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Materials obtained from end of life tyres — Quality criteria for the selection of whole tyres, for recovery and recycling processes

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National foreword

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Materials obtained from end of life tyres - Quality criteria for the selection of whole tyres, for recovery and recycling processes

Matériaux issus de pneumatiques en fin de vie - Critères qualitatifs de sélection de pneumatiques entiers pour des procédés de récupération et de recyclage

Materialien aus Altreifen - Qualitätskriterien für die Auswahl von ganzen Reifen für Verwertung und Recycling-Prozesse

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European foreword

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Introduction

The purpose of this document is to establish general and specific criteria for the use of whole tyres in recycling processes and in material recovery into different applications, mainly in the field of civil engineering.

This document does not provide any criteria to select whole tyres to be reused in their original application, i.e. to be mounted on a vehicle. See Figure 1 for an overview of the whole process.

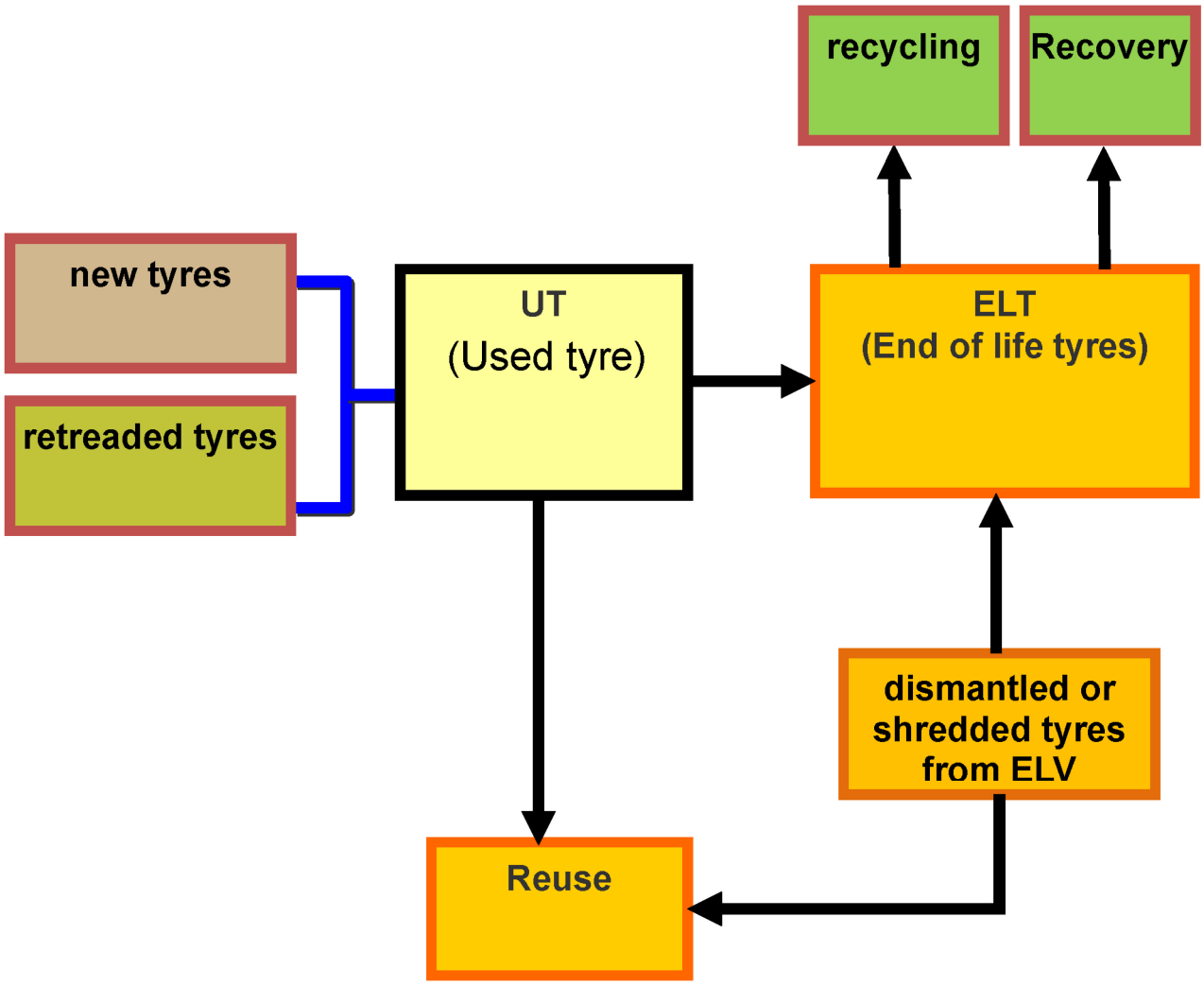

Figure 1 — General scheme of the process to generate end of life tyres and their final processing

The criteria established in this document focus on determining the conditions under which a whole end of life tyre (WELT) can be used for materials recovery.

From a legal point of view, in Europe, end of life tyres are considered as waste, listed in the European Waste Catalogue with code 16.01.03, tyres removed from vehicles.

The criteria for establishing when ELT cease to be waste are ultimately drafted in the EU legislation, by the relevant Directives and their further adoption into national regulations.

The purpose of this document is to facilitate those who make the decision to establish the end of the waste status. This document also aims to overcome the limitations to the use of WELT in certain

applications and to clarify the conditions under which they can be used for recycling or recovery process in compliance with all conditions ensuring no negative impact to health and environment.

The document aims to increase consumer confidence in the applications of used tyres and facilitate the development of the market by the introduction of a specific set of parameters to ensure the quality and consistency of whole tyres to be used for both in recycling and recovery applications.

Compliance with the criteria set in this standard, results in the protection to the human health and the environment.

WARNING — This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This European Standard provides criteria for the selection of whole end-of-life tyres (WELT) under different classes based on their size. It also provides criteria for determination of their suitability to be used in recycling and material recovery processes.

The processes described in this document include sorting of WELT in order to determine their acceptance in recovery and recycling processes.

Criteria regarding the reuse of tyres to be mounted again in a vehicle are not addressed in this document.

This document does not cover the operational performance of the applications or the requirements of the materials for certain applications, which are usually agreed between the manufacturer and the customer.

Solid tyres are excluded from the scope of this document.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4223-1, *Definitions of some terms used in the tyre industry — Part 1: Pneumatic tyres*

ISO 18604:2013, *Packaging and the environment — Material recycling*

ISO 4000-1, *Passenger car tyres and rims — Part 1: Tyres (metric series)*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in ISO 4223-1 and the following apply.

3.1
aspect ratio
AA
number obtained by dividing the number expressing the nominal section height in mm by the number expressing the nominal section width in mm

3.2
bead
part of a tyre which is of such shape and structure as to fit the rim and hold the tyre on it

3.3
designated applications
collective term for the final use to which tyre-derived rubber material is put within the designated market sector

3.4
inner diameter
RR
represents the dimension of the rim on which the tyre is mounted, usually expressed in inches

3.5
original shape
it is the shape created by a revolution toroid, which maintain its shape in any position without any help

3.6
processor
operator undertaking end of life tyre shredding, crumbing and granulating processes

3.7
quality statement
documentation accompanying each load or consignment of tyre derived rubber materials supplied

3.8
recovery of whole tyres
reprocessing of tyres into applications other than the original intended purpose and excluding the generation of energy

Note 1 to entry: This definition applies only to this document and is not the general definition of recovery that can be found in other standards.

3.9
recycling process
physical, mechanical or chemical process which converts collected and sorted WELT, into secondary (recycled) raw materials, products, excluding energy recovery and the use of the product as a fuel (see ISO 18604:2013)

3.10
reuse of tyres
repeat deployment of used tyres in their original application

3.11
sidewall
part of the tyre, excluding the tread, which is visible when the tyre, fitted to a rim, is viewed from the side

3.12
size reduction process
process of cutting and/or grinding whole tyres using a mechanical equipment

3.13
structure
technical characteristics of the tyre's carcass

3.14
tyre tread
part of a pneumatic tyre that normally comes in contact with the ground

3.15
tyre width
WWW
linear distance between the outsides of the sidewalls, usually expressed in mm

3.16
Whole End of Life Tyre
WELT
any pneumatic tyre removed from any vehicle and not selected to be mounted on a vehicle again

4 General information on tyres

4.1 General

The information on tyres contained in this clause is not related with the recycling and recovery itself but pretend to maintain homogenous criteria on this step in comparison with the general concepts and information related with new and in use tyres.

4.2 Categories of whole tyres

Different applications of the WELT may require different properties such as crush strength, shock absorption and vibration absorption to ensure the feasibility of the recovery process.

These properties will depend in many cases on the category of tyre which also determines its dimension. The categories of tyres are the following:

— Scooter, Motorcycle

— Passenger car

— Light trucks

— Truck and bus

— Industrial Agro and Forestry

In addition to these categories there are also solid tyres, which rather than a hollow structure, are completely filled with elastomeric material. This kind of tyres have different physical characteristics, and are not covered by this document.

4.3 General composition of tyres

Each single tyre has its own specific chemical composition. Nevertheless, all tyres here considered will contain rubber, metal and textile. The percentages of these materials typically depend on: size, type of tyre, intended use for the tyre and the manufacturer. The typical materials breakdown in percentages is shown in Table 1.

Table 1 — Average composition of different categories of tyres

Material	Passenger car average composition	Truck and bus average composition
Rubber	78 %	75 %
Metal	16,5 %	25 %
Textile	5,5 %	1 < %

4.4 Relevant information from tyre marks

Generally, tyres are marked with several inscriptions providing useful information for their use when mounted on a vehicle. For WELT, most of this information is not relevant for recycling and recovery purposes. The main parameters useful for this purpose are the size and the age.

The size usually determines both the process and the WELT possible application in the form of whole tyre. Especially for civil engineering applications a classification by sizes is important to allow the uniformity of the structures to be built. There are three dimensional parameters generally selected for their characterization:

— Tyre width (WWW)

— Aspect ratio (AA)

— Inner diameter (RR)

With some exceptions, those three parameters are marked in the sidewall of the tyres in the following way:

WWW / AA - RR

NOTE Further explanation on tyre marks can be found in ISO 4000-1.

The age of the tyre is located on the sidewall, expressed as date of manufacture. It is marked in the form of a group of four digits, the first two showing the week and the last two the year of manufacture.

For tyres manufactured before 2000, rather than two, there are three digits marked on sidewall, the first two digits expressing the week and the last digit expressed the year of the decade of 1990s.

5 General criteria for selection of tyres

5.1 General

The main reason to establish acceptance criteria for whole used tyres to be recycled and/or recovered is to avoid the introduction in those processes of material which might lead to a non-conformity product.

5.2 describes some features that could affect the potential use of WELT and 5.3 establishes the requirements for selection.

The general requirements for the selection of whole tyres aim to avoid the introduction of harmful substances via contamination, which might impact on human health, environment, or on the quality of the products or applications obtained.

The compliance with the requirements established in this document does not guarantee the suitability in the recycling or in their use in several applications, as it depends on other factors related to the application itself.

5.2 describes some features that could affect the potential use of WELT and the 5.3 establishes the requirements for selection.

5.2 Criteria for the selection and use of whole tyres

5.2.1 Source

Tyres might come from stockpile or other location where they have been mixed with any other type of waste. In such a case, care should be taken in order to ensure that WELT are not contaminated by other waste.

5.2.2 Exposition to fire

WELT might come from stockpiles that have been exposed to fire. In those stockpiles, even those tyres not yet being burned, have been into contact with the compounds of decomposition of the tyre caused by fire.

Tyres that have been partially burnt or that may be contaminated by burning tyres shall not be used for recycling processes.

5.2.3 Presence of greases and oils

Depending on the source, some tyres might have been in contact with greases and oils that may contaminate the materials obtained in the recycling process or affect its use in most applications. It is especially important to avoid such tyres in a recycling process.

5.2.4 Fillings

Some tyres are filled with polymeric material in order to prevent punctures during their use in vehicles. The composition of these tyres is different from the tyres covered in this document and could affect the quality of the recycling product applications and the characteristics of whole tyres.

5.2.5 Dirtiness

Tyres might be contaminated with mud, soil, or may include stones, gravel, sand or any other rigid materials. These materials could be easily removed from the tyres and WELT should be properly cleaned prior to their processing or delivery to the next agent in the chain.

5.2.6 Painted tyres

Some tyres might be painted. Paintings usually contain specific chemicals not compatibles with some uses of the recycled rubber and therefore, in all cases, it shall be confirmed that the painted tyres do not interfere with their intended use in the recovery processes. E.g. painted tyres could be used in safety barriers.

This type of tyres should not be used for recycling processes.

5.2.7 Tyres fitted on rims

Usually collectors receive the tyres without the rims. Therefore, before supplying them to the recycling and recovery process, WELT shall be revised to be free from rims.

5.2.8 Inner tubes

Collectors might receive some tyres with inner tubes. Therefore, before supplying them to the recycling and recovery process, WELT shall be revised to be free from inner tubes.

5.2.9 Water content

As WELT are traded by mass, the presence of water could affect the real quantity of transactions. Therefore, measurements shall be taken to minimize the presence of water in WELT.

5.3 General selection requirements

Tyres under the conditions described in 5.2.1 to 5.2.4 shall be completely separated from those tyres going to recycling or recovery processes and shall be managed appropriately and in accordance with the criteria established in the relevant legislation.

Tyres under the conditions described in 5.2.5 to 5.2.8 could be managed in a way that they could be considered as valid for recycling and recovery processes, providing that actions are taken to fulfill those criteria. E.g. if stones and mud are cleaned, tubes or rims are removed, etc.

Tyres not fulfilling any of these requirements shall not be used in recycling or recovering processes. Therefore, they shall be managed appropriately, according to relevant legislation, e.g. energy recovery or other options.

A summary of the above explained can be seen in Table 2.

Table 2 — Summary of general selection requirements

Criteria	Applications as WELT	Recycling process
Stockpile origin	N.A.	N.A.
Exposition to fire	N.A.	N.A.
Presence of grease or oil	N.A.	N.A.
Presence of fillings for puncture repairing	N.A.	N.A.
Presence of dirt (mud, stones, etc.)	Possible if cleaned	Possible if cleaned
Painted tyres	Possible for certain applications	Better avoided
Presence of rims	Possible if removed	Possible if removed
Presence of inner tubes	Possible if removed	Possible if removed
Presence of water	Should be minimized	Should be minimized
N.A.: not appropriate.		

6 Specific criteria for whole tyres to be recycled or to be used in recovery applications

6.1 Specific criteria for whole tyres to be recycled

In case different categories of WELT are mixed, the percentage in weight of each tyre category (passenger car /truck and bus/other) shall be reported to the processing facility.

6.2 Specific criteria for whole tyres to be used in recovery applications

6.2.1 General

When whole tyres are intended to be used for any specific application, one or more of the following criteria might also be applicable.

6.2.2 Visual aspect

The tyres shall keep its original shape.

Whole tyres shall not have visible damage in their structure. Specifically, tyres beads shall not present any cut for all applications.

6.2.3 Depth of tread pattern

The depth on the tread pattern can be relevant for several applications. E.g. usually tyres intended for safety barriers in race circuits require minimum depth.

6.2.4 Structure of tyres

Structure of whole tyres selected shall be declared; e.g. bias-belted, radial or diagonal.

6.2.5 Age of tyres

For some specific applications the age of the tyre could also be important and shall be registered and reported.

6.3 Specific selection requirements

These requirements are additional to those expressed in Clause 5.

Whole tyres to be recycled shall comply with the criteria in Clause 5 and 6.1.

All the tyres for recovery applications shall fulfil the criteria in Clause 5 and 6.2.

Tyres not fulfilling criteria in 6.2 shall not be intended for recovery applications and therefore their use is limited to recycling applications.

Tyres not fulfilling any of these requirements shall not be used in recycling or recovering processes. Therefore, they shall be managed appropriately, according to relevant legislation, e.g. energy recovery or other options.

7 Control and inspection

When used as a whole tyre in their final application, tyres shall be individually inspected, either visually or by other means (e.g. artificial vision, X-ray, etc.).

8 Storage of whole tyres

The storage shall not alter the selection of materials performed and shall avoid the contamination, damage and change in relevant features expressed in Clauses 5 and 6.

The operator performing the selection process maintains responsibility for the materials until it is delivered to the next user in the process chain.

9 Records

Records established to provide evidence of conformity to requirements and of the effective process of recycling and recovering shall be controlled.

Records shall remain legible, readily identifiable and retrievable for a minimum of 5 years.

10 Selection report

The operator responsible for supplying the tyres shall record the process of selection used, which should include at least the following information:

a) Information relating to the procedure established to ensure the compliance of quality criteria.

b) Quantities of tyre selected.

c) Types of whole tyres.

d) Dates and procedure of selection.

e) Name of the operator that have selected tyres.

f) Any relevant information related with the selection procedure.

Annex A
(informative)

Examples of applications

Example 1: Wave height reducer

The contact with water and need of a regular structure is necessary for the fulfilment of requirements of this application.

Figure A.1

Example 2: Safety barrier for race circuits

Regularity of the structure and no damage in tyres are essential requirements. According with FIA guidelines, tyres intended to be used in these barriers shall also preserve a minimum depth in the tread pattern.

— Landfill engineering.

— Civil engineering.

— Quarry reconstruction.

— Sports, fields and playgrounds.

— Sand pit.

— Urban furniture.

— Docks.

— Seats for swings and other playground equipment.

— Climbing equipment, or as damping element for some playground equipment (for “springs” or rocking equipment).

Figure A.2

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

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