data (date of manufacture, plant number, mileage) and the reason for the claim. In addition, the applicant must keep in mind that the tires shall be accepted for examination together with the inner tubes used in the operation, cleaned out from dirt and with the points of assumed defects marked.

A natural person shall fill in the Application for consideration of a claim. Legal persons shall fill in the Application and a Reclamation report. The reclamation report for a tire shall specify the name of the company (organization), the address of the company (organization), vehicle model, tire data (date of manufacture, plant number, mileage, reason for withdrawal from service). In case of inner tube damage due to destruction of tire during operation, the tires complete with the tube shall be accepted for examination.

The actions to be taken by the legal person to claim for reclamation shall be reflected in the sale and purchase contract.

Consideration of a claim and execution of an examination

The following basic documentation shall be used for consideration of claims:

- GOST 4754-97 Pneumatic tires for passenger cars, trailers for them, light-duty trucks and buses of especially small capacity. Specifications.
- GOST 5513-97 Pneumatic tires for trucks, trailers for them, buses and trolleybuses. Specifications.
- GOST 7463-2003 Pneumatic tires for tractors and agricultural machinery. Specifications.
- GOST 8430-2003 Pneumatic tires for earthmoving, loading and mining machines. Specifications.
- GOST 13298-90 Tires with regulated pressure. Specifications.
- GOST 22374-77 Pneumatic tires. Construction. Terms and definitions.
- GOST 24779-81 Pneumatic tires. Packing, transportation, storage.
- GOST 26585-2003 Giant and super giant pneumatic tires for off-the-road trucks. Specifications.

- GOST R 52899-2007 Pneumatic tires for truck power-driven vehicles and trailers.
- Russian Federation Consumer Protection Act.
- Civil Code of the Russian Federation.
- Instruction No. P-6 (П-6), No. P-7 (П-7).
- Technical regulation of the Customs Union 018/2011 On the safety of wheeled vehicles, Technical regulation of the Customs Union 031/2012 On safety of agricultural and forestry tractors and their trailers.
- GOST RV 0015-703-2019 System for the development and launch of military equipment. The procedure for filing and settling complaints. Basic provisions.
- The process specification of tire mounting/dismounting on a rim SP-NKhK-03-2019 (СП–НХК-03 - 2019).

As well as other documentation according to which the products are manufactured.

The handling of tire claims requires appropriate practical training and theoretical knowledge:

- the fundamentals of automobile tire design;

- the fundamentals of automobile tire manufacturing technology;

- the fundamentals of the theory of automobile tire operation.

Knowledge of these fundamentals will help to consider tire failure in service as a complex of all factors that have affected the formation of defects during tire operation. The examination must include:

- Analysis of the inscriptions on the tire. All inscriptions and markings on the tire must comply with GOST and TU.
- Parameter estimation and assessing the correct application of tire. The tire application must comply with the vehicle registration certificate and the tire manufacturer's recommendations.

Measurement of the actual tread depth in mm (for the rules for measuring tread depth, see Appendix Ж).

The allowable minimum remaining tread depth of tires:

- passenger tires – minimum 1,6 mm;

- truck tires – minimum 1,0 mm;

- tires for buses and trolleybuses – minimum 2,0 mm;

- tires for trailers and semi-trailers — the tread depth is the same as for the tires of the vehicles they operate with.

The operation of tires is allowed up to the limit of wear of the tread pattern corresponding to the height of the wear indicator, within the guaranteed service life of tire.

The results of tire examination will make it possible to determine the causes of tire defects.

In the event of a dispute or disagreement of vehicle owners with the decision of the reclamation committee, they can appeal to the judicial authorities.

Appendix Д

(Informative)

Winter tire operational features

According to the regulatory documentation, the operation of winter tires is recommended on icy and snow covered roads.

The Technical Regulation of the Customs Union On the safety of wheeled vehicles (TR CU 018/2011, Annex 8, items 5.5 and 5.6.3) prohibits the operation of vehicles of categories M_1, N_1 not equipped with winter tires (i.e. tires with a marking M+S and/or a symbol of snowflake inside a mountain with three peaks ) on all axles of the vehicle during the three winter months (December, January, February). The winter period may be amended to increase by the local authorities of the individual areas.

The information on the operation of studded winter tires is set out in the regulatory documentation for the tires.

Only winter tires that are specially marked on the tire tread should be fitted with studs.

Their running-in mode is compulsory, namely: within the range from 800 to 1000 km, the driving speed should not exceed:

- for passenger cars - 70 km/h;
- for trucks and buses - 50 km/h.

A sporty driving style is prohibited – sudden start, wheel spin, high-speed cornering, sharp braking. Driving on asphalt, as well as running over potholes and other obstacles, contributes to increased stud wear and tire destruction.

After completion of the running-in period, the studs shrink, therefore the tire and wheel assembly must be re-balanced.

According to the regulatory documentation, the maximum permissible operating speed of studded winter passenger tires is 130 km/h.

The remaining tread depth of winter tires designed for use on icy or snow-covered road surface is minimum 4 mm.

In case of heavy wear, the studs do not provide adequate traction and driving safety. They can also damage the tire belt and destroy the tire.

Appendix E

(Informative)

Automobile tire manufacturer's guarantee

The tire manufacturers guarantee the compliance of tires with the requirements of the construction standards provided the transportation, operation and storage conditions are observed.

The guaranteed service life of tires for passenger cars, trailers for them, light-duty trucks and buses of especially small capacity (GOST 4754); trucks, vehicle trailers, buses and trolleybuses (GOST 5513, GOST R 52899) is five years from the date of manufacture or until the limit of wear of the tread pattern, whichever comes first.

The guaranteed service life of tires for the Ministry of Defence is 8 years for truck tires and 10 years for light truck tires from the date of manufacture.

The guaranteed service life of tires with regulated pressure (internal pressure check tires) (GOST 13298) is 12 years for 1500×600-635, 1600×600-685 tires and 10 years for other tire designations.

The guaranteed service life of studded tires is 2 years from the date of manufacture within the limits of guaranteed service life of tire, subject to the recommendations for the operation of winter tires and no more than 10% of the studs are lost.

The possibility of further tire operation is determined by the consumer on the basis of the technical condition of the tire.

The manufacturer guarantees within the guaranteed service life the absence of manufacturing defects and tire serviceability up to the limit of wear of the tread pattern corresponding to the height of the tread wear indicator, provided the requirements for transportation, operation and storage are observed by the consumer.

Dynamic imbalance, radial or lateral runout shall be determined when a new tire is fitted. If dynamic imbalance, radial or lateral runout of a tire with the mileage being above 500 km are detected, the tire manufacturer's guarantee does not cover the tire.

Tires found to be free from manufacturing defects upon expert findings, but showing signs/evidence of external interference and changes made to the design by third parties (local/homemade repair, unprofessional studding, etc.) are not covered by the manufacturer's guarantee.

A claim for tire quality shall not be accepted if the tire manufacturer's recommendations and the above-mentioned provisions are violated.

Appendix Ж

(Informative)

The rules for measuring the tread depth

The tread depth is determined by measuring the depth of the tread groove from the tread surface to the base of the groove, excluding the tread wear indicator. The caliper is placed on the tread surface, the depth gauge is extended to the bottom of the groove and the measurement is taken (photo 1).

The depth of the tread groove is measured in four equally spaced sections:

- tire tread groove is a space between tread ribs, blocks or in the tread bar;

- tread groove depth is a perpendicular distance from the tread surface defined by the edges of two adjacent ribs to the lowest point of contact in the groove.

Photo 1 – Tread depth measurement

The remaining tread depth is measured at the points of the extreme wear, but not at the tie-bars and steps at the base of the tread groove.

For tires with a solid rib in the center of the tread cap, the tread depth shall be measured along the edges of the rib.

For off-road tires, the tread depth shall be measured between the tread lugs in the center or in the areas least distant from the center of the tread cap, but not on the shoulder at the base of the tread lugs or at the tie-bars.

For tires with wear indicators, the maximum allowable tread height is determined by the appearance of wear indicators (raised bars along the bottom of the grooves of the tread cap, the height of which is equal to the minimum allowable tread height).

For tires with wear indicators, in case of a uniform wear of the tread pattern, the wear limit is determined by the appearance of one indicator, in case of uneven wear, by the appearance of two indicators in each of the two sections.

Conclusion

In order to avoid operational defects during tire operation, the regulations and recommendations of the tire and vehicle manufacturers as well as the following basic rules must be observed:

- strictly comply with the tire and vehicle manufacturer's recommendations. Careful handling of the tire helps to maximize tire life;
- check that the vehicle is equipped with appropriate tire size, design, cross section, type and wear rate of the tread pattern. Match the tires along the axle and on dual wheels;
- keep standard inflation pressure, including that of the spare tire. Do not reduce tire inflation pressure when it builds up from heating during vehicle driving;
- before release on the road carefully inspect the tire for defects (local damage, tread wear, stuck objects, etc.);
- do not overload the vehicle, distribute the load evenly;
- avoid hard braking of the vehicle, except in an emergency situation;
- reduce speed on rough terrain, at traffic lights, barriers, when cornering;
- avoid abrupt impacts on sharp or protruding objects, do not approach the curb or other objects and protect tires from damage;
- do not operate tires if the tread wear indicators become visible;
- provide timely retreading, regrooving of tires and repair of local damage;
- check the steering wheel alignment. Remove any malfunctions in the vehicle's running gear;
- check wheel balance when fitting new tires, during seasonal replacement of tires, after repair of vehicle suspension system. Tire imbalance should be checked every 2-3 ths.km, and wheel balance should be performed after 10 ths.km;
- carry out mounting/dismounting of tires in accordance with the process specification of tire mounting/dismounting on a rim SP-NKhK-03-2019 (СП–НХК-03 – 2019) (link: http://www.td-kama.com).

Revision history

Revision No.	Effective date	Reason	Developer (author)
1	12.04.2012	A new document.	Tire testing and homologation department (Suvorova O.F.)
2	26.04.2019	1. Rearrangement of the catalogue, addition of defect numbering. 2. Addition of Defects classification according to severity rating. 3. Update of the text of the catalogue of Automobile tire defects. 4. Update of the following Appendices: №1 (examples of tire marking); №3 (section 4); №4 (revision of the list of documents when dealing with complaints and examinations); №5 (entry of the information on the remaining tread depth of winter tires); №6 (guaranteed service life of studded tires). 5. Addition of the following Appendices: №2 Recommendations on the operation, №7 The rules for measuring the tread depth. 6. Addition of a new section: Carcass defects. 7. Addition of new defects: 1.12 Cutting/cracking on the tread edge; 1.14 Damage caused by corrosion environment; 2.3 Tire innerliner damage; 3.6 Sidewall cracking. 8. Addition and/or replacement of photos of defects in the following items: 1.6, 1.11, 2.1, 3.5.	Tire testing and homologation department (Bezina O.E.)
3	15.05.2020	1. Addition of defects of winter studded tires: 1.16 Tread cracking and tear around the antiskid studs; 1.17 Antiskid studs "sinking" into the tire tread; 1.18 Loss of anti-skid studs; 1.19 Antiskid studs punching the tread up to the belt ply. 2. Addition of a new defect 3.4 Sidewall separation with star cracks. 3. Additional items in the Causes and defect prevention recommendations of the following defects: 1.1-1.3, 1.8, 1.13, 3.1-3.4, 4.3, 4.4. 4. Addition and/or replacement of photos of defects in the following items: 1.3, 2.3, 3.5, 4.4. 5. Renaming of defect 3.5. Addition of Multiple bulges in the sidewall (of all steel tires).	Tire testing and homologation department (Bezina O.E.)
4	19.04.2021	1. Addition of Section 5 Tire uniformity, defect 5.1 Static and dynamic imbalance to the catalogue pursuant to Protocol No. 1633/01/03-Prot-NKSh (1633/01/03-Прот-НКШ) of 23.09.2020. Addition of tire uniformity deviation: dynamic imbalance and/or excessive runout of the wheel assembly in items 1.5, 1.7, 1.8 The causes of defects and recommendations for the prevention of defects. 2. Renaming of the catalogue of Operational defects of automobile tires to replace Defects of automobile tires. 3. Revision and/or update of defect names in items 1.15, 2.3, 3.1, 4.3.	Tire testing and homologation department (Bezina O.E.)

		4. Addition of defects: 1.6 River wear of the tread pattern, 3.5 Sidewall blowout. 5. Addition and/or replacement of photos of defects in the following items: 1.1, 1.3, 1.9, 2.3, 3.8, 4.1, 4.2, 4.3. 6. Revision and/or update and bring consistency to the wording of the reason of the causes of defects in the catalogue of Operational defects of automobile tires and the Reference book available at 1C УПП КОРП\Учет рекламация\Справочник «Причины дефектов продукции» in the following items: 1.1, 1.2, 1.4, 1.5, 1.7, 1.9, 1.10, 1.12, 1.13, 1.14, 1.16, 1.17, 1.18, 1.19, 2.1, 2.3, 3.1, 3.2, 3.3, 3.4, 3.6, 3.8, 4.1, 4.3, 4.4. 7. Revision and/or update of the Recommendations for the prevention of defects in the following items: 1.2-1.8, 1.10, 1.12-1.14, 1.16-1.19, 2.1, 2.3, 3.1-3.4, 3.6, 3.8, 4.1-4.4. 8. Clarification of the index C according to GOST 4754 in Appendix 1. 9. Amendment on the use of the specification for the process of mounting and dismounting of tires on a rim SP-NKhK-03-2019 (СП-НХК-03-2019) to replace standard No. 0830 (rev.002) of 31.01.2013 in the Appendix No. 4 and in the conclusion to the catalogue. 10. Update of the standard name GOST RV 0015-703-2019 System for the development and launch of military equipment. The procedure for filing and settling complaints. Basic provisions. 11. Removal of a link for the application of the recommendations on tire operation in accordance with the Rules of operation of automobile tires AE 001-04 (АЭ 001-04), Rules of operation of tires for tractors and agricultural machinery, Rules for operation of tires for heavy duty trucks, lifting and transport, construction and road machines, Manual for the equipment of vehicles with tires for motor transport companies ATP No. RD 3112199-0188-95 (АТП № РД 3112199-0188-95) due to irrelevance of the documents in the catalogue. 12. Update of the Appendix 2; addition of recommendations on the rules of tire operation (transportation; storage; equipment; mounting/dismounting; maintenance of tires of motor vehicles owners; drivers' responsibilities for automobile tire maintenance; recommendations for motor transport companies on accounting of automobile tires). 13. Addition of the Appendix 2.1 Form of a card for recording automobile tire operation. 14. Update of the conclusion to the catalogue.	
5		1. Addition of a new Section 6 Defects of the inner tubes comprising the following defects: 6.1 Mechanical damage of the inner tubes (puncture, cut, blowout); 6.2 Inner tube valve fracture/breaking/tear; 6.3 Inner tube walls abrasion (porosity)/crack network due to ageing, to the catalogue pursuant to Letter No. 618/8-IskhDNKh-NKh (№618/8-ИсхДНХ-НХ) of 12.04.2021. 2. Renaming of the catalogue of Operational defects of automobile tires. Recommendations on the operation of automobile tires to replace Operational defects of automobile tires.	Tire testing and homologation department (Bezina O.E.)

		3. Renaming of defect 5.1 Static and dynamic imbalance deviation to replace Static and dynamic imbalance. 4. Renaming of defect 2.1 Broken belt (steel cord exposure) to replace Broken belt. 5. Update and bring consistency to the wording of the causes of defects and recommendations for the prevention of the following defects: 1.4, 1.13, 1.14, 1.16, 1.17, 1.18, 3.3, 5.1. 6. Addition of the defect photo in item 3.2 Carcass cord break. 7. Introduction of a sign showing the location of the indicator of tread regrooving and a mark of the certificate of compliance with the INMETRO standard in the Appendix A Tire marking. 8. Update of the text of the catalogue. Introduction of links throughout the text for the application of the Appendices to the catalogue.	

Revision Record Sheet

to the catalogue of Operational defects of automobile tires. Recommendations on the operation of automobile tires.

No.	Sheet (page) number			Effective date	Authorized signature and the date of revision
	replaced	new	cancelled		