

About Nordic Ecolabelling of
Vehicle Tyres

Version 3.0

Background for ecolabelling

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Nordic Ecolabelling

Nordic Ecolabelling of vehicle tyre - Background for ecolabelling

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1 What is a Nordic Ecolabelled Vehicle Tyre?

Tyres have an advanced composite structure comprising rubber and reinforcements. A tyre carries the vehicle's weight and enables movement. The textile and steel reinforcements give the tyre its shape and stability under load. The rubber mixture comprises various polymers (natural and synthetic rubbers), carbon black, plasticizers, vulcanizing agent, accelerators, protecting agents and other substances.

The aim of a Nordic Ecolabel for vehicle tyres is to limit environmental impact by promoting products that are least damaging to the environment. These criteria have been developed to minimise environmental impact during manufacture and use.

An ecolabelled tyre must have a low rolling resistance since lower fuel consumption has many environmental benefits (such as lower CO₂ emissions, lower emission of carcinogens and lower levels of PM₁₀). The tyre must also be quiet since noise is an increasing environmental problem that causes health problems (e.g. heart and vascular disorders). The manufacturing of ecolabelled tyres must use environmentally suitable raw materials and production methods (e.g. to reduce the dispersion of toxic substances and minimise environmentally harmful emissions). There are also requirements on safety, durability and the possibility to retread.

2 About the Criteria

What can carry the Nordic Ecolabel?

The product group covers non-studded new or retreaded vehicle tyres (summer and winter tyres for cars, buses and trucks) with a low rolling resistance. The load index¹ for tyres for heavy vehicles must exceed 121. For car tyres, the load index must be 121 or lower according to ECE 54.

General about ecolabelling of tyres

The original consultant study on the feasibility of establishing environmental criteria for tyres was performed by Rencon Consulting Ky. The original study focused especially on passenger car tyres. To acquire more information about heavy vehicle tyres, Technical Research Centre of Finland (VTT) studied the environmental impacts of heavy vehicle tyres in a survey commissioned by Nordic Ecolabelling. These studies are available on request from the Nordic Ecolabelling Secretariats.

A Nordic expert group for developing heavy vehicle tyre criteria was formed in 1999. This expert group comprised representatives from manufacturers of new heavy vehicle tyres, heavy vehicle tyre retreading agencies, research institutions representing both passenger car and heavy vehicle tyres, and trade organisations.

The product group of vehicle tyres comprises new and retreaded tyres for passenger cars, buses and trucks.

¹ The load index is a numerical categorisation based on the maximum load that the tyre can carry under specific conditions at the maximum speed of the given speed rating up to 220 km/h. The load index 121 is equivalent to 1450 kg. See Appendix 4.

The expert group has in its work assessed the entire lifecycle of tyres, beginning with production and the selection of raw materials, through the manufacture of tyres, the use of tyres, retreading and finally the recycling of used tyre bodies. The requirements do not cover all properties of the tyre, because some are not considered appropriate.

The ecolabelling criteria for passenger vehicle tyres were concluded 15th June 1999. Afterwards, at 3rd December 1999, some changes to the document were done by Nordic Ecolabelling Board (NMN). After some corrections of grammatical points, the present version of the criteria for passenger vehicle tyres is 1.2. When approved the passenger vehicle tyre NMN also decided to continue criteria developing work for heavy vehicle tyres including bus- and truck vehicle tyres. The main goal of the present expert group has been to develop criteria for bus- and truck tyres. Later NMN has decided that it is possible to revise the requirements of passenger vehicle tyre at the same time with the criteria development for bus and truck tyres. Nordic Ecolabelling Board has so given a mandate to update also passenger vehicle tyre requirements, and also some changes have been done in the requirements for passenger vehicle tyres.

Revision 2001

The new proposal of the document, version 2.0 will be valid for four years.

The following chapters have been changed or added in version 2.0 compared to version 1.2:

- Lay-out has been changed.
- Definition of the product group is changed to include also bus- and truck tyres (chapter 2 in version 2.0).
- Requirement regarding PCA compounds is changed (chapter 4.1.1 in version 2.0).
- Requirement regarding substances classified as dangerous for the environment and health is removed (chapter 4.1.2 in version 1.2).
- Requirement for lead and cadmium as impurities in zinc oxides is added (chapter 4.1.2 in version 2.0).
- Requirement for the use of organic solvents in production is changed to cover a tyre as a product (chapter 4.1.3 in version 2.0).
- Documentation of rolling resistance is changed (chapter 4.1.4 in version 2.0).
- Documentation of noise is changed (chapter 4.1.5 in version 2.0).
- Requirement regarding design is removed (chapter 4.1.8 in version 1.2)
- Documentation of safety considerations is changed (chapter 5.1.1 in version 2.0).
- Alternatively the requirement for durability is added.

Further the requirements for bus- and truck tyres are added in chapter 4.2 and 5.2. The following requirements are covered for heavy tyres in the version 2.0:

- PCA compounds in the process oil and documentation of PCA compounds in tread rubber (chapter 4.2.1)
- Substances classified as dangerous to the environment and health in the protective agents (chapter 4.2.2).
- The amount of lead and cadmium in zinc oxides (chapter 4.2.3).
- The use of organic solvents (chapter 4.2.4).
- Rolling resistance (chapter 4.2.5)
- Noise (chapter 4.2.6)
- Instruction for marking of tyres (chapter 4.2.7).
- Waste handling and strategy (chapter 4.2.8).
- Safety considerations (chapter 5.2.1) and durability (chapter 5.2.2) as alternatives to each others.

Revision 2009

The following chapters have been changed or added in version 3.0 compared to version 2.4:

- Lay-out has been changed.
- The test methods and standards have been updated.
- Requirement regarding PCA compounds has been removed, in version 3.0
- Requirement regarding rolling resistance has been changed (criterion K2 in version 3.0).
- Requirement regarding noise has been changed (criterion K3 in version 3.0).
- Requirement for the documentation of lead and cadmium as impurities in zinc oxides in tyres has been changed (criterion K4 in version 3.0).
- Documentation regarding consumption of organic solvents have been adjusted (criterion K5)
- Requirement of safety has its own criterion (criterion K12 in version 3.0).
- Requirement for durability has its own criterion (criterion K13 in version 3.0).

More detailed information about the background of requirements is presented in chapter "CRITERIA FOR ENVIRONMENTAL LABELLING" in this document.

Market overview

Three companies manufacture new passenger vehicle tyres in the Nordic countries and a total of about 20-25 companies retread passenger vehicle tyres. There is only one company which manufacture new bus- and truck tyres in Scandinavian. The number heavy tyre retreaders is over 100 in Scandinavian.

The 1999 sales figures for vehicle tyres are summarised in the table below. The data was obtained from the different Nordic vehicle tyre associations.

Table 1. 1999 sales figures for vehicle tyres.

	DENMARK Tyres/yr.	FINLAND Tyres/yr.	NORWAY tyres/yr.	SWEDEN tyres/yr.	ICELAND Tyres/yr.
Passenger vehicle tyres					
Vehicle tyres, new	2 280 000	1 470 000	2 100 000	3 800 000	150 000
Retreaded tyres	300 000	320 000	155 000	1 200 000	87 000
Total sales	2 580 000	1 790 000	2 255 000	5 000 000	237 000
Bus- and truck tyres					
New tyres	135 000	100 000	120 000	210 000	10 000
Retreaded tyres	110 000	250 000	120 000	220 000	30 000
Total sales	245 000	350 000	240 000	430 000	40 000

Revision 2009

Detailed sales figures for version 3.0 (2008) were not obtained due to lack of statistics and conflicting information. The old data from 1999 were reevaluated by different Nordic vehicle tyre associations and thought to be about accurate perhaps slightly underestimating the market, except from the rethread part. Since 1999 rethreaded tyres is being replaced with cheap tyres bought over the internet. This has also contributed to a situation where only about 5 companies that retread passenger vehicle tyres remains.

Other labelling systems

“Der Blaue Engel” in Germany also has criteria for ecolabelling of tyres, since January 2004². A new criteria version was published in January 2009. Carbon black could possibly contribute to a content of PAH in tyres even after the introduction of the Directive 2005/69/EC. This has “Der Blaue Engel” observed and compensated for in their tyre criteria from January 2009. The Nordic Swan has inspired by those criteria inserted a similar criterion in version 3.0 for tyres with Carbon black.

3 Environmental impacts of tyres

After the consultant study by VTT, the Nordic expert group proposed environmental criteria for tyres. The findings of the external consultants, the work of the expert group and the available literature were all taken into account.

By considering the entire lifecycle of tyre production, use, reuse and final disposal are taken into account. Environmental impact is caused by the use of chemicals and raw materials during production, during the use of the vehicle and in the handling of the used tyres. An environmentally conscious tyre has characteristics such as low rolling resistance, low noise level and good wear properties. Further the tyre should work so that there is no need to retire it too soon. The design of the tyre and how it is used affect its durability. It is difficult to incorporate all such factors in ecolabelling criteria. Low energy consumption during production and environment-friendly raw

² <http://www.blauer-engel.de/en/>

materials are basics for ecolabelled tyres. The reuse of the tyre carcass as material, energy or in other way forms the last phase of the life cycle.

The studies have in particular examined some potential environmental risks caused by rubber chemicals, primarily high aromatic process oils, zinc, protective agents in rubber and sulphuric chemicals. The expert group aimed to establish requirements for the most significant chemicals used in the manufacturing of tyres. The group also set limits for the noise level of tyres. Noise levels are influenced by the construction, dimensioning and stiffness of the tyre and the tread pattern. Further requirements for rolling resistance, durability, decrease of materials, safety and handling of retired tyres have been studied.

Raw materials

Tyres are composed of rubber compounds, textile fibres, steel belts and bead bundles. A passenger car tyre weighs about 8 kg. The materials used to make bus and truck tyres are quite similar but, of course, the amounts of chemicals in heavy vehicle tyre production are higher. The general composition of tyre rubber is:

Polymers (natural or synthetic rubber)	40-60%
Filler (black carbon, silica)	25-35
Softening agents (process oil)	20
Protective agents (wax, antioxidant, antiozonant)	1-2
Activators (zinc oxide, stearic acid)	2-5
Accelerators	0.5-2
Vulcanizing agent (sulphur)	1-2

Synthetic rubber may include styrene butadiene, polybutadiene and polyisopren rubber.

Process oil is a residue from processing. The oil, depending on its composition, may contain polyaromatic hydrocarbons (PAH). The total content of PAH in a tyre may vary greatly due to the method of measurement and the quality of the oil fraction used in the production process.

Carbon black could possibly contribute to a content of PAH in tyres even after the introduction of the Directive 2005/69/EC.

Most protective agents and accelerators are classified as environmentally harmful chemicals. A typical antiozonant is classified as environmentally dangerous. Protective agents and accelerators have been developed particularly for the rubber industry and production of tyres. Due to health hazards, the tyre industry has over the last fifteen years co-operated closely with raw material producers to develop less harmful agents. The tyre industry has successively managed to substitute all potentially carcinogenic and toxic chemicals with less hazardous alternatives.

Usually a combination of several accelerators is used. During the vulcanization process these react further with polymers and other agents. The most usual accelerators are sulphur amides and guanidines.

Protective agents, a combination of wax and different types of p-phenylamides, are used to protect the tyre against heat, oxygen, UV radiation and ozone. The protective agents diffuse to the surface of the tyre to protect it against ageing. The protective agents provide extended protection to the rubber polymers. Over time old protective agents are leached from the surface and are replenished by new ones. Active protective agents are needed to extend the life of the tyre. It is argued that the leached protective agents have a negative impact on the environment. The toxicity to fish of water extracted from rubber has been tested by several research institutes. The results vary from low toxicity to higher degrees.

The environmental aspects of zinc oxide activator and sulphur vulcanizing agent must also be considered. Both substances are necessary for the vulcanizing of tyres. Zinc oxide with lead and cadmium impurities (about 0.2% lead and 0.001% cadmium) can release heavy metals into nature. Theoretically sulphur can cause acidification through acid rain. However, the amount of sulphur in tyres is minimal compared to other sources in society.

The wearing surface of the tyre gets dispersed into nature as particles and chemicals as the tyre wears against the road surface. Rubber degrades very slowly in nature. Fine particles take several years to degrade. There is little scientific knowledge about the effects of the chemical compounds from rubber material in nature. The particles emitted from the road surfaces are also a significant risk to human health and the environment. Unfortunately, the ecolabelling criteria for tyres cannot also include requirements for roads.

Over 80% of the raw material in tyres comprises processed oil or natural gas, i.e. non-renewable natural resources. Accordingly the energy content of a new tyre is very high and a used tyre still contains 70-80% of the initial energy. The energy content of the materials of a new passenger car tyre exceeds 300 MJ, which corresponds to 7-8 kilograms of heavy crude oil. Due to the large amounts of sulphur and other components in the tyre, a tyre is not as attractive as other fuels for incineration. Accordingly it is important that a tyre has a long service life, that the tyre body can be retreaded, that retreaded tyres are of high quality and finally that worn tyres are reused, primarily as material and secondarily as energy. In the Nordic countries the state/authorities have together with tyre sellers, the tyre industry and retreading agencies agreed on the collection and reuse of used tyres. It is not allowed to dispose of tyres on rubbish heaps/dumps.

Nano materials

Of the materials used in the production of tyres some are small enough to be nanoparticles, made of metals or oxides and are used mainly as chemical catalysts.

Nanoparticles are of great scientific interest as they are effectively a bridge between bulk materials and atomic or molecular structures. When materials are made into nanoparticles their surface area to volume ratio increases. The greater specific surface area (surface area per unit weight) may lead to increased rate of absorption through the skin, lungs, or digestive tract and may cause unwanted effects to the lungs as well as other organs. However, the particles must be absorbed in sufficient quantities in

order to pose health risks³. The ecolabelling criteria for tyres haven't included requirements for nanomaterial in tyres in version 3.0.

Production

The manufacturing of tyres consumes energy during the mixing and preparation of rubber compounds and the vulcanization process. Buffing and retreading the old wearing surface and the vulcanization processes require significant amounts of energy. Nonetheless, it is not appropriate to limit energy consumption during manufacturing or raw material extraction since tyres comprise small amounts of a range of raw materials. Energy calculations are not sufficiently exact in such a situation. Energy consumption also varies between different machines in production. Accordingly, an exact limit value for energy consumption has not been set in the present criteria.

Organic soaking agents and rubber adhesives are used during production to join different rubber compounds. Soaking agents cause emissions to air during production. Retreading may also cause the emission of small particles, but no limit value has been established in the current criteria since no technical decision has been taken.

The handling and recovery of production waste is important to minimize the quantity of rejects that are disposed of and maximise the re-use of materials. In many cases, waste handling is controlled by legislation in the Nordic countries. Nonetheless it is still useful to develop waste and reject handling procedures.

Use of tyres

Environmentally beneficial characteristics of a tyre in use include low rolling resistance, low noise level and good durability.

New road vehicles must for many reasons reduce their fuel consumption. A tyre influences fuel consumption by its weight, its aerodynamic resistance and its rolling resistance. Approximately 13-20% of a vehicle's fuel consumption is due to the tyres. By decreasing the rolling resistance of a vehicle's tyres by 35% it is possible to reduce fuel consumption by 5% and lower exhaust emissions. A 5% reduction of fuel consumption equals as an average a reduction of 7.75g CO₂ eq/car /km. With an average driving distance per year of 15000km the reduction is 116 kg CO₂ eq/car /year. Other exhaust emissions such as HC, NO_x and PM₁₀ that may cause adverse effects will also decrease.

The majority of noise from a modern vehicle comes from the tyres. Noise pollution is an environmental problem in the society. The engine and drive train of vehicles have

³ [Small Sizes that Matter: Opportunities and Risks of Nanotechnologies](http://www.oecd.org/dataoecd/37/19/37770473.pdf), Joint report of the Allianz Center for Technology and the OECD International Futures Programme, ed. Dr. Christoph Lauterwasser, OECD.org 18 July 2007
<http://www.oecd.org/dataoecd/37/19/37770473.pdf>

been made increasingly quieter. By reducing noise emissions from tyres it is possible to reduce road traffic noise considerably.

Tyre performance and the effect this has on vehicle handling is a combination of several factors. Environmentally beneficial characteristics of a tyre may have a negative impact on other technical characteristics.

In the draft criteria, the expert group focuses on the rolling resistance, noise level, safety and durability of tyres. The group believes that improved product development and innovative solutions to the different characteristics can enable the fulfilment of both the environmental requirements and the important technical and driving characteristics.

Safety is a fundamental characteristic of tyres in traffic. The environmental requirements are designed not to compromise the normal safety of the tyre.

Reuse of tyre carcasses

To minimize the demand and use of natural resources for tyre production, it must be possible to reuse the tyre body.

Passenger car tyres may be retreaded once while tyres for heavy vehicle may be retreaded several times. In Finland, heavy vehicle tyres are retreaded an average of 2.5 times. In the other Nordic countries, heavy vehicle tyres are on average retreaded twice. Retreading is significantly more commonplace among heavy vehicle tyres than passenger car tyres.

Nowadays it is unfortunately difficult to purchase sufficient numbers of quality carcasses. Used tyres are scrapped for various reasons: The construction of the tyre body is not sufficiently strong; the tyre has been abused and the carcass is damaged; or the dimensions of the carcass vary so much that they do not meet the quality requirements of retreads. Accordingly, the lifetime of the carcass can be influenced by tyre manufacturers, tyre sales and the consumers using the tyres. Depending on these factors, the service life of a new passenger car tyre is approximately 40-50 kkm. The service life of heavy vehicle tyres is greater; approximately 120-170 kkm.

Retreading shall not impair the characteristics of the tyre or have a negative impact on the fuel consumption of the vehicle. The UN Economic and Social Council has compiled E rules for retreading that will be introduced within the years to come. The dimension variations specified in the rules are adapted to the standards for new tyres. Dimension variations in the circumference and wearing surface of retreaded passenger car tyres allow a weight variation of tread rubber greater than one kilogram. Accordingly it is possible to produce heavier retreaded tyres than the corresponding new tyres. The weight of the tyre affects the rolling resistance and by extension the fuel consumption of the vehicle. The expert group believes that, taking consideration to the environment, retreaders should use only the necessary amount of new rubber compound and proposes a tolerance limit to weight. This is incorporated in the quality requirements for retreads.

The retreading of heavy vehicle tyres differs from the retreading of passenger car tyres. The method of retreading varies between the Nordic countries. Pre-curing is common in Finland and Sweden but mould curing is more popular in Norway and Denmark. The differences between the techniques are small and do not require consideration in the environmental requirements. In the case of pre-curing, carcasses are transported directly from consumers to retreading and again back to the consumer. In the case of mould curing, the market is open and specified tyre collection systems are used. In pre-curing the identification of different types of carcass is possible. Mould curing makes it difficult to identify the original carcass after one vulcanization unless extra markings are used.

Recycling of used tyres

Tyres should be recycled. Material recovery is the preferred method followed by energy recovery. The method is regulated by legislation on waste. Since the Nordic countries have a co-ordinated collection and recycling system for used tyres, the expert group does not have any views on recycling in particular. Rubber material that has been removed during tyre production or retreading shall also be recycled as material or energy.

4 General Background to the Requirements

Rolling resistance (requirement R2)

Rolling resistance is an important characteristic of the tyre that influences the fuel consumption of the vehicle. The current high fuel prices have a large impact on running costs. Costs can be reduced by lowering the rolling resistance of the tyres. On the other hand, the rolling resistance cannot be made too low since this will impair safety. Further, possibilities to test a tyre are limited and the costs of testing are quite high. These factors have been taken into account in the development of the ecolabelling criteria.

Passenger car tyres

Each variation in load index and tread type must be tested. In other words, if the tread pattern has been changed, tests must be performed for this new tread type. In addition, the results from tyres with the largest load index in each load index category must be submitted.

Documentation requirements for retreaded tyres have been changed compared to version 1.2. Rolling resistance is the result of the carcass (70%) and the tread pattern (30%). Retreaders cannot influence the carcasses coming in for retreading. They can on the other hand influence the quality aspects of retreading. These quality aspects have been considered in the additional requirements for retreads (weight variation of retreaded tyres). Weight also affects rolling resistance. Accordingly, retreads weight tolerances are set for retreads. Test results must be submitted for the specific tread pattern and the largest load index in each load index category.

Bus and truck tyres

The test matrix for rolling resistance differs from that for passenger car tyres. This is partly due to the different use of heavy vehicle tyres in different locations on the vehicle. Tyres on steering, drive and trailer axles can differ from each other regarding material composition and size. The chemical composition of tyres may also differ between all-season and winter tyres. These facts are taken into account in criteria development. The limited scope for retreaders to test tyres is also considered. Accordingly, the matrix for testing is designed to utilize information from corresponding new tyre carcasses. Rolling resistance is mainly influenced by carcass design and tread pattern. Retreaders can not control which carcasses arrive for retreading. Retreaders do however control the quality aspects of retreading (inspection of incoming and outgoing tyres). On this basis, some additional requirement on quality are set for retreaded tyres (requirement in Section 5.2).

Noise (requirement R3)

Tyre noise is primarily dependent on the pattern and composition of the tread rubber. The tyre carcass also has an influence on noise levels.

Passenger car tyres

The proposed limit values and measuring method (92/23/EEC) primarily follow the future European directive on the noise level of tyres. The limit values as established in the proposed criteria are more demanding for broader tyres. The limit values in the draft EU directive are just being introduced and are the following:

Table 3. EC directive proposal for tyre noise.

Nominal section width (mm)	Limit values in dB(A)	Limit values in dB(A)
= 145	72 *	71*
>145 = 165	73 *	72 *
> 165 = 185	74 *	73 *
> 185 = 215	75 **	74 **
>215	76 ***	75 ***

*) Limit values in column A shall apply until 30 June 2007.

*) Limit values in column B shall apply as from 1 July 2007.

**) Limit values in column A shall apply until 30 June 2008.

**) Limit values in column B shall apply as from 1 July 2008.

***) Limit values in column A shall apply until 30 June 2009.

**) Limit values in column B shall apply as from 1 July 2009.

Noise is mainly dependent on carcass design and the tread pattern. Retreaders can not influence which carcasses arrive for retreading. Testing must be performed for to each tread pattern and section width. In other words, if the tread pattern changes, testing must be performed for this tread rubber type. In addition, the results of the testing shall be based on the largest dimension in each nominal width category. Retreaders must also pass extra requirements on quality aspects.

2009 revision

Tyre class	Nominal section width (mm)	Limit values in dB(A)
C1a (new)	= 185	69
C1b (new)	185 = 215	70
C1c (new)	215 = 245	70
C1d (new)	245 = 275	71
C1e (new)	> 275	73

Bus and truck tyres

Different tread rubber compositions are used in all-season and winter tyres. Further, retreaded treads differ from new ones. Even the tread rubber quality can differ between the tyres used on front and rear axles. This can cause some practical difficulties in testing tyres due to the large number of variables. Limit values of 76 dB(A) and 78 dB(A) for tyres have been established.

2009 revision

Tyre class	Nominal section width (mm)	Limit values in dB(A)
C2	Normal	71
	Drive axel tyre	72
C3	Normal	72
	Drive axel tyre	74

The smallest and largest nominal rim diameter of each variation in tread pattern must be tested. In other words, if the tread pattern changes, testing must be performed for this tread rubber type. Noise is mainly caused by the tyre carcass and the tread pattern. Retreaders can not influence which carcasses arrive for retreading. They can however influence the quality aspects of retreading. Accordingly, retreaders must document the results of corresponding new tyres with the same carcass. To ensure that the quality

aspects of the retreaded tyres are high, an additional requirement for work quality has been established (requirement 5.2).

The chemical aspects of passenger car and heavy vehicle tyres are fairly similar. Subsequently, similar requirements have also been established.

Polycyclic aromatic compounds (PAH) Replaced in version 3.0, 2009.

The expert group did established the requirement for the content of polyaromatic hydrocarbon (PAH) in process oil and further, documentation concerning PAH compounds in the extract from tread rubber. However, this criterion where replaced in version 3.0 since Commission Directive 2005/69/EC prohibits the use of oils containing PAH in all tyres sold in EU member states as of 2010, but PAH content in carbon black is not regulated.

Lead and cadmium impurities in zinc oxide (requirement R4)

Optimizing the use of zinc oxide in the wearing surface to the minimum necessary amount for vulcanization also influences the amount of zinc and its impurities, lead and cadmium. A certain amount of zinc oxide is always needed for the tyre to fulfil its function. However lead and cadmium are impurities in zinc oxides. Considering the environmental aspects, the amount of cadmium that through wear the tyre spreads in the environment is relatively low compared with the other sources of emission. However, the total pollution caused by heavy metals as a result of tyre wear in the Nordic countries is estimated to be in the region of 700 tons of zinc and one ton of lead per year. Because technical factors influence the use of zinc oxides, the expert group decided to set a quality requirement for the purity of zinc oxide. The maximum impurity concentration allowed in zinc oxide is 0.10% for lead and 0.006% for cadmium. Typically, lead concentrations in zinc oxide vary between 0.03% and 0.3%. The corresponding range of cadmium in zinc oxide is 0.001% to 0.10% in the world market. Pharmaceutical grade zinc oxide is the purest, but this grade is not appropriate to use in the rubber industry due to its cost. This requirement is quite easy to control even in global passenger car tyre manufacturing since zinc oxide used is specific to each tyre.

On 3 December 2008, the Secretariat Manager Meeting decided to change the maximum concentration of cadmium impurities in zinc oxide from 0.006% to 0.01% to agree with REACH.

Consumption of organic solvents (requirement R5)

Limit values for volatile hydrocarbons have been established in accordance with Council Directive 99/13/EC. This directive applies to production units for rubber products that on an annual basis use more than 15 tons of organic solvents. It restricts the amount of solvent that may freely evaporate into the air to 25%. The legislation came into full force in 2004 for new production units and in 2007 for existing ones. Emission levels are difficult to monitor, why the ecolabelling requirement is based on the consumption of organic solvents instead of the emissions. A limit value of 0.40 weight-% for organic solvents used in the production or retreading of tyres was

established. Nowadays many of the substances used in processes are water soluble and the amount of those non-harmful chemicals in production must be increased. Subsequently, the requirement for passenger car tyres is also being changed: the limit value of 0.50 weight-% has been changed to 0.40 weight-% to reflect current production better.

The requirement applies to individual tyres, not the entire production line, to make it easier for global manufacturers to document this requirement and apply for a licence.

2009 revision

A clear definition of “volatile organic compounds” was added to the criterion *Volatile organic compounds are defined for these purposes as volatile organic compounds with an initial boiling point that is lower than or equal to 250°C measured at a normal pressure of 101.3 kPa. Volatile organic substances that include one or more benzene rings are referred to as volatile aromatic compounds.*

PAH content from Carbon black (requirement R6)

Carbon black could possibly contribute to a content of PAH in tyres even after the introduction of the Directive 2005/69/EC. This has “Der Blaue Engel” observed and compensated for in their tyre criteria from January 2009. The Nordic Swan has inspired by those criteria inserted a similar criterion in version 3.0 for tyres with Carbon black.

Production waste (requirement R7)

A waste plan is required. The purpose is to reuse as much production waste as possible.

Customer information: Passenger car tyres (requirement R8)

The expert group believes that customer information is necessary for passenger car tyres. Users of bus and truck tyres are predominantly professional and know more about the safety aspects of tyres. On this basis, the requirement on information applies only to passenger car tyre manufactures and retreaders.

Substances dangerous for the environment and human health (concerning only heavy vehicle tyres; requirement R10)

When restricting the use of substances in tyres that are dangerous for the environmentally and human health the main emphasis has to be on important protective agents. A limit value of 0.85% is set for chemicals which are classified as dangerous for the environment and human health according to Council Directive 67/548/EEC on the classification, Packaging and labelling of dangerous substances for substances with risk phrases R45, R46, R49, R50+R53, R51+R53, R52+R53, R60 or R61. This requirement applies only to heavy vehicle tyres. Protective agents are primarily technical chemicals that are necessary to preserve the properties of the tyre. The proportion of protective agents in heavy vehicle tyres is higher than in passenger car tyres since less rubber and other additives are used in tyre manufacturing, and also because heavy vehicle tyres are retreaded two or even three times. See also table 2.

However, the requirement on passenger car tyres have been omitted because manufacturers of passenger car tyres are global and global producers can have some difficulties in documenting the requirement. The reason for omitting the requirement is mainly due to the request from the Scandinavian Tyre and Road Association (STRO).

Table 2 Compound recipes in general form for passenger car tread and heavy vehicle tread.

MATERIAL	PASSENGER CAR TREAD	HEAVY VEHICLE TREAD
	Amount in phr (*	Amount in phr (*
POLYMERS (rubbers)	100	100
FILLERS	80	50
ACTIVATORS (includes several chemicals)	6	6
PROCESSING OIL	50	5
PROTECTING AGENTS (includes several chemicals)	3	3
CURING SYSTEM (includes several chemicals)	5	5
TOTAL	243	168

A certain amount of protecting agent is needed to protect the rubber. Due to the different basic composition of heavy vehicle tread compound, the relative amount of protecting agent is higher than for passenger car tread compound:

passenger car tread	$3 / 243 \times 100\% = 1.2\%$
heavy vehicle tread	$3 / 168 \times 100\% = 1.8\%$

(* phr = parts per hundred rubber = parts by weight per 100 parts by weight of rubber Example: for every 100 g of rubber in a passenger car tread there is 80 g of filler, 6 g of activators, etc.

Safety considerations (requirement R13)

There is no exact laboratory testing methods for friction. In many cases, friction properties are measured in field tests where the road surface, climatic conditions and subjective comparisons can vary. Also, difficulties surround the choice of a reference tyre for comparison. Nonetheless, friction properties are included as a requirement due to their central importance to safety.

Friction properties

The friction properties of an ecolabelled vehicle tyre must be as good as or better than equivalent tyres on the Nordic markets. The test results from field tests must be

established and a comparative examination of different tyres presented. The choice of reference tyre must also be justified.

Durability (requirement R14)

This requirement on the durability of tyres is possible to test under laboratory conditions. Tyres are expected to provide a long service life. High durability saves natural resources, and is especially important for heavy vehicle tyres since these are often retreaded several times. The requirements are based on ECE regulations for verifying better durability. Retread heavy vehicle tyres must also follow ECE quality guidelines regarding the checking, production and inspection of tyres. This requirement may present some problems, especially for retreads since ECE requirements are not yet applicable to retreads.

Other requirements in Section 2

Other requirements including meeting the requirements laid down by the authorities, quality assurance, eco-assurance and the marketing of tyres. These requirements are generally comply with the principles of ISO 9 000 system and ISO 14 000 system. These systems help to document the requirements described in Section 2.

5 Changes compared to version 2.x

Revision 2009

The order of the requirements in version 3.0 has been changed/adjusted to correspond to the new criteria template.

The following chapters have been changed or added in version 3.0 compared to version 2.4:

- Lay-out has been changed.
- The test methods and standards have been updated.
- Requirement regarding PCA compounds has been removed, in version 3.0
- Requirement regarding rolling resistance has been changed (criterion K2 in version 3.0).
- Requirement regarding noise has been changed (criterion K3 in version 3.0).
- Requirement for the documentation of lead and cadmium as impurities in zinc oxides in tyres has been changed (criterion K4 in version 3.0).
- Documentation regarding consumption of organic solvents have been adjusted (criterion K5)
- Requirement of safety has its own criterion (criterion K12 in version 3.0).
- Requirement for durability has its own criterion (criterion K13 in version 3.0).

6 New requirements

The next revision will focus on:

Improved rolling resistance for bus and truck tyres.

Good performance even when tyres are worn.

7 References

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