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BSI Standards Publication

Biobased products — Overview of standards

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National foreword

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Biobased products - Overview of standards

Produits biosourcés - Vue d'ensemble des normes

Biobasierte Produkte - Übersicht von Normen und Standards

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Foreword

This document (CEN/TR 16208:2011) has been prepared by Technical Committee CEN/BT/WG 209 “Bio-based products”,, the secretariat of which is held by DIN .

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1 Scope

This Technical Report analyzes a set of standards, documents and other reports, related to bio-based products. The report is limited to the aims of mandate M/429 on bio-based products, and hence excludes traditional products, energy applications and food.

2 Criteria & approach

2.1 Results presented in this report

1. Criteria and approach

2. A standards and documents analysis matrix, which identifies relevant standards, manuals and reference documents on bio-based products, and their relevance to pre-defined criteria

3. A chapter with descriptions of the scope of all the relevant standards, manuals and reference documents; an evaluation of the applicable criteria to each paper ('horizontal assessment" of the matrix)

4. A chapter with an evaluation of coverage per criterion and the resulting gap ("vertical assessment" of the matrix)

5. Conclusions

Sources of information include:

— EU Lead Market Initiative documents (LMI);

— standards (CEN, ASTM, ASME, BSI, VDI);

— web posted information such as certification schemes; and

— knowledge of Task group members;

2.2 Criteria list

In relation to bio-based products, the following criteria are evaluated in this report:

1. Bio-content / Amount of Renewable Raw materials;

2. Product Functionality / Technical Performance ;

3. End of life:

    a. Biodegradability;

    b. Compostability;

    c. Recycling;

    d. Durability.

4. Life-Cycle Assessment:
    a. GHG emissions;
    b. Energy use;
    c. Other LCA criteria.
5. Sustainability:
    a. Environmental;
    b. Social;
    c. Economic.

2.3 Analysis approach

The documents in the gap-analysis matrix are evaluated by their relevance. First, their scope is presented. Then their applicability for bio-based product standards in general terms is evaluated. This is the horizontal evaluation.

A vertical evaluation on each criterion will be presented, in order to highlight coverage and gaps.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Existing definitions [and their source(s)] of the evaluated criteria are listed below.

3.1 Bio-content / Amount of renewable raw materials

3.1.1
bio-based
derived from biomass

[CEN BT/WG 209]

3.1.2
bio-based carbon content
carbon in a sample that is of recent origin, as evidenced by its 14C isotope content

NOTE 1 The amount of bio-based carbon in the material or product is often expressed as a percent of the weight(mass) of the total organic carbon of the product

[CEN/TR 15932]

NOTE 2 ASTM D6852-02 defines bio-based content as the amount of bio-based material as fraction weight or percent weight of the total material

3.1.3
bio-based product
product wholly or partly bio-based

NOTE The bio-based product is normally characterised by the bio-based content.

[CEN BT/WG 209]

3.1.4
biomass
material of biological origin excluding material embedded in geological formations and/or fossilized

NOTE This definition refers to the well-known short-cycle of carbon, i.e. the life cycle of biological materials (e.g. plants, algae, marine organisms, forestry, micro-organisms, animals, and biological waste from households, agriculture, animals and food/feed production).

[CEN BT/WG 209]

3.1.5
biomass content
mass fraction of bio-based material

NOTE Claim of biomass content is difficult to verify due to lack of standards.

[CEN/TR 15932]

3.1.6
renewable raw material
material used to produce a product and replenished by natural processes at a rate comparable to its exploitation rate

[Adapted from ISO 14040 and CEN/TR 15932]

3.2 Product functionality / Technical performance

3.2.1
product
any goods or service

[ISO 14040:2006]

3.2.2
product function
characteristic attribute or characteristic in the performance and use of a product

[ISO 14024:1999]

NOTE The first criterion to be considered in the choice of materials and design of a product is that it shall perform the function for which it is intended to an acceptable standard. These criteria will vary depending on the application but the key requirements are:

— meeting legal and statutory requirements including for example composition control and migration limits for food contact, physical performance for containing of hazardous products;

— functional including physical strength, hygiene, safety and barrier performance;

— use performance including opening, closing, pouring/emptying, child resistant;

— minimum use of material, consistent with the three points above;

— content identification and communication.

The specifications of the product should be defined by the performance requirements, and not by the source of material.

3.3 End of life / Biodegradability / Compostability / Recycling / Durability

3.3.1
biodegradation
degradation caused by biological activity especially by enzymatic action leading to a significant change of the chemical structure of a material

[EN 13193:2000]

3.3.2
biodegradable
capable of undergoing biological anaerobic or aerobic degradation leading to CO_2, H_2O, methane, biomass and mineral salts depending on the environmental conditions of the process

[CEN/TR 15932]

3.3.3
compostability
potential of a material to be disintegrated and biodegraded without hindrance in a composting process

[Based on EN 13193:2000]

3.3.4
durability
capability of a product or any component to satisfy, with planned maintenance, the design performance requirements over a specified period of time under the influence of the environmental actions, or as a result of a self-ageing process

[Adapted from ISO 15928-3]

3.3.5
maximum level of biodegradation
degree of biodegradation, measured in percent, of a chemical compound or organic matter in a test, above which no further biodegradation takes place during the test

[ISO 14853:2005]

3.3.6
organic recycling (organic recovery)
aerobic (composting) or anaerobic (biomethanization) treatment, under controlled conditions and using microorganisms, of the biodegradable parts of waste, which produces stabilized organic residues or methane. Landfill shall not be considered a form of organic recycling

[adapted from Directive 94/62/EC]

3.3.7
recycling
reprocessing in a production process of the waste materials for the original purpose or for other purposes including organic recycling but excluding energy recovery

[Directive 94/62/EC]

3.3.8
ultimate biodegradability
breakdown of an organic chemical compound by micro-organisms in the presence of oxygen to carbon dioxide, water and mineral salts of any other elements present (mineralization) and new biomass or in the absence of oxygen to carbon dioxide, methane, mineral salts and new biomass

[EN 13432:2000, also in EN 14995:2006]

3.4 Life-Cycle Assessment / GHG emissions / Energy use / Other LCA criteria

3.4.1
greenhouse gas
GHG
gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds

NOTE GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro-fluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6)

[ISO 14064-1:2006]

3.4.2
greenhouse gas emission
total mass of a GHG released to the atmosphere over a specified period of time

[ISO 14064-1:2006]

3.4.2
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal

[ISO 14040:2006]

3.4.3
life cycle assessment (LCA)
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[ISO 14040:2006]

3.4.4
life cycle inventory (LCI)
collection and assembly of materials and energy input and output data for a specified product system

NOTE LCI is only one of the phases in conducting an LCA and is not an assessment of the environmental impacts associated with the product system

[ASTM D 7075 – 04]

3.5 Sustainability / Environmental / Social / Economic criteria

3.5.1
biological diversity values
intrinsic, ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components

[NTA 8080]

3.5.2
environmental aspect
element of an organization's activity or products that can interact with the environment [ISO 14021:1999]

3.5.3
environmental claim
statement, symbol or graphic that indicates an environmental aspect of a product, a component or packaging

[ISO 14021:1999]

NOTE An environmental claim may be made on product or packaging labels, through product literature, technical bulletins, advertising, publicity, telemarketing, as well as through digital or electronic media such as Internet.

3.5.4
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partially resulting from a products environmental aspects

[Adapted from ISO 14001:2004]

3.5.5
environmental impact assessment
a process of predicting and evaluating the effects of an action or series of actions on the environment, then using the conclusions as a tool in planning and decision-making

[RSPO]

3.5.6
environmental profile or environmental footprint
environmental consequences of the creation of a material, measured in terms of impact indicators such as the generation or recapture of CO2, biodegradability, recycling, and so forth

[ASTM D6852]

3.5.7
product environmental criteria
environmental requirements that the product shall meet in order to be awarded an environmental label

[ISO 14024:1999]

3.5.8
social and economic sustainability criteria
NOTE At the moment there are no clear definitions on social and economic sustainability criteria. This is currently under investigation in CEN/TC 383.

4 Standards and documents analysis matrix

Document Reference	Title		1. Bio-content / Amount of Renewable Raw materials	2. Product Functionality / Technical Performance	3. End of life	a.Biodegradability	b.Compostability	c. Recycling	d. Durability	4. Life-Cycle Assessment	a. GHG emissions	b. Energy use	c. Other LCA criteria	5. Sustainability	a.Environmental	b. Social	c. Economic
ANSI/ASABE S 593:2006	Terminology and Definitions for Biomass Production, Harvesting and Collection, Storage, Processing, Conversion and Utilization	5.1	y	y	y	y	n	n	n	n	y	y	y	n	n	n	n
CEN/TR 15932	Plastics - Recommendation for terminology and characterisation of biopolymers and bioplastics	5.1	y	y	y	y	y	y	n	n	y	y	n	n	y	n	n
ILCD/ELCD	Int Life Cycle Data system handbook and European database	5.2	n	n	y	n	n	y	n	y	y	y	y	n	y	n	n
CR13910 CEN TC 261	Reporting criteria for life cycle analysis for packaging	5.2	n	n	y	n	n	n	n	y	n	n	y	n	y	n	n
ASTM D7075	Standard Practice for Evaluating and Reporting Environmental Performance of Biobased Products	5.2	y	n	y	y	n	n	n	y	n	n	y	y	y	n	n
VDI 4431	Life-cycle management in the manufacturing industry	5.2	n	n	y	n	n	y	n	y	n	n	n	n	y	y	n
ISO 14064-1:2006	Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals	5.2	n	n	y	n	n	n	n	y	y	n	n	n	n	n	n
ISO/WD 14067-1	Carbon footprint of products	5.2	n	n	y	y	n	y	n	y	y	y	n	n	n	n	n
ISO/NP 14046	Water footprint - principles, requirements and guidance	5.2	n	n	y	n	n	n	n	y	y	n	n	n	n	n	n
NTA 8080	Sustainability criteria for biomass for energy purposes	5.2	n	n	n	n	n	n	n	y	y	y	y	y	y	y	y

BEES	USDA green public procurement	5.2	y	n	y	y	y	y	n	y	y	y	y	y	y	y	y
ASTM D6852	Standard Guide for Determination of Biobased Content, Resources Consumption, and Environmental Profile of Materials and Products	5.2	y	n	n	n	n	n	n	y	y	y	y	n	y	n	n
ISO DIS 26000	Guidance on social responsibility	5.2	n	n	y	n	n	n	n	y	y	y	y	y	y	y	y
ISO 14025	Environmental labels and declarations - Type III environmental declarations - Principles and procedures	5.2	n	n	y	y	n	n	n	y	y	y	y	n	n	n	n
ISO 14040 series	Environmental management - Life cycle assessment - Principles and framework	5.2	n	y	y	n	n	y	n	y	y	y	n	n	y	n	n
PAS 2050	Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	5.2	y	y	y	n	n	y	n	y	y	y	n	n	y	n	n
BP X30-323	General principles for an environmental communication on mass market products	5.2	y	y	y	n	n	y	n	y	y	y	y	n	y	n	n
ASTM D6866-6a	Standard Test Methods for Determining the Biobased Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis	5.3	y	n	n	n	n	n	n	n	n	n	n	n	n	n	n
ASTM D7026	ASTM D7026 - 04 Standard Guide for Sampling and Reporting of Results for Determination of Biobased Content of Materials via Carbon Isotope Analysis	5.3	y	n	n	n	n	n	n	n	n	n	n	n	n	n	n
WI 00249737	Plastics - Biopolymers - Determination of biobased carbon content	5.3	y	n	n	n	n	n	n	n	n	n	n	n	n	n	n
EN 15440	Solid recovered fuels - Method of the determination of biomass content	5.3	y	n	n	n	n	n	n	n	n	n	n	n	n	n	n
ISO 15380	Lubricants, industrial oils and related products (class L) - Family H (Hydraulic systems) - Specifications for categories HETG, HEPG, HEES and HEPR	5.4	n	y	y	y	n	y	n	n	n	n	n	n	y	n	n
EU Ecolabel 2005/360/EC	Criteria_for_the_award_of_the_European_Eco-label_to_lubricants.pdf	5.4	y	y	y	y	n	n	n	n	n	n	n	n	y	n	n
Blue Angel	RAL-UZ-48 Readily Biodegradable Chain Lubricants for Power Saws	5.4	n	n	y	y	n	n	n	n	n	n	n	n	y	n	n
Blue Angel	RAL-UZ 64 Lubricants & Forming	5.4	n	n	y	y	n	n	n	n	n	n	n	n	y	n	n

	oils															
Blue Angel	RAL-UZ 79 Hydraulic Fluids	5.4	n	y	y	y	n	n	n	n	n	n	n	n	y	n	n
SS 155434	Hydraulic fluids - Requirements and test methods	5.4	y	y	y	y	n	n	n	n	n	n	n	n	y	n	n
SS 155470	Lubricants, industrial oil and related products (Class L) Specifications for family X (Greases)	5.4	n	y	y	y	n	n	n	n	n	n	n	n	y	n	n
ISO DIS 12924	Lubricants, industrial oils and related products (Class L)— Family X (Greases)— Specification	5.4	n	y	n	n	n	n	n	n	n	n	n	n	n	n	n
EN 14995	Plastics - Evaluation of compostability - Test scheme and specifications	5.4	n	n	y	y	y	n	n	y	n	n	n	n	n	n	n
EN 13432:2000	Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging	5.4	n	n	y	y	y	n	n	n	n	n	n	n	n	n	n
EN ISO 14855-1:2005	Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide - Part 1: General method (ISO 14855-1:2005)	5.4	n	n	y	y	n	n	n	n	n	n	n	n	n	n	n
prCEN/TR 15822	Plastics - Biodegradable plastics in or on soil - Recovery, disposal and related environmental issues	5.4	n	n	y	y	n	n	n	n	n	n	n	n	n	n	n
NF U 52-001	Biodegradable materials for use in agriculture and horticulture — Mulching products — Requirements and test methods	5.4	n	y	y	y	y	n	y	n	n	n	n	n	y	n	n
CEN TS15534-1, 2 & 3	Wood plastic composites	5.4	n	y	n	n	n	y	y	n	n	n	n	n	n	n	n
XP T 25-501	Reinforcement fibres - Flax fibres for plastics composites	5.4	n	y	n	n	n	n	n	n	n	n	n	n	n	n	n
ISO 22621	Plastics piping systems for the supply of gaseous fuels	5.4	n	y	n	n	n	y	y	n	n	n	n	n	n	n	n
Cradle to cradle	Cradle to CradleSM Certification Program	5.4	y	n	y	y	y	y	n	n	n	y	y	y	y	y	n

5 Scope of standards

5.1 Vocabulary

5.1.1 ANSI/ASABE S 593:2006 - Terminology and Definitions for Biomass Production, Harvesting and Collection, Storage, Processing, Conversion and Utilization

5.1.1.1 Scope of ANSI/ASABE S 593

The purpose of this standard is to provide uniform terminology and definitions in the general area of biomass production and utilization. This includes all the terminologies that are used in biomass feedstock production, harvesting, collecting, handling, storage, processing and conversion, bioenergy, biofuels, biopower and bioproducts.

5.1.1.2 Evaluation of ANSI/ASABE S 593

This standard provides a list of 69 definitions related to biomass and production, particularly from an energy point of view. The definitions include three main categories of biomass, which are primary, secondary and tertiary biomass. Animal products are not included in the primary biomass. Bio-based product is defined as fuels, food, feed, chemicals, or industrial materials commercially produced in whole or in-part from biomass materials. The term Greenhouse Gases is explained slightly deviating from the ISO 14064 definition. Other terms are more related to energy and production, and do not overlap with the definitions as posted in this report.

5.1.2 CEN/TR 15932 Plastics - Recommendation for terminology and characterisation of bioplastics

5.1.2.1 Scope of CEN/TR 15932

This Technical Report gives recommendations for bioplastics and biopolymers related terminology. These recommendations are based on a discussion of commonly used terms in this field.

This Technical Report also briefly describes the current test methods state of the art in relation to the characterization of bioplastics and products made thereof.

5.1.2.2 Evaluation of CEN/TR 15932

The terminology and definitions have been documented particularly in order to provide a basis for more standards in the field of bio-based plastics. Although the terms focus on applications in plastics, most terminology has a wider applicability to bio-based materials in general. The CEN/TR 15932 definition for biomass is material of biological origin excluding material embedded in geological formation or fossilized. Other definitions do not conflict with the definitions of this report.

5.1.2.3 Other vocabulary standards

The following standard could also be considered for bio-based vocabulary, but is not evaluated here:

X30-110, *Raw materials and energy – Vocabulary and methodology in determination of energy content – Energy equivalents*

5.2 Life Cycle Analysis

5.2.1 ILCD - International Reference Life Cycle Data System Handbook / ELCD - European Reference Life Cycle Database

5.2.1.1 Scope of the ILCD and ELCD

The ILCD and ELCD initiatives are being coordinated at European level by the European Platform on LCA (http://lct.jrc.ec.europa.eu/eplca). The European Platform on LCA project acts in the context of the European Commission's Thematic Strategy on the Prevention and Recycling of Waste (COM (2005) 666) and the Thematic Strategy on the Sustainable Use of Natural Resources (COM (2005) 670). Finding its foundation in the European Commission's Integrated Product Policy Communication (IPP), it provides an important methodological and data basis also for the integration and operationalisation of Life Cycle Thinking in the upcoming Sustainable Consumption and Production and Sustainable Industrial Policy Action Plans (SCP/SIP). The SCP/SIP will build on and further develop resource and waste policies, the Integrated Product Policy (IPP), the Ecodesign of Energy-using Products (EuP), the Environmental Technologies Action Plan (ETAP), Green Public Procurement (GPP), the EU Eco-label Regulation, and the Eco-Management and Auditing Scheme Regulation (EMAS). SCP/SIP will re-enforce their impact, address gaps, and ensure contribution to global initiatives.

5.2.1.2 Business foundation

While LCA is successfully used in many companies of the private sector, credibility and acceptance of LCA studies need to be improved. This complementary character of the EU LCA handbook holds especially true for public comparisons and in communication with the authorities. Also the cost of LCA studies is to be reduced.

The platform project meets these needs by co-ordinating methodological and data format harmonisation across LCA applications and the development and publication of high-quality industry based reference Life Cycle Inventory data, and of recommended Life Cycle Impact Assessment factors. This is done in global cooperation and consultation with third countries and UNEP to ensure international consistency as far as possible.

The work of the European LCA platform and the ILCD are based on the LCA framework established in ISO 14020 and ISO 14040. (http://lca.jrc.ec.europa.eu/lcainfohub/index.vm)

5.2.1.3 LCA assessment criteria

The assessment criteria applied in the impact assessment phase of the LCA must be specified before the inventory analysis starts the collection of the relevant data. See http://lca.jrc.ec.europa.eu/lcainfohub/index.vm. The following example list of environmental impact categories on the mid-point level may be included as assessment parameters when performing an LCA.

— Climate change

— Ozone depletion

— Acidification

— Eutrophication

— Photochemical oxidant formation (summer smog)

— Radiation

— Human toxicity

— Ecotoxicity

— Depletion of abiotic resources

— Use of biotic resources

— Land use

There have been attempts to include socio-economic aspects as assessment criteria. However, the majority of LCAs at this time consider direct environmental (and human) impacts and resource consumption as assessment criteria. For noise, a methodological approach has recently been developed, but the availability of data in LCI databases is very limited yet.

These impacts can further be assessed to derive end-point indicators that relate the above impact category results to impacts level of the protection targets (human beings, natural environment, resources).

5.2.1.4 ELCD – European Life Cycle database

The ELCD core database comprises Life Cycle Inventory (LCI) data from front-running EU-level business associations and other sources for key materials, energy carriers, transport, and waste management. Focus is laid on data quality, consistency, and applicability. The respective data sets are officially provided and approved by the named industry association; some data sets are still under preparation and will be added subsequently.

5.2.1.5 Evaluation of ELCD and bio-based products

The International Reference Life Cycle Data System (ILCD) Handbook is a set of technical guidance documents that provide the basis for coherence and quality-assurance for data, methods, and studies in Life Cycle Assessment (LCA) and related applications.

The LCA methodology (ILCD Handbook) and ELCD are based on the EN 14040 series standards. The database and tools should make it possible to provide comparisons of products and their properties.

ELCD comparability potential relies on the expansion of the database with as much data as possible for a product or industrial sector. These data have to be generated (by industry) following ILCD principles or that existing data are being evaluated and validated against these principles. Therefore, to be appropriate for bio-based products and eventual comparisons with fossil-based products of equivalent function, a data collection exercise will have to take place among relevant industries to provide the relevant data. Only then will the ELCD reach its full potential for bio-based products.

5.2.2 CR 13910 – CEN/TC 261 - Packaging - Report on criteria and methodologies for life cycle analysis of packaging

5.2.2.1 Scope of CR 13910

The life-cycle assessment is based upon the ISO 14040 standards series for Environmental management – Life Cycle Assessment. This reports aims to establish a set of best practice guidelines for undertaking those aspects of life cycle assessment specific to packaging and distribution systems.

Applying a LCA to packaging is one of several tools available for the continuous improvement of packaging environmental performance. This encompasses the whole life cycle of the packaging i.e. material extraction, manufacture of packaging, service performance to the packed product, post-use collection, recovery or disposal.

When defining the goal and scope of a LCA study of packaging, the following comments on how packaging is actually used have to be taken into account.

- Packaging is always used to pack products, resulting in a strong link between the life cycle of packaging and the packed product. Packaging is used to facilitate handling and transportation through the logistic chain, to protect the product, and to give relevant information. This means that for example closures, labels and printing inks have to be taken into account
- Packaging is one component of a distribution system. A change of packaging will therefore often causes changes in this system, resulting in changes in resource consumption, emissions and hence in the environmental impact of the total system. LCA studies of packaging should therefore include the distribution system, the wastage of packaging material and products, the relevant collection systems, as well as recovery and/or disposal operations.
- Primary, secondary and tertiary packaging have a direct influence upon each other's function, construction and dimensions. They are all integral parts of the distribution system and should be included in the LCA.
- In some cases, the production or use of products may be influenced by a change of packaging, which should also be considered in a LCA study.
- Most packaging only follows the packed product through a certain part of its life cycle, hence a LCA of the packaging should include all the steps of the life cycle of the packaging.

5.2.2.2 Evaluation of CR 13910

CR 13910 describes the application of ISO 14040 standards series for packaging applications, considering how the different terms considered in an LCA (boundaries, functional unit, reference flow, etc.) of a packaging system should be determined. Advice is given on the use of life-cycle inventory analysis, impact assessment, and interpretation in the case of packaging (ISO 14044). No specific references to bio-based products are made.

The results of a Life Cycle Analysis depend very much on the defined boundaries of a product or process. One can consider a package itself, or a packaged product for example. LCA is a useful tool to evaluate performance improvement of a defined system over time. When comparing different types of products without a common basis, consideration should be given to all aspects of the system.

5.2.3 ASTM D7075-04 Standard Practice for Evaluating and Reporting Environmental Performance of Bio-based Products

5.2.3.1 Significance and use of ASTM D7075

A schematic of the sequence of steps involved in development of a LCA is shown in Figure 1. A life cycle assessment (LCA) consists of four independent elements (see Figure 1), which have been standardized internationally (ISO 14040 series standards). These are:

- Definition of goal and scope;

- Life cycle inventory analysis (LCI);

- Life cycle impact assessment (LCIA); and

- Life cycle interpretation.

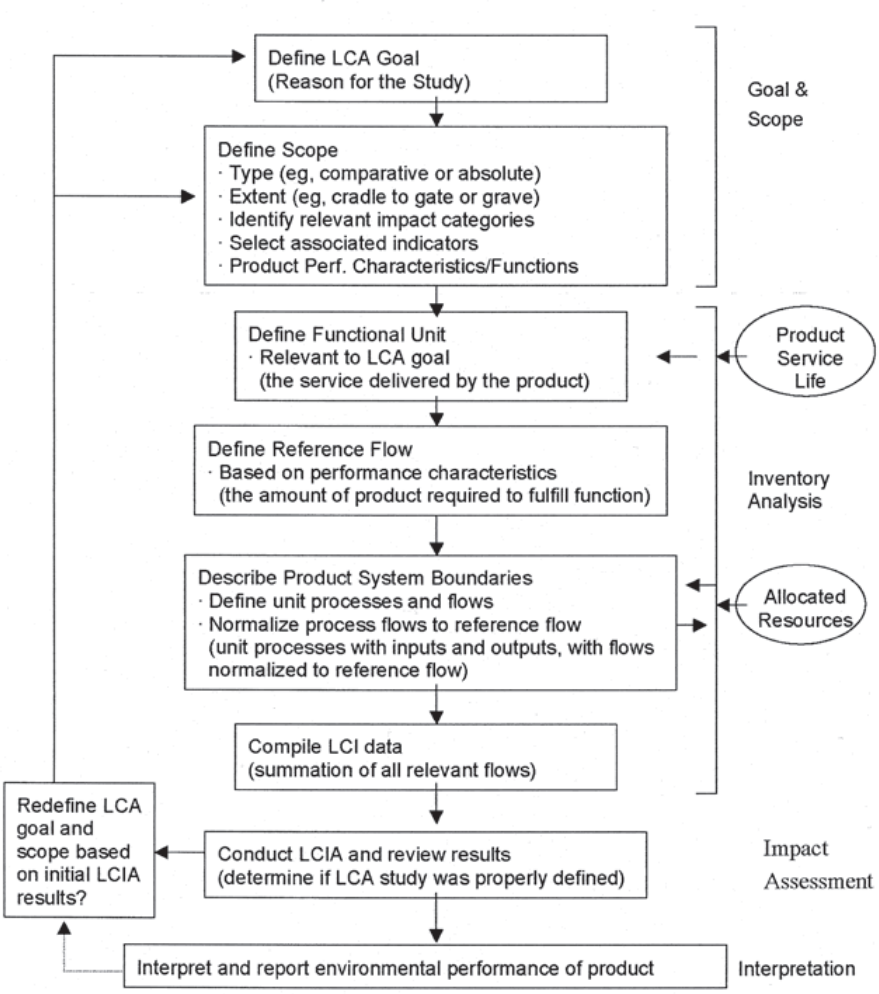

Figure 1 — Process for evaluating and reporting environmental performance of bio-based products

5.2.3.2 Scope of ASTM D7075

Environmental performance shall be measured using the life-cycle assessment (LCA) approach. LCA is a "cradle-to-grave" approach that evaluates all stages in the life of a product, including raw material acquisition, product manufacture, transportation, use and ultimately, recycling (that is, "cradle to cradle" and waste management).

LCAs for bio-based products shall be conducted and communicated in a similar manner, including consistent boundary conditions, functional units, environmental indicators, and reporting formats.

This practice is limited to environmental performance metrics and excludes other metrics such as those related to economics and social equity.

5.2.3.3 Referenced documents in ASTM D7075

ASTM D6852 Guide for Determination of Bio-based Content, Resources Consumption, and Environmental Profile of Materials and Products

ASTM D6866 Test Methods to Determine the Bio-based Content of Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry

ASTM D7026 Guide for Sampling and Reporting Results for Determination of Bio-based Content of Materials via Carbon Isotope Analysis

ISO 14049 Environmental Management--Life Cycle Assessment--Examples of Application of ISO 14041 to Goal and Scope Definition and Inventory Analysis

5.2.3.4 Evaluation of ASTM D7075

ASTM D7075 defines the implementation of ISO 14040 series standards in the specific case of bio-based products. No equivalent of this standard exists at European or international level. It was specifically designed for the implementation of the US Bio-preferred public procurement programme which requires that an LCA be conducted and where additional definitions and boundaries for bio-based products were needed. This is the only standard that requires to include bio-based content in the Life Cycle Analysis (using ISO 14040).

5.2.4 VDI 4431 – life-cycle management in the manufacturing industry

5.2.4.1 Scope of VDI 4431

This guideline is intended for those in industrial businesses who are responsible for the plant-specific development and operation of life-cycle management systems. The purpose of this guideline is to describe the possibilities offered by life-cycle management for products to be used by several users at several levels of use, and to identify the boundaries between products and materials cycles on the one hand and waste flows on the other hand.

This standard is oriented towards providing tools to the industry to develop life-cycle management focusing on for instance the efficient use of reconditioned components with clear technical description in repairs, or the efficient use of repaired or reconditioned components and/or materials with clear technical description in new products.

The realisation of these targets requires a close coordination between production and reconditioning. This report considers the environmental impact of waste reuse/recycling in the manufacturing industry but also discuss its potential economic impact in the short and medium-term.

5.2.4.2 Evaluation of VDI 4431

This Technical Report considers the reduction of existing wastes in the manufacturing industry and how life-cycle management could provide solutions in addressing these through the reconditioning or reuse of components and materials.

This thinking can be applied at very early stage for products in other industries in the design of production systems and in the design of business value chain for the creation/commercialisation of consumer products. The focus is on re-use and recycling. There is no mention of bio-based products.

5.2.5 ISO 14064 - Greenhouse gases

5.2.5.1 Scope of ISO 14064-series

ISO 14064 consists of the following parts, under the general title Greenhouse gases:

— Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.

— Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.

— Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions.

ISO 14064-1 details principles and requirements for designing, developing, managing and reporting organization- or company-level GHG inventories. It includes requirements for determining GHG emission boundaries, quantifying an organization's GHG emissions and removals, and identifying specific company actions or activities aimed at improving GHG management. It also includes requirements and guidance on inventory quality management, reporting, internal auditing and the organization's responsibilities for verification activities.

ISO 14064-2 focuses on GHG projects or project-based activities specifically designed to reduce GHG emissions or increase GHG removals. It includes principles and requirements for determining project baseline scenarios and for monitoring, quantifying and reporting project performance relative to the baseline scenario and provides the basis for GHG projects to be validated and verified.

ISO 14064-3 details principles and requirements for verifying GHG inventories and validating or verifying GHG projects. It describes the process for GHG-related validation or verification and specifies components such as validation or verification planning, assessment procedures and the evaluation of organization or project GHG assertions. ISO 14064-3 can be used by organizations or independent parties to validate or verify GHG assertions.

ISO 14064 is expected to benefit organizations, governments, project proponents and stakeholders worldwide by providing clarity and consistency for quantifying, monitoring, reporting and validating or verifying GHG inventories or projects. Specifically, use of ISO 14064 could:

— enhance the environmental integrity of GHG quantification;

— enhance the credibility, consistency and transparency of GHG quantification, monitoring and reporting, including GHG project emission reductions and removal enhancements;

— facilitate the development and implementation of an organization's GHG management strategies and plans;

— facilitate the development and implementation of GHG projects;

— facilitate the ability to track performance and progress in the reduction of GHG emissions and/or increase in GHG removals; and

— facilitate the crediting and trade of GHG emission reductions or removal enhancements.

5.2.5.2 Evaluation of ISO 14064-series

These standards provide a general framework for GHG emission and removal from the atmosphere. In the identification of GHG sinks, reference is made to the following publications as examples of GHG sinks:

- World Business Council for Sustainable Development (WBCSD)/World Resources Institute (WRI). Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard, April 2004;
- Intergovernmental Panel on Climate Change. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Reporting Instructions, 1997.

It will be interesting to further explore how these ISO 14064 references, as well as European or international implementation guidelines (such as PAS 2050) develop regarding biomass and bio-based products as GHG sinks.

5.2.6 ISO 14067–1 Carbon footprint of products (under development)

5.2.6.1 Scope of ISO 14067-1

The purpose of this International Standard is to provide requirements for the quantification and communication of GHG associated with products (ISO definition – including goods and services). It is intended to promote the monitoring, reporting, and tracking of progress in the mitigation of GHG emissions.

The purpose of each part will be to:

- Part 1: quantify the carbon footprint
- Part 2: harmonize methodologies for communicating the carbon footprint information and also provide guidance for this communication.

5.2.6.2 Evaluation of ISO 14067-1

It will be important to check if/how biomass and bio-based products are considered in the carbon footprint quantification.

5.2.7 ISO NWIP 14046 – Water footprint

5.2.7.1 Scope of ISO 14046

The water footprint NWIP is under the scope of ISO Technical Committee (TC) 207, Environmental Management, Subcommittee (SC) 5 – Life Cycle Assessment.

Water is a very important resource to manage for the coming years, especially for agricultural products. A standard that can explain and describe what a water footprint is will be crucial, to ensure coherence with other environmental metrics, especially carbon footprint and other life cycle based indicators, and other standards in the ISO 14000 series.

The proposed international standard will:

— deliver principles, requirements, and guidelines for a water footprint metric of products, processes, and organisations, based on the guidance of impact assessment as given in ISO 14044:2006, *Environmental management – Life cycle assessment – Requirements and guidelines*.

— define how the different types of water sources (for example, ground, surface, lake, river, green, blue, grey, and so on) should be considered, how the different types of water releases should be considered, and how the local environmental conditions (dry areas, wet areas) should be treated.

— for products, it will apply the life cycle approach and will be based on the same product system as specified in ISO 14040:2006, *Environmental management – Life cycle assessment – Principles and framework,* and ISO 14044.

— at the organisation level, consider the guidance given by ISO 14064, Parts 1 to 3, for greenhouse gases.

— address the communication issues linked to the water footprint, in accordance with the related published standards (ISO 14020:2000, *Environmental labels and declarations – General principles, ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures),* and standards under preparation (ISO 14067–2).

5.2.7.2 Evaluation of ISO 14046

As the standard is not yet complete, evaluation is not yet possible. It is however expected that a water footprint could become equally important in the future as a carbon footprint.

5.2.8 NTA 8080 sustainability criteria for biomass for energy purposes

5.2.8.1 Scope of NTA 8080

NTA 8080 is a Dutch technical agreement or market pre-standard. It describes the requirements for sustainable biomass for energy purposes (power, heat & cold and transportation fuels). With biomass solid as well as liquid and gaseous biofuels are meant.

The sustainability requirements as described in Clause 5 of this NTA apply to organizations which produce the primary biomass. An exception on this is the provision of 5.2.1 (greenhouse gas balance), which applies to all organizations who belong to the whole bio-energy chain, from cultivation to end use.

This NTA is intended to be applied at organizations that:

- want to produce biomass for energy purposes and to sell this as sustainably produced;
- want to convert biomass and sell this as sustainably obtained and sustainably converted;
- want to trade and/or transport biomass and have to demonstrate that (a part of) the charge is produced, converted and obtained as sustainable;
- want to use (converted) biomass for generation of energy or as transportation fuel (pure or blend) and shall demonstrate that (a part of) the biomass is produced, converted and obtained as sustainable.

Requirements can be excluded from assessment, when the organization can explain with proof that the requirement(s) is (are) not applicable. The certifying body is responsible for the determination if a criterion for application may be excluded.

5.2.8.2 Evaluation of NTA 8080

This Technical Agreement provides a basis for the sustainable use of biomass in energy (electricity, heat and power or fuel) production. It is based on the Directive 2009/28/EC on the “promotion of the use of energy from renewable sources” and the Dutch “Cramer criteria”. Further work is ongoing in CEN TC 383 (sustainably produced biomass for energy applications) to define standards on sustainable biomass for energy at European level.

The criteria for sustainability are listed in NTA 8080, but measurement methods are still lacking. Particularly for social criteria, further elaboration would be of use. This work is currently also under progress in CEN/TC 383.

5.2.8.3 Other sustainability documents

The following system could also be considered for sustainability criteria, but is not evaluated here:

International Sustainability and Carbon Certification (ISCC) - http://www.iscc-system.org

5.2.9 BEES – Building for Environmental and Economic sustainability

5.2.9.1 General on BEES

Federal purchasers are increasingly asked to address the issues of environmental preferability and long-term cost performance. Is a product automatically environmentally preferable if it has recycled content? Do mainstream products marketed and perceived as "environmentally friendly" perform better than emerging bio-based products? Do environmentally preferable products always cost more? The BEES software tool says, "not necessarily."

The 2002 Farm Bill authorized the creation of a program, known as BioPreferred, awarding Federal purchasing preference to bio-based products. To address the questions of environmental and cost performance, the BEES (Building for Environmental and Economic Sustainability) tool will evaluate candidate bio-based products, and performance results shared with Federal purchasers. *While the BEES tool has been primarily used to evaluate building products to date, its evaluation methods are applicable to any product, used for any purpose*. Indeed, its database has been updated to include performance data for the production of a range of major inputs to bio-based products, including soybeans, corn, wheat, rice, cotton, canola, potatoes, and wool.

The National Institute of Standards and Technology (NIST), an agency of the U.S. Department of Commerce that works with U.S. industry to develop and apply technology, measurements, and standards, began developing the BEES decision-making tool in 1994. With over 22,000 users worldwide, BEES has become the

most popular tool of its kind in the world. Its power lies in providing understandable, science-based information often lacking from "green" marketing claims. BEES development has been supported by the U.S. Department of Agriculture, the U.S. EPA Environmentally Preferable Purchasing Program, and NIST.

BEES measures the environmental performance of products by using the internationally-standardized and science-based life-cycle assessment approach specified in ISO 14040 standards. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. Economic performance is measured using the ASTM standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal. See *BEES Scores for USDA* for an overview of the BEES scoring system and its use in the BioPreferred context.

[http://www.bfrl.nist.gov/oae/software/bees/bees_USDA.html]

5.2.9.2 Evaluation of BEES

Following the BEES methodology, many bio-based products have been evaluated. Products that are to be labelled in the USDA Voluntary Bio-based Product Labelling can use this analysis.

Products must be bio-based to receive the label. Bio-based products falling under a USDA designated item category under the *Federal procurement preference* portion of the BioPreferred program must meet the minimum bio-based content of the relevant item. Products not falling under a designated item must be 51 % bio-based unless the label applicant applies for and receives an alternative minimum bio-based content. The USDA biopreferred website lists all BEES studied products and documents the BEES results for them. On the basis of these results, an evaluation is made of which products (and at which percentage bio-based) can apply to the biopreferred label. In round 3 for example, a number of lubricating products were evaluated, see: http://www.biopreferred.gov/Round3.aspx .

The BEES methodology is an example of a life cycle analysis tool that is already being used publicly to distinguish the environmental, economical and social effects of products and apply the results to designate products for certain applications. This includes the use of bio-based products.

BEES is the only applied (and simplified) LCA tool currently in use, but still far from complete. It would be appropriate to check whether it is useful to adopt this methodology also outside of the USA.

5.2.10 ASTM D6852-02 Standard Guide for Determination of Bio-based Content, Resources Consumption, and Environmental Profile of Materials and Products

5.2.10.1 Scope

The standard covers a process to determine:

(1) bio-based content of materials and products,
(2) total resource consumption, both bio-based and non-renewable, in the form of raw materials and energy, and
(3) an environmental profile, which would also include emissions and waste generated.

The 'product system' considered is the energy and material inputs and outputs from raw material acquisition through production of the bio-based material or product (“cradle-to-gate”).

Some specific definitions are introduced:

Bio-based carbon equivalent (B)
total bio-based carbon used in the creation of the materials, including raw materials and bio-based energy, where energy has been converted to carbon equivalent using well documented methods and conversion-factors. (B) is thus the total Bio-based resource equivalent used in creation of the material.

Fossil carbon equivalent (F)
total of fossil carbon equivalent used in creation of the material, including raw materials and energy, where energy has been converted to carbon equivalents. F is thus the total fossil resource equivalent used in creation of the material.

Fraction Bio-based carbon equivalent or bio-based resource content, E(B)
fraction of total carbon equivalent attributable to Bio-based origin. E(B) = B/(F+B), as fraction or percent.

Net Bio-based carbon equivalent, E(NB)
amount of Bio-based carbon equivalent, less fossil carbon equivalent, used in the creation or manufacture of a material.

Total carbon equivalent or total resource consumption, E(T)=F+B
E(T) represents the total resources required to create or manufacture a material, and is thus a measure of total resource demand. E(T) is expressed as weight of carbon per unit weight of finished material, since there is no defined molecular weight associated with the carbon equivalent of energy.

5.2.10.2 Evaluation

The standard is not "cradle-to-grave" because the ultimate function unit or use of the Bio-based material could take many forms and have many different fates.

It is outside the scope of this guide to specify a particular set of impact categories for developing an environmental profile.

5.2.10.3 Significance and use of ASTM D 6852

Bio-based materials are considered a means to reduce the consumption of non-renewable resources and reduce the environmental impact associated with the creation of materials and products, such as increased CO^2 emissions and so forth. The U.S. Government has expressed the desire to use its buying power to promote usage of bio-based materials, as evidenced in Presidential Orders 13101 and 13123 and the recently passed Farm Security and Rural Investment Act of 2002 (P.O. 107 - 171.).

This guide provides a vendor with a standardized process to develop and compile information on the total resources consumed in creation of a product, define what fraction of the resources are bio-based, and transmit the information in a clear and logical way. Carbon is the foundation of both bio-based and fossil (non-renewable) resources. Carbon also represents a large fraction of the environmental profile considerations of a product. Therefore carbon is used in this guide to combine and track energy and raw materials resources consumption involved in creation of a product.

This guide provides a way to determine and report weight fraction of bio-based material in a product, or its bio-based content. This guide also provides for verification and validation of the information supplied by vendors to support their product claims.

This guide provides a way to determine the bio-based and non-renewable (fossil) resource consumption, both as raw materials and as energy, involved in creation of a product and to combine the bio-based and non-renewable resources into total resource consumption on a consistent basis.

A companion standard provides a test method for authentication of the origin of carbon claimed to be derived from renewable resources.

5.2.10.4 Scope of ASTM D 6852

This guide covers a process to determine (1) bio-based content of materials and products, (2) total resource consumption, both bio-based and non-renewable, in the form of raw materials and energy, and (3) an environmental profile, which would also include emissions and waste generated.

Reference to the use of factors to convert materials and energy to carbon equivalents are provided (1 to 6). In addition, the use of ISO standards to determine the material and energy inventories and an environmental profile of the products and materials is discussed. It is outside the scope of this guide to provide a detailed description of the use and application of life cycle assessment tools and conversion factors for the determination of a bio-based material's environmental profile. Future ASTM International standards are being prepared to cover these subjects.

In the application of this guide, the protection of business confidential information is an important consideration. In general, the level of detail required to evaluate material and energy inputs and outputs can be reported without revealing proprietary unit process information. Unit processes can be treated as black boxes with inputs and outputs. If business confidentiality is still a concern, unit processes can be further combined or the final LCA (Life Cycle Assessment) results can be reviewed and certified by an external, independent expert with which the vendor will have the appropriate secrecy agreement.

5.2.10.5 Evaluation of ASTM D 6852

This ASTM guide appears to be slightly outdated as it is still referring to ISO 14043 (Environmental Management-Life Cycle Assessment-Life cycle interpretation), which has been replaced by ISO 14040. The concepts of this ASTM 6852 are very important in extending the bio-based content measurement to the life cycle and resource consumption of products. There are no equivalent international or European standards. This is a (useful) umbrella standard.

5.2.11 CEN/TC 383 Sustainability Work items

The subject of sustainability criteria is dealt with under CEN/TC 383 "Sustainably produced biomass for energy applications". Even though for the moment the scope of work is focussed on biofuels and bioliquids in order to support the implementation of the Renewable Energy Directive [1], several sustainability topics should be standardised within this CEN/TC. The documents planned to be released from the CEN Technical Committee are listed in Table 1.

Table 1 – work items of CEN TC/383

00383001 (prEN 16214-1)	Sustainably produced biomass for energy applications - Principles, criteria, indicators and verifiers for biofuels and bioliquids - Part 1: Terminology
00383010 (prEN 16214-2)	Sustainably produced biomass for energy applications - Principles, criteria, indicators and verifiers for biofuels and bioliquids - Part 2: Conformity assessment including chain of custody and mass balance
00383009 (prEN 16214-3)	Sustainably produced biomass for energy applications - Principles, criteria, indicators and verifiers for biofuels and bioliquids - Part 3: Biodiversity and environmental aspects
00383008 (prEN 16214-4)	Sustainably produced biomass for energy applications - Principles, criteria, indicators and verifiers for biofuels and bioliquids - Part 4: Calculation methods of the greenhouse gas emission balance using a life cycle analysis

CEN/TC 383 has developed a committee draft prEN 16214-3 on "Sustainably produced biomass for energy applications - Principles, criteria, indicators and verifiers for biofuels and bioliquids - Part 3: Biodiversity and environmental aspects". This European Standard defines procedures, criteria and indicators to provide the required evidence for:

— production of raw material in areas for nature protection purposes as given in Directive 2009/28/EC [1], Art. 17(3)(b);
— harvesting of raw material from highly bio diverse non-natural grassland as given in Directive 2009/28/EC, Art. 17(3)(c)(ii); and
— cultivation and harvesting on peatland as given in Directive 2009/28/EC, Art. 17(5).

This European Standard specifies requirements relevant for the provision of evidence by economic operators that the production, cultivation and harvesting of raw materials is in accordance with the requirements of the Directive 2009/28/EC [1] concerning the areas mentioned above. This European Standard is applicable to production, cultivation and harvesting of biomass for biofuels and bioliquids production. This European Standard is intended for reference in the communication on the practical implementation of the sustainability scheme that the European Commission announced to adopt in December 2009.

5.2.12 ISO/DIS 26000 Guidance on social responsibility

5.2.12.1 Scope of ISO/DIS 26000

This International Standard provides guidance to all types of organizations, regardless of their size or location, on:

— concepts, terms and definitions related to social responsibility;

— the background, trends and characteristics of social responsibility;

— principles and practices relating to social responsibility;

— core subjects relating to social responsibility;

— issues of social responsibility (issues);

— integrating, implementing and promoting socially responsible behaviour throughout the organization and through its policies and practices related to its sphere of influence;

— identifying and engaging with stakeholders; and

— communicating commitments and performance related to social responsibility.

By providing this guidance, this International Standard is intended to assist organizations in contributing to sustainable development. This International Standard encourages an organization to undertake activities that go beyond legal compliance, recognizing that compliance with law is a fundamental duty of any organization and an essential part of its social responsibility.

This International Standard is intended to promote common understanding in the field of social responsibility. It is intended to complement other instruments and initiatives for social responsibility, and not to replace them.

In applying this International Standard it is advisable that an organization take into consideration societal, environmental, legal and organizational diversity, as well as differences in economic conditions, while being consistent with international norms of behaviour.

This International Standard is not a management system standard. It is not intended or appropriate for certification purposes or regulatory or contractual use. Any offer to certify, or claims to be certified, to ISO 26000 would be a misrepresentation of the intent and purpose of the International Standard.

This International Standard is intended to provide organizations with guidance concerning social responsibility and can be used as part of public policy activities.

5.2.12.2 Evaluation of ISO/DIS 26000

This guide forms the basis of Social Responsibility in the wide sense of the definition. The guide is not specific for products or bio-based products, but is expected to become one of the underlying standards when social sustainability criteria are further standardized.

5.2.13 ISO 14025 Environmental labels and declarations - Type III environmental declarations - Principles and procedures

5.2.13.1 Scope of ISO 14025

This International Standard establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations. It specifically establishes the use of the ISO 14040 series of standards in the development of Type III environmental declaration programmes and Type III environmental declarations. This International Standard establishes principles for the use of environmental information, in addition to those given in ISO 14020. Type III environmental declarations as described in this International Standard are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded. This International Standard does not override, or in any way change, legally required environmental information, claims or labelling, or any other applicable legal requirements. This International Standard does not include sector-specific provisions, which may be dealt with in other ISO documents. It is intended that sector-specific provisions in other ISO documents related to Type III environmental declarations be based on and use the principles and procedures of this International Standard.

5.2.13.2 Evaluation of ISO 14025

This Internatonal Standard forms a basis when developing labels and certification schemes. It is not specific for bio-based products.

5.2.13.3 Other labelling standards

The following standards could also be considered for sustainability criteria, but are not evaluated here:

ISO 14020:2000 Environmental labels and declarations – General principles

ISO 14021:1999 Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)

5.2.14 BP X 30-323:2009, General principles for an environmental communication on mass market products

5.2.14.1 Scope of BP X30-323

This good practice guide defines the principles and guidelines for drawing up a product's environmental declarations for consumer information. This good practice guide will be made clear to AFNOR through methodological guidelines so as to draw up a product's environmental declarations relating to consumer information broken down into product categories. A general methodology covering all product categories is given in annexes. It may be necessary to make changes to this guide to take into account the developments in European and International standardisation works and the recognised practices currently in place if they bear relevance to this guide.

The objective of the environmental communication is to allow the consumer to use the information concerning the environmental impacts of a product throughout its life cycle as a choice criterion when deciding on a purchase. The environmental communication shall allow comparison of products belonging to the same category and, when relevant, between product categories. The relevance for the consumer will be assessed when defining the nomenclature of the product categories. The communication shall respect the principles and guidelines of this guide so that the information is comparable, on the one hand within the same purchase or acquisition location of a product, and on the other hand, with different purchase or acquisition locations of a product.

5.2.14.2 Evaluation of BP X30-323

The aim of this good practice guide is to harmonise the environmental communication practices. The environmental communication must be implemented, irrespective of product category, at an acceptable cost and must also be based on scientific knowledge.

This guide applies to all products currently available on the market irrespective of how they are distributed. It applies to the environmental communication at the purchase or acquisition location and it will focus on the environmental impacts of the products. It does not cover other sustainable development related issues.

5.2.15 ISO 14040 Environmental management - Life cycle assessment - Principles and framework

5.2.15.1 Scope of ISO 14040

This International Standard describes the principles and framework for life cycle assessment (LCA) including:

a) goal and scope definition of the LCA;

b) life cycle inventory analysis (LCI) phase;

c) life cycle impact assessment (LCIA) phase;

d) life cycle interpretation phase;

e) reporting and critical review of the LCA;

f) limitations of the LCA;

g) relationship between the LCA phases; and

h) conditions for use of value choices and optional elements.

This International Standard covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA. The intended application of LCA or LCI results is considered during the goal and scope definition, but the application itself is outside the scope of this International Standard. This International Standard is not intended for contractual or regulatory purposes or registration and certification.

5.2.15.2 Evaluation of ISO 14040

ISO 14040 presents the principles and the framework of LCA in general, i.e. for all possible products and services. This explains why it does not specifically address:

- Bio-content / Amount of renewable raw materials
- Biodegradability
- Compostability

ISO 14040 addresses these aspects in more abstract terms, e.g. compostability is covered by the end of life stage. This is also valid for the feature of durability, which is covered in LCA by the function and the functional unit (see below).

The following aspects are included but no specific rules or procedures are provided for bio-based products (neither directly nor indirectly):

- Product Functionality / Technical Performance: is addressed in general terms when explaining the terms “function” and “functional unit”, thereby pointing out the following: “Comparability of LCA results is particularly critical when different systems are being assessed, to ensure that such comparisons are made on a common basis.”
- End of life: is referred to as one step in a product's life cycle.
- Recycling: is referred to as one (possible) step in a product's life cycle.

The following aspects are specifically mentioned:

- Greenhouse gases: Reference is made to ISO 14064, and
- Energy (energy flow, feedstock energy etc.)

LCA focuses on the environmental assessment, while economic and social aspects are not explicitly addressed. At the same time, ISO 14040 states: ”*LCA typically does not address the economic or social aspects of a product, but the life cycle approach and methodologies described in this International Standard can be applied to these other aspects*“ (in other parts of ISO 14040, a somewhat more modest standpoint is taken about the role for the economic and the social assessment).

The ISO 14040 series is a framework on how to perform Life Cycle Assessments, without being specific for Bio-based products. The ISO 14040 series form a basis, particularly to monitor performance over time, but does not necessarily provide sufficient detail for different products to ensure fair comparisons.

5.2.16 ISO 14044 Environmental management - Life cycle assessment - Requirements and guidelines

5.2.16.1 Scope of ISO 14044

This International Standard specifies requirements and provides guidelines for life cycle assessment (LCA) including:

a) goal and scope definition of the LCA,

b) life cycle inventory analysis (LCI) phase,

c) life cycle impact assessment (LCIA) phase,

d) life cycle interpretation phase,

e) reporting and critical review of the LCA,

f) limitations of the LCA,

g) relationship between the LCA phases, and

h) conditions for use of value choices and optional elements.

This International Standard covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. The intended application of LCA or LCI results is considered during the goal and scope definition, but the application itself is outside the scope of this International Standard. This International Standard is not intended for contractual or regulatory purposes or registration and certification.

5.2.16.2 Evaluation of ISO 14044

ISO 14044 forms part of the same series as ISO 14040. It similarly presents the LCA generics, however with some difference regarding environmental impact. Examples of some further environmental impact categories are given, i.e. ozone formation and acidification. However, no “long list” is presented.

5.2.17 PAS 2050:2008 - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

5.2.17.1 Scope of PAS 2050

This PAS specifies requirements for the assessment of the life cycle GHG emissions of goods and services (collectively referred to as “products”) based on key life cycle assessment techniques and principles. This PAS is applicable to organizations assessing the GHG emissions of products across their life cycle, and to organizations assessing the cradle-to-gate GHG emissions of products.

Requirements are specified for identifying the system boundary, the sources of GHG emissions associated with products that fall inside the system boundary, the data requirements for carrying out the analysis, and the calculation of the results.

This PAS addresses the single impact category of global warming, and does not assess other potential social, economic and environmental impacts arising from the provision of products, such as non-greenhouse gas emissions, acidification, eutrophication, toxicity, biodiversity, labour standards or other social, economic and environmental impacts that may be associated with the life cycle of products. The life cycle GHG emissions of products, calculated using this PAS, do not provide an indicator of the overall environmental impact of these products, such as may result from other types of life cycle assessment.

This PAS does not include product category-specific rules for goods and services; however, it is intended that selected product category-specific rules for goods and services, developed in accordance with BS ISO 14025, will be adopted where available, as specified in this PAS.

It is one of the intentions of this PAS to allow for the comparison of GHG emissions between products, and to enable the communication of this information. However, this PAS does not specify requirements for communication.

5.2.17.2 Evaluation of PAS 2050

PAS 2050 also presents the LCA generics similar to ISO 14040, however with some minor differences:

- Biocontent: is covered in PAS 2050 by addressing the storage of bio-based carbon, which reduces the net global warming impact.
- Biodegradability: is not specifically addressed but reference is made to: CEN/TR 14980:2004*, Solid recovered fuels – Report on relative difference between biodegradable and biogenic fractions of SRF*

PAS 2050 is the only standard at this moment that considers the fact that durable bio-based products can also form a bio-based carbon sink (fixation) result in the life-cycle analysis.

5.3 Bio-based content

5.3.1 General

The modern reference standard used in radiocarbon dating is a NIST or equivalent other NMI standard with a known radiocarbon content equivalent approximately to the year AD 1950. AD 1950 was chosen since it represented a time prior to thermo-nuclear weapons testing which introduced large amounts of excess radiocarbon into the atmosphere with each explosion (termed "bomb carbon"). This was a logical point in time to use as a reference for archaeologists and geologists. For an archaeologist or geologist using radiocarbon dates, AD 1950 equals "zero years old". It also represents 100 pMC (see further 5.3.2.2).

"Bomb carbon" in the atmosphere reached almost twice normal levels in 1963 at the peak of testing and prior to the treaty halting the testing. Its distribution within the atmosphere has been approximated since its appearance, showing values that are greater than 100 pMC for plants and animals living since AD 1950. It's gradually decreased over time with today's value being near 107.5 pMC. This means that a fresh biomass material such as corn would give a radiocarbon signature near 107.5 pMC. Combining fossil carbon with present day carbon into a material will result in a dilution of the present day pMC content. By presuming 107.5 pMC represents present day biomass materials and 0 pMC represents petroleum derivatives, the measured pMC value for that material will reflect the proportions of the two component types. A material derived 100% from present day soybeans would give a radiocarbon signature near 107.5 pMC. If that material was diluted with 50% petroleum derivatives, it would give a radiocarbon signature near 54 pMC.

A biomass content result is derived by assigning 100 % equal to 107.5 pMC and 0 % equal to 0 pMC. In this regard, a sample measuring 99 pMC will give an equivalent Bio-based content result of 93 %. This value is referred to as the mean bio-based result and assumes all the components within the analyzed material were either present day living or fossil in origin. It is highly probable in a real life situation that the results provided by test laboratories involve materials without any source information.

5.3.2 ASTM D6866-06a Standard Test Methods for Determining the Bio-based Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis

5.3.2.1 Scope of ASTM D6866

ASTM D6866 is applicable to any product containing carbon-based components that can be combusted in the presence of oxygen to produce carbon dioxide (CO_2) gas. The preparation of samples for the above test methods is described.

The described Method A utilizes Liquid Scintillation Counting (LSC) radiocarbon (^{14}C) techniques to quantify the bio-based content of a given product with maximum total error of 15 % count, which is associated with sample preparation and actual counting. This test method is based on LSC analysis of CO_2 cocktails after collecting the CO_2 in a suitable absorbing solution.

The described Method B utilizes Accelerator Mass Spectrometry (AMS) and Isotope Ratio Mass Spectrometry (IRMS) techniques to quantify the bio-based content of a given product with possible uncertainties of (1 to 2) % and (0,1 to 0,5) %, respectively. Sample preparation methods are identical to Method A, Method B diverges then and rather than LSC analysis the sample CO_2 remains within the vacuum manifold and is

distilled, quantified in a calibrated volume, transferred to a quartz tube, torch sealed. The stored CO_2 is then delivered to an AMS facility for final processing and analysis.

Another described Method C uses LSC techniques to quantify the bio-based content of a product. However, whereas Method A uses LSC analysis of CO_2 cocktails, Method C uses LSC analysis of sample carbon that has been converted to benzene. This test method determines the bio-based content of a sample with a maximum total error of 63 % (absolute).

5.3.2.2 Evaluation of ASTM D6866

ASTM D6866 determines the bio-based carbon content of materials, based the ^{14}C analysis of the product. The application of ASTM D6866 to derive a "bio-based carbon content" is built on the concepts of radiocarbon dating, but without use of the age equations. It is done by deriving a ratio of the amount of radiocarbon (^{14}C) in an unknown sample to that of a modern reference standard. The ratio is reported as a percentage with the units "pMC" (percent modern carbon). If the material being analyzed is a mixture of present day radiocarbon and fossil carbon (containing no radiocarbon), then the pMC value obtained correlates directly to the amount of biomass material present in the sample.

ASTM D6866 cites precision on the mean bio-based carbon content result as +/- 3% (absolute). This is the most conservative estimate of error in the measurement of complex bio-based containing solids and liquids based on empirical results. Real precision for readily combustible and homogenous materials (e.g. gasoline) and especially samples received as CO^2 (e.g. flue gas or CEMS exhaust) can be as low as +/- (0,5 – 2)%. The accuracy of the result as it applies to the analyzed product relies upon all the carbon in the analyzed material originating from either recently respired atmospheric carbon dioxide (within the last decade) or fossil carbon (more than 50,000 years old). "Percent bio-based" specifically relates % renewable carbon to total carbon (bio-based and fossil), not to total mass or molecular weight. Mean bio-based estimates greater than 100% are assigned a value of 100% for simplification.

Alternative EN or ISO standards are currently under development for this technique. Meanwhile, the ASTM D6866 method remains the reliable way of getting to know the bio-based carbon content of a product, if the material sources are unknown. For solid biofuels, the EN 15440 has been published, based on the same principles.

Whilst currently several work items are being launched for the use of carbon dating for separate products, the question remains whether these should all be separate standards. An umbrella standard or international series could include sampling, and/or calculation/counting methods. The need for additional standard test methods for determining the “bio-based content” or “bio-based material content” independent of carbon should also be evaluated.

5.3.3 ASTM D7026-04 Standard Guide for Sampling and Reporting of Results for Determination of Bio-based Content of Materials via Carbon Isotope Analysis

5.3.3.1 Scope of ASTM D 7026

This guide provides a framework for collecting and handling samples for determination of bio-based content of materials by means of the carbon isotope method described in Test Methods D 6866. Tests for sampling adequacy based on the standard statistical tools are provided. In addition, reporting of the results, including sampling techniques, handling procedures and chain-of-custody issues are discussed.

This guide is concerned with collecting representative samples within a given material or a lot, not with lot-to-lot variations such as considered in quality control schemes.

Bio-based materials often represent sampling problems specific to a given material, such as heterogeneity, and so forth, which require employment of material-specific sampling methods. The use of specialized sampling methods already accepted and validated by industries that manufacture and/or use the biomaterial is encouraged. However, all sampling techniques, especially non-standard techniques developed for specific materials must be reported in sufficient detail to allow critical assessment of the techniques used.

Carbon isotope analysis involves thermal processing in presence of oxidants. Compatibility of any given material with Test Methods D 6866 must be assessed. Special attention must be given to materials with potential for explosion hazards, such as peroxides, nitrated compounds, azides, and so forth. Examples of peroxide-forming compounds are ethers, some ketones and a number of other compounds.

5.3.3.2 Evaluation of ASTM D 7026

ASTM D7026 is a brief guide and method of sample collection and determination of the number of samples required. The method states that if there is a standard sampling technique for the material to be tested that is widely accepted by the industry, such a procedure may be used and the details of sampling recorded. However, such standards are not quoted. In this respect, standards like EN 15440 (Solid recovered fuels - Method of the determination of biomass content), ISO 18283 (Hard coal and coke - Manual sampling), ISO 186 (Paper and board - Sampling to determine average quality) and EN ISO 3170 (Petroleum liquids - Manual sampling) could well be considered.

The significance of this guide is that it highlights the importance of representative sampling. However, the guide only refers to sampling of a homogeneous material, or a sample large enough to encompass inhomogeneities in a representative way. Where bio-based products are not per se a homogeneous material, the boundary conditions and reporting are of great importance, which is not elaborated in this guide.

5.3.4 CEN WI 00249737 - Plastics - Biopolymers – Determination of biobased carbon content

5.3.4.1 Scope of work under CEN/TC 249

This draft European Standard specifies one test method for the determination of the biomass fraction in biopolymers, This method is based on the ^{14}C content measurement from which the bio-based carbon content of the polymer may be calculated.

This method is applicable to any organic carbon containing polymers.

NOTE 1 The calculation needs to take into consideration any presence of inorganic carbon source, such as inorganic carbonate (e.g. calcium carbonate) as well as organic carbon present in additives (e.g. carbon black, carbon nanotubes).

NOTE 2 This draft European Standard is based on EN 15440 issued by CEN TC 343

5.3.4.2 Evaluation of CEN/TC 249 activities

When finished, this CEN standard should provide an improved alternative to ASTM D6866. It is currently aiming at biopolymers only, but could easily be used for, or adapted for materials and products in general.

5.3.5 EN 15440 Solid recovered fuels - Method of the determination of biomass content

5.3.5.1 Scope of EN 15440

This European Standard specifies three normative methods for the determination of the biomass fraction in solid recovered fuel, and when to use each method. The methods are the selective dissolution in a hydrogen peroxide/sulphuric acid mixture, the manual sorting method and the method based on the ^{14}C content.

The determination of the biomass content using the ^{14}C method is based on the well established analytical procedures that are used for the determination of the age of carbon containing objects. The method of selective dissolution is based on the reaction of biomass material with a mixture of sulphuric acid and hydrogen peroxide. The manual sorting method is based on the separation of different fractions on visual aspects.

With this European Standard the fraction of biomass is expressed:

— by weight;

— by energy content (gross or net calorific value);

— by carbon content.

This European Standard is primarily geared toward laboratories, producers, suppliers and purchasers of solid recovered fuels, but is also useful for the authorities and inspection organizations.

5.3.5.2 Evaluation of EN 15440

This method to determine the bio-based content of materials includes 2 sorting and calculation techniques, as well as a ^{14}C based method building on ASTM D6866. Although the method aims at solid biofuels only, it could easily be used for, or adapted for materials and products in general.

NOTE EN 15747 has been replaced by EN 15440

5.4 Specific products

5.4.1 ISO 15380 Lubricants, industrial oils and related products (class L) - Family H (Hydraulic systems) - Specifications for categories HETG, HEPG, HEES and HEPR

5.4.1.1 Scope

This International Standard specifies the requirements for environmentally acceptable hydraulic fluids and is intended for hydraulic systems, particularly hydraulic fluid power systems. The purpose of this International Standard is to provide guidance for suppliers and users of environmentally acceptable hydraulic fluids, and for the direction of original equipment manufacturers of hydraulic systems. This International Standard stipulates the requirements for environmentally acceptable hydraulic fluids at the time of delivery. Classification of fluids used in hydraulic application is defined in ISO 6743-4. Of the categories covered by ISO 6743-4, only four types of environmentally acceptable fluids are embraced in this International Standard. These categories are HETG, HEPG, HEES and HEPR.

5.4.1.2 Evaluation

This ISO standard for environmentally acceptable lubricants provides product performance requirements for a number of lubricating and hydraulic oils. It focuses on non-toxic biodegradable hydraulic fluids. As such, it does not cover other product categories, such as automotive lubricating oils.

ISO 15380 forms the basis of many certification or labelling schemes for "bio"lubricants. This standard does not specify the origin of the products (i.e. if they would be equally environmentally acceptable, petroleum products could also qualify).

5.4.2 Ecolabel Lubs final criteria

NOTE See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:118:0026:0034:EN:PDF

5.4.2.1 Scope of Ecolabel Lubricants

In order to be awarded the community eco-label for lubricants under Regulation (EC) No 1980/2000 a lubricant must fall within the product group “lubricants” and must comply with the criteria set out in the annex to this decision.

The criteria shall apply to the freshly manufactured product at the time of delivery.

Where criteria are formulated on the level of constituent substances, these criteria shall apply to substances deliberately added and constituting more than 0.1 % as present in the product and after any chemical reaction has taken place between substances mixed to provide the lubricant preparation.

The criteria shall not, however, apply to substances that on application change their chemical nature to no longer warrant classification according to Directive 1999/45/EC, and where less than 0.1% of the substance in the treated part remains in the form as before application.

The criteria listed are on:

1) R-phrases;

2) Aquatic toxicity;

3) Biodegradability and bio-accumulative potential;

4) Exclusion of specific substances;

5) Renewable raw materials;

6) Technical performance;

7) Information appearing on the eco-label.

EXAMPLE The formulated product shall have a carbon content derived from renewable raw materials that shall be: 50 % (m/m) for hydraulic oils (etc). The criteria are currently being revised, with intended publication mid 2010.

5.4.2.2 Evaluation of Ecolabel Criteria and bio-based products

The listed criteria are applicable to the bio-based lubricant classes identified. They set a high standard for specific lubricants. However, they are not applicable to all types of lubricants, and not to other types of products. The criteria for renewable raw materials are not substantiated and lack a test method. They appear to be derived from the BEES methodology. Some criteria identified and some assessment methods could be of use for (other) bio-based products, but not all.

5.4.3 Der Blaue Engel / Blue Angel

Under the Blue Angel Eco-label, 3 biodegradable lubricant products can be certified.

5.4.3.1 RAL-UZ 48 Readily Biodegradable Chain Lubricants for Power Saws

5.4.3.1.1 Scope of RAL-UZ 48

Criteria for the award of an environmental Blue Angel Label for Chain Lubricants for power saws.

Benefits to Environment and Health:

— particularly health-threatening substances are not used ;

— no ecotoxicological impact on soils and water bodies;

— good biodegradability.

Is it possible to saw cleanly?

Power saws operating with total loss lubrication release up to 7,000 tons of chain lubricants into the environment per year. Blue Angel-labelled chain lubricants are an environmentally friendly alternative to conventional products. Products carrying the Blue Angel eco-label mainly consist of rapeseed or beet oil that feature a good biodegradability. Thus, heavy alkylates, used oils and ecotoxicologically critical substances are avoided.

5.4.3.1.2 Evaluation of RAL-UZ 48

This specification for Blue Angel "Eco"-labelled chain lubricants is mainly focused on non-toxicity (defined mainly by risk phrases) and biodegradability (e.g. by OECD 301). The reference to avoidance of heavy alkylates is not repeated in the specification. There are no criteria for bio-content.

5.4.3.2 RAL-UZ 64 Readily Biodegradable Lubricants & Forming oils

5.4.3.2.1 Scope of RAL-UZ 64

Benefits to health and environment:

— exclusion of ingredients posing a significant risk to health;

— no eco-toxicological impact on soil and waterbodies;

— good biodegradability.

Lubricants in the environment?

Whether in concrete processing at construction sites or when operating cable cars and ski lifts or when lubricating switches for rail vehicles, more than 10,000 tons of lubricants get into the environment every year when properly used. Blue Angel-labelled forming oils, lubricating oils and lubricating greases are an environmentally friendly alternative to conventional products. Eco-labelled lubricants often consist of vegetable or animal oils that distinguish themselves by a good biodegradability. In addition, the additives added to improve the technical properties do not contain any eco-toxicologically critical substances.

5.4.3.2.2 Evaluation of RAL-UZ 64

This specification for Blue Angel "Eco"-labelled lubricating oils and greases is mainly focused on non-toxicity (defined mainly by risk phrases) and biodegradability (e.g. by OECD 301). The reference vegetable or animal oils are not repeated in the specification. There are no criteria for bio-content.

5.4.3.3 RAL-UZ 79 Readily Biodegradable Hydraulic Fluids

5.4.3.3.1 Scope of RAL-UZ 79

Criteria for the award of an environmental Blue Angel Label for Hydraulic Fluids.

Benefits to health and environment:

— exclusion of ingredients posing a significant risk to health;

— no eco-toxicological impact on soil and waterbodies;

— good biodegradability.

Hydraulic fluids and sensitive ecosystems?

Leakages and accidents occurring during the operation of stationary hydraulic systems, such as locks, weirs, water-power plants as well as during the use of construction machinery, agricultural or forestall machinery may cause serious contamination of waterbodies and soil. Blue Angel-labelled hydraulic fluids are an environmentally friendly alternative: They are often made of vegetable or animal oils that distinguish themselves by a good biodegradability. In addition, the additives added to improve the technical properties do not contain any eco-toxicologically critical substances.

5.4.3.3.2 Main criteria of RAL-UZ 79

The product may not contain any toxic substances and the like.

Each of the basic substances (accounting for more than 5% by weight) should be readily biodegradable (i.e. 70 % of TCO^2 or TOD in 28 days [OECD 301, ISO 14593 or ISO 10708]).

The hydraulic fluids must meet the technical minimum requirements under ISO 15380.

5.4.3.3.3 Evaluation of RAL-UZ 79

Although similar to the European Ecolabel, all 3 listed Blue Angel label products have no requirement for the amount of renewable raw material. Only the hydraulic fluids have technical performance criteria, as in ISO 15380; the other specifications do not include technical performance criteria.

5.4.4 SS 155434 Hydraulic fluids – Requirements and test methods

5.4.4.1 Scope of SS 155434

Class V hydraulic fluids are intended for both indoor and outdoor equipment, and must therefore operate within a wide temperature range. Class M hydraulic fluids are not intended for low temperature operation, i.e. below approximately 0 °C.

The standard applies to the final product including additives.

5.4.4.2 Evaluation of SS 155434

Contrary to the international standardisation within ISO/TC 28/SC 4 [e.g. ISO 15380], the products in this Swedish standard have not been classified according to base oil type. The classification between different categories is instead based on functional requirements.

5.4.5 SS 155470 Lubricants, industrial oil and related products – (Class L) – Specifications for family X (Greases)

5.4.5.1 Scope of SS 155470

This standard covers all types of lubricating greases used in industrial, automotive or marine applications. The intended meaning of the term lubricating grease is a product with a documented ability to lubricate determined in relevant laboratory tests and by practical tests in the actual or equivalent application. Lubricating grease, according to this standard, is a lubricating fluid that, by the addition of a thickener and possibly additives, provides a product, which in a state of rest demonstrates the properties of a solid body, and in its entirety has a lubricating ability. When force is applied, the product is plastically deformed and, if the force is enough to exceed the yield point of the material, the product will exhibit shear-thinning properties and the shear rate will increase until it eventually starts to flow. When the applied force is removed, the product once again exhibits the properties of a solid body. Only lubricating grease is covered by this standard.

For certain applications, one or more of the technical requirements cannot always be fulfilled because other requirements have a predominant significance for the functionality of the lubricating grease and consequently

its contents and properties. It is essential to specify recommendations according to this standard, which are based on experience from the practical use of the type of lubricating grease. In lubricating grease applications where the risk for contact with foodstuffs cannot be excluded, the choice of product should be made in consultation with the supplier and/or an expert. In applications where there is the possibility of leakage into sensitive environments, additional requirements according to the environmental criteria in this standard may be applied.

5.4.5.2 Evaluation of SS 155470

This Swedish standard identifies 3 environmentally adapted classes (A, B and C) in which greases can be categorized according to toxicity, degradability and renewable resources. For the designation environmentally adapted Class A, > 65 % of the product mass content shall originate from renewable resources. For the designation environmentally adapted Class C, no part of the product has to originate from renewable resources.

NOTE Renewability is defined in this context as raw materials from animal or vegetable origin with a life cycle < 150 years.

5.4.6 ISO/DIS 12924 Lubricants, industrial oils and related products (Class L) - Family X (Greases) - Specification

5.4.6.1 Scope of ISO 12924

This International Standard specifies the requirements of greases used for the lubrication of equipment, components of machines, vehicles, etc. The purpose of this standard is for the guidance of suppliers and end users of greases and for the direction of equipment manufacturers of grease lubricated equipment.

This International Standard is written in a general form so that its application can accommodate various climatic conditions throughout the world. It also stipulates the requirements of the lubricating grease in the time of the delivery.

The classification of Family X (Greases) which belongs to class L (Lubricants, industrial oils and related products) is defined in ISO 6743-9. This International Standard should read in conjunction with ISO 6743-9.

In this classification, a grease cannot have more than one symbol. This symbol should correspond to the most severe conditions of temperature, water contamination and load in which the grease can be used.

5.4.6.2 Evaluation of ISO 12924

Although title and scope of this ISO standard are similar to the Swedish standard (5.4.5) it does not contain any environmental or other requirements related to bio-based grease.

5.4.7 EN 14995 Plastics - Evaluation of compostability - Test scheme and specifications

5.4.7.1 Scope of EN 14995

This European Standard specifies requirements and procedures to determine the compostability or anaerobic treatability of plastic materials by addressing four characteristics: I) biodegradability, II) disintegration during biological treatment, III) effect on the biological treatment process and IV) effect on the quality of the resulting compost.

5.4.7.2 Evaluation of EN 14995

The listed requirements are specific for one of the end of life options for plastics, i.e. organic recovery or composting. The criteria are not material specific but can be applied to any type of plastic, regardless of the origin (bio-based or fossil resources). The specifications and evaluation criteria are derived from EN 13432.

5.4.8 EN 13432 Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging

5.4.8.1 Scope of EN 13432

This standard specifies requirements and procedures to determine the compostability and anaerobic treatability of packaging and packaging materials by addressing four characteristics: 1) biodegradability; 2) disintegration during biological treatment; 3) effect on the biological treatment process; and 4) effect on the quality of the resulting compost. This standard covers the compostability of packaging itself and also how to deal with multicomponent packaging. It does not address regulations that may exist regarding the compostability of any residual contents.

5.4.8.2 Evaluation of EN 13432

The listed requirements are specific for one of the end of life options for packaging, i.e. organic recovery or composting. The criteria are not material specific but can be applied to any type of packaging, regardless of the origin (bio-based or fossil resources). Its application area can even further be extended to any type of solid material or (single or multi component) product.

5.4.9 ISO 14855-1 - Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide — Part 1: General method

5.4.9.1 Scope of ISO 14855

Part 1 of ISO 14855 specifies a method for the determination of the ultimate aerobic biodegradability of plastics, based on organic compounds, under controlled composting conditions by measurement of the amount of carbon dioxide evolved and the degree of disintegration of the plastic at the end of the test. This method is designed to simulate typical aerobic composting conditions for the organic fraction of solid mixed municipal waste. The test material is exposed to an inoculum which is derived from compost. The composting takes place in an environment wherein temperature, aeration and humidity are closely monitored and controlled. The test method is designed to yield the percentage conversion of the carbon in the test material to evolved carbon dioxide as well as the rate of conversion.

Subclauses 8.6 and 8.7 specify a variant of the method, using a mineral bed (vermiculite) inoculated with thermophilic microorganisms obtained from compost with a specific activation phase, instead of mature compost. This variant is designed to yield the percentage of carbon in the test substance converted to carbon dioxide and the rate of conversion.

The conditions described in this part of ISO 14855 may not always correspond to the optimum conditions for the maximum degree of biodegradation to occur.

5.4.9.2 Evaluation of ISO 14855

ISO 14855 is a test method for biodegradability and composting of plastic materials, based on carbon dioxide evolution. It defines biodegradability and composting. Not specific for materials of biological origin. Only relevant for solid materials. Although specified for plastic materials, its application area can be further extended to any type of solid material.

5.4.10 CEN/TR 15822 Plastics - Biodegradable plastics in or on soil - Recovery, disposal and related environmental issues

5.4.10.1 Scope of CEN/TR 15822

The present Technical Report is intended to summarise the current state of knowledge and experience in the field of biodegradable plastics which are used on soil or end up in soil. It also addresses the links between use, disposal after use, degradation mechanisms and the environment.

Therefore, this document is intended to provide a basis for the development of future standards. Its aim is to clarify the ideas and ensure a level playing field, without hiding possible needs for further research or areas of disagreement among experts.

5.4.10.2 Evaluation of CEN/TR 15822

When completed this document addresses the application of plastics and end of life options in soil environments. It is not material specific but can be applied to any type of plastic, regardless of the origin (bio-based or fossil resources).

5.4.11 NF U 52-001 Biodegradable materials for use in agriculture and horticulture - Mulching products - Requirements and test methods

5.4.11.1 Scope of NF U 52-001

This French Standard specifies the requirements for characterization of mulching products made from biodegradable materials, in lap, used in agriculture and horticulture. It also specifies the test methods to assess these requirements as well as requirements for packaging, identification and marking of mulching products. It defines a classification of the mulching products according to their life expectancy on the soil.

This document applies to mulching products made mainly from organic materials in which mineral constituents can be included. These products are normally intended, at the end of life, for the incorporation in soil or composting. They take the form of lap: plastics films, papers, textiles, nonwoven products in natural fibres, etc.

5.4.11.2 Evaluation of NF U 52-001

This French Standard is the most severe existing product standard regarding the biodegradability (2 biodegradability test criteria) and the ecotoxicity (3 ecotoxicity test criteria). It specifies also the components of mulching materials (heavy metals, organic substances, yearly fluxes).

5.4.12 NF mark NF 082, Plastic waste bags

5.4.12.1 Scope

These certification regulations are applicable to non-biodegradable bags for collection of household waste and for selective collection of waste, to biodegradable bags in composting facilities for collection of organic waste and bags for soft infections risk-generating waste

The products shall conform to:

- EN 13592, Plastic sacks for household waste collection — Types, requirements and test methods

- NF X 30-501, Packaging for medicinal care waste — Bags for soft infections risk-generating waste — Specifications and test methods

- EN 13432, Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging

5.4.12.2 Evaluation

In addition to the conformance to EN 13432, the biodegradable bags shall satisfy criteria of fitness for purpose, based on testing the effectiveness of bags after acclimatization at ambient temperature and at 40 °C.

5.4.13 CEN/TS 15534:2007, Wood-plastics composites (WPC)

- Part 1: Test methods for characterisation of WPC materials and products

- Part 2: Characterisation of WPC materials

- Part 3: Characterisation of WPC products.

5.4.13.1 Scope

CEN/TS 15534-1 specifies test methods and their relevant parameters and test conditions to be used in determining selected properties of wood-plastics composites, materials and products. It is applicable to cellular or non-cellular WPC materials processed through plastics processing techniques.

Wood-plastics composite is defined as material or product made thereof being the result of the combination of one or several cellulosic materials with one or several thermoplastics and being or to be processed through plastic processing techniques.

CEN/TS 15534-2 and CEN/TS 15534-3 identify the required and optional properties of WPC materials and WPC products, respectively. They are intended to be used as basis for the specifications of WPC materials and products.

5.4.13.2 Evaluation

WPC materials can be considered neither as filled plastics nor as a special kind of wood. They should be considered as a different material having their own characteristics. No limitation has been introduced for the content of cellulosic materials. The contents of natural fibres and polymers depend on the application and the processing techniques.

Products standards for WPC profiles intended to be used as decking and sidings are currently in preparation.

5.4.14 XP T 25-501, Reinforcement fibres — Flax fibres for plastics composites

Part 1: Terminology and characterisation of flax technical fibres (to be published in 2010)

Part 2: Determination of tensile properties of elementary fibres (2009)

Part 3: Determination of tensile properties of technical fibres (to be published in 2010)

5.4.14.1 Scope

XP T 25-501-1 defines the terminology for flax fibres intended to be used as reinforcement in plastics composites. It gives the main characteristics of flax fibres intended to be used as reinforcement in plastics composites and the associated test methods.

XP T 25-501-2 specifies a method for the determination of the tensile strength, tensile strain at break, modulus of elasticity (Young's modulus) and the stress/strain curve of elementary flax fibres with strain at break less than or equal to 8 %.

XP T 25-501-3 specifies a method for the determination of tensile properties of bundles of elementary flax fibres.

5.4.14.2 Evaluation

The growing interest for the use of crop fibres as reinforcements of composites with plastic matrix concerns in particular flax fibres, which are known to present excellent mechanical properties. However, the professionals of the flax were quickly confronted with a need of characterization of fibres to answer the requests of the industry of composites.

The first experiences show that flax fibres intended to be used as reinforcement in plastics composites require processing methods different from those used for fibres for textile application. Furthermore, there was no standardized method in the textile domain which allows characterizing flax fibres according to the criteria commonly used for the fibres for reinforcement, as glass or carbon fibres.

The extension to other natural fibres as hemps and at the European level will be considered in a second step.

5.4.15 ISO 22621:2007, Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to and including 2 MPa (20 bar) — Polyamide (PA)

5.4.15.1 Scope

ISO 22621-1 specifies the general properties of polyamide (PA 11 and PA 12) compounds for the manufacture of pipes and fittings made from these compounds, intended to be buried and used for the supply of gaseous fuels at maximum operating pressures (MOP) up to and including 20 bar. It also specifies the test parameters for the test methods to which it refers.

ISO 22621-2 specifies the physical and mechanical properties of pipes made from polyamide (PA), jointed typically by using mechanical, electrofusion or butt fusion techniques, but not by solvent cement jointing.

ISO 22621-3 specifies the physical and mechanical properties of fittings made from polyamide (PA).

5.4.15.2 Evaluation

This series of standards covers PA 11 material, which is performance polyamide derived from a 100 % renewable raw material: castor oil (Ricinus Communis) which grows primarily in tropical countries. PA 11 material production is characterized by lower fossil energy requirements and lower CO_2 emissions in comparison to other polymers based on fossil resources. These standards are product specifications.

5.4.15.3 Other specific product standards

The following standards could also be considered for specific bio-based products, but are not evaluated here:

NF T60-198, *Lubricants – Evaluation of primary biodegradability – Method by infrared spectroscopy*

NF T73-260, *Surface active agents – Detergents – Anionic surface active agents – Determination of biodegradability*

NF T73-265, *Surface active agents – Detergents – Anionic surface active agents – Determination of biodegradability – Reference method*

NF T73-276, *Surface active agents – Detergents – Non-ionic surface active agents – Determination of biodegradability – Reference method*

ISO 7628:2010, *Road vehicles - Thermoplastics tubing for air braking systems*

DIN 74324-1:1996, *Air braking systems - Thermoplastic tubing - Part 1: Requirements and tests*

DIN 74323:1991, *Air braking systems - Coiled tubing*

5.4.16 Cradle to cradle[SM] Certification Program (Version 2.1.1)

5.4.16.1 Scope of Cradle to Cradle

The Cradle to Cradle[SM] certification includes requirements for:

- Product/Material transparency and human/environmental health characteristics of materials:
- Product/Material reutilization:
- Production energy:
- Water use at manufacturing facility:
- Social fairness/corporate ethics.

Cradle to Cradle[SM] certification is a four-tiered approach consisting of Basic, Silver, Gold, and Platinum levels to reflect continuing improvement along the cradle-to-cradle trajectory. This certification program applies to materials, sub-assemblies and finished products. Special considerations will be given to certain classes of products (e.g., VOC emission standards will be applicable to indoor products only, reutilization criteria will be applied to the substrate, rather than the material, for paint and other coating products, etc.). In the case of technical nutrient based products where a take back system is in effect and there is a well-defined chain of custody, certain rare, high value, but potentially toxic substances (e.g., cadmium, silver, etc.) may be appropriate and effective substances as defined in use.

This program does not address performance concerns associated with any and all products that qualify for Cradle to Cradle[SM] certification.

5.4.16.2 Evaluation of Cradle to Cradle

The Cradle to Cradle[SM] certification scheme is a very simple approach to include a very wide variety of life cycle and sustainability effects. It is a very interesting approach to a complex field and could form a very good example of a scheme that can qualify a wide variety products.

6 Coverage of criteria

Several types of standards exist and have been evaluated in Clause 5. Typically these can be divided into umbrella standards, methods and specifications. Umbrella standards - or series of standards – typically cover a subject horizontally. This means that the sub-parts of the umbrella standard may address several details within a subject. Umbrella standards are of particular importance for the introduction of new topics, and as such are lacking for bio-based products.

Methods typically address test and calculation principles and can sometimes be used in several application fields. They describe the measurement method and principles.

Specifications typically detail to which level certain criteria need to be met for a product. They are normally product specific.

6.1 Bio-based content

6.1.1 Bio-based content determination

Bio-based content determination is currently primarily covered in the ASTM D6866 standard. At a European level, the equivalent EN 15440 has been published. The latter includes additional methods on calculation and sorting for determination of bio-based content in solid recovered fuels. Another work item is in progress to determine bio-based carbon content in bio-based polymers under CEN TC 249.

There is currently no single method or definition of bio-based content in all types of products in general. Particularly when products are not homogeneous, this may lead to confusion. The ASTM D6852 (from cradle to gate) report aims to fill this gap, also in relation to total resource consumption and life cycle analysis.

Further work is still to be expected in this area. Evaluation of future work and needs of co- and prenormative research are to be considered by TG2 of CEN/BT WG209.

6.1.2 Bio-based content in products

In the specific products surveyed (plastics, lubricants, paints) there are only few specifications on bio-based content. Only one study determining the bio-based content for several products was identified; this is the BEES methodology. The BEES results used by the USDA allow different acceptable bio-based content for products, depending on the type, use, impact and alternatives for the product considered. There are no uniform specifications for bio-based content.

When bio-based content is detected by carbon isotope analysis, in fact only the bio-based carbon content is detected. This is normally divided over the total carbon content in the product. This can result in different outcomes from other biomass determination methods

When process energy is also included to evaluate a product, such as in ASTM D 6852, analysis to determine the overall bio-based resources used is much more difficult to achieve.

Currently, a number of committees are working on bio-based content analysis, based on the ASTM D 6866 methodology. Annex B includes a listing of identified Technical Committees that may have some overlap with the subject of bio-based products. It would be beneficial to verify that no duplicate work will be performed regarding the development of standards for bio-based products and particularly for bio-based content.

6.2 Product functionality

6.2.1 Plastics

Performance criteria for plastic products depend– amongst others – on the mechanical properties, thermal- and barrier properties.

Standards requirements for products should be based on the performance of products in the function to fulfill, not on the origin of the material they are made of. This means that in order to create a level-playing field, no undue discrimination should be included in favour or against the use of bio-based, fossil-based, virgin or recycled materials. In case the results are used for public comparison purposes, the function to be fulfilled should be the same; if not, the differences should be clearly highlighted.

For environmental labels and claims, many (voluntary) schemes exist. In this respect, ISO 14021 which governs the use of environmental claims should be considered.

6.2.2 Lubricants

6.2.2.1 Lubricant characteristics

Important characteristics of lubricants are viscosity, flashpoint, operating range/temperature, operational life and compatibility.

The performance criteria for products in 2005/360/EC are as follows:

— Hydraulic fluids: ISO 15380;

— Greases: Fit for purpose;

— Chain saw oil: RAL-UZ 48 of the Blue Angel;

— Controlled release agents: Fit for purpose;

— 2-stroke oils: NMMA Certification for Two-Stroke Cycle Gasoline Engine Lubricants (NMMA TC-W3).

ISO 19378:2003 provides the manufacturers and users of machine tools with criteria for the choice among the various categories of lubricants and gives specifications for these lubricants. ISO 19378:2003 facilitates the application of ISO 5169 relating to the presentation of lubrication instructions for machine tools.

6.2.2.2 Lubricants Market

Valbiom has published a market survey on the penetration and certification of bio-based products. Some data on the amount of certified biolubricants are given in Table 2 below.

Table 2 – Status of Ecolubs according to Valbiom per 02/2009

Swedish Standard Hydraulic oils SS 15 54 34	Swedish Standard Lubricating greases SS 15 54 70	Nordic Swan (Finland)	BLUE ANGEL Hydraulic Fluids RAL-UZ 79	BLUE ANGEL Lub. and Form. Oils RAL-UZ 64	EUROPEAN ECO-Label	GERMAN POSITIVE LIST
37 companies (+1)	13 companies (-1)	0 companies	25 companies	25 companies (+11)	14 companies (+5)	40 companies (+5)
84 product (-3)	19 products (-1)	0 products	77 products	53 products (+24)	57 products (+19)	232 products (+28)

6.2.3 Paints

Important functional properties of (finished) paints are: weatherability, gloss and colour retention, heat- and chemical resistance.

The Natureplus label has some basic requirements regarding the functional suitability for paints/building materials:

— Technical approval (if required by law / by the building inspectorate), i.e. European technical approval, Statement of compliance as per EN / DIN, or technical approval in a country or region within the European Economic Area.

— Each product must comply with the minimum standards as laid down either in the relevant European Standard (EN) or in the equivalent standard(s) specific to the country in which the product is to be sold and used (EN / DIN / ÖNORM). If no such minimum standards exist, the product's functional suitability must be proved.

— Product quality must be guaranteed by means of a quality assurance system.

— The product's expected technical useful life and the amount of work and cost involved in its routine and preventive maintenance must suit the requirements of actual use.

In the case of indoor paints the Natureplus label requires at least class 3 according to EN 13300.

6.2.4 Detergents

The European Ecolabel uses the fit-for-use principle: products must meet the needs of the consumers. Assessment and verification must be proved with an adequate and justifiable laboratory test, or an adequate and justifiable consumer test. An example of a laboratory test is the "performance test of household detergents". This test compares the washing performance with reference detergents of the same type.

The Swan label states that the most significant aspect in the LCA for dishwasher detergent comes from the energy required to warm the water used during washing, and concludes that the greatest environmental gains can be achieved by lowering the wash temperature from 65 °C to 55 °C. Therefore it is required that the detergent shall produce satisfactory results in a 55 °C performance test. Extra points can be earned if the product passes the test at 50 °C.

6.2.5 Wood based products

http://www.nnfcc.co.uk/metadot/index.pl?id=4286;isa=DBRow;op=show;dbview_id=2487

For wood based products, a comparative study on standards looking at whether BSI standards discriminate against reclaimed and/or recycled wood has been published by Nnfcc. The study also looks at perceptions and attitudes to reclaimed/ recycled wood. In this approach, many wood related standards have been evaluated on whether they could pose a barrier to introduction of alternative recycled or reclaimed wood-

based materials. For example, where certain species are indicated instead of performance criteria (e.g. "oak" versus "hardness", this could pose a barrier to reclaimed or recycled alternatives.

6.2.6 Evaluation of product functionality in relation to bio-based products

Product functionality is strongly product/application related. In most cases tests methods and standards are available.

The product is only part of the environmental performance of the system in which it is used. The environmental impact of the system is in many cases bigger than the impact the product itself.

Labels all have different criteria and specifications of what a product should comply with. Producers, users and regulators all benefit from information on the criteria, provided that they are based on uniform methods. In this respect, ISO 14021 should be considered.

Criteria for performance (and measurement methods) should be the same for bio-based and non-bio-based products. However, specifications do not have to be equal, depending on the relevance of the criterion. Where a bio-based product has better properties in one area (e.g. biodegradability), these can compensate for lower performance (strength or necessary wall thickness) in another area. The overall environmental impact resulting from product functionality is the main criterion that should be used for evaluation of products.

Products should be fit for purpose or fit for use. There is no specific need to develop functionality product specific standards at this point. At times, current product functionality criteria (when requirements are not function based, but more specific on how the function is guaranteed) can form a barrier for entry of bio-based products.

Where barriers exist as a result of functionality criteria not based on function, research could help in identifying bottlenecks and addressing these specifically for these product groups.

6.3 End of life

6.3.1 Biodegradability

Biodegradability is typically a parameter only relevant in specific applications and/or end of life options. There is no direct link between bio-based content and biodegradability. Biodegradation is affected by environmental conditions and proceeds over a period of time, comprising one or more steps. A material is called biodegradable with respect to specific environmental conditions if it undergoes biodegradation to a specified extent within a given time, measured by standard test methods, covered in many standards. The applications or end of life options of a product determine the environmental conditions of the test method, and further requirements such as extent of conversion and the timeframe in which it occurs. That is why there are many different standards for biodegradability, some of which are listed in Annex A.

These test methods are designed to measure biodegradation in specific environmental conditions (related to a specific application) regardless of the origin of the product. They are applicable for both bio-based and fossil based products.

The emphasis on biodegradability within bio-based products is not correct. Biodegradability is a product property depending on the chemical structure of the polymer and independent from the origin of the material, There is not necessarily a correlation between the 2 characteristics. Biodegradability and bio-based should not be confused! Biodegradability is extensively covered in the standards mentioned in Annex A. Biodegradability is already addressed by the following Technical committees:

— regarding Packaging: CEN/TC261/SC4/WG2

— regarding Plastics: CEN/TC 249

— regarding biodegradation in water: CEN/TC 165

— regarding biodegradation in soil: CEN/TC 190 and CEN/TC 345

Where bio-based products do enhance biodegradability, this will be reflected back in the life cycle assessment.

6.3.2 Compostability

6.3.2.1 General

Compostability is the potential of a material to be disintegrated and biodegraded without hindrance in a composting process. Besides demonstrating inherent ultimate biodegradability, the product should show complete disintegration (falling apart) in a (industrial) composting process, and it should not have adverse effects on the composting process, nor a negative effect on the quality of the resulting compost. There are several international standards, i.e. ASTM D6400 (Standard specifications for compostable plastics), EN 13432 (Packaging - organic recovery), ISO 17088 (Specifications for compostable plastics). However, they are harmonized and follow exactly the same methodology. Minor variations exist in for example maximum tolerated amounts of heavy metals, or the allowed duration of biodegradability assessments.

6.3.2.2 Other compostability standards

The following standard could also be considered for compostability, but is not evaluated here:

EN 14995:2007, *Plastics – Evaluation of compostability, test scheme and specifications*

6.3.3 Recycling

For packaging significant work has been done to standardise requirements for recycling (see also EN 13427:2004 and EN 13430:2004). However, similar to the case of biodegradability and compostability, the evaluation criteria for recyclability, are independent of the origin of the product. In any case, the evaluation criteria for recycling are independent of the origin of the product. They are applicable for both bio-based and fossil based products.

6.3.4 Durability

Durability is not often listed as a criterion in standards for (bio-based) products. Some categories of products, such as for woods and paints and varnishes, mention durability as a performance criterion. This to indicate the expected service time of the product. Durability is a factor that should express itself during the life cycle assessment, as it determines the service life phase of the product.

When durability is defined, this is not a barrier. However, sometimes durability is translated into specific requirements of the type of material to be used. This can then form a barrier to the introduction of new and bio-based products. Research could help identifying barriers for products – as detailed in 6.2.6.

In any case, the evaluation criteria for durability are independent of the origin of the product. They are applicable for both bio-based and fossil based products.

6.4 Life-Cycle Analysis

Life Cycle Assessment is described in the ISO 14040 series Standards. Other standards (international, European or national) which are considering LCA make reference to the relevant ISO 14040 and provide additional guidelines for the definition of the specific characteristics of a system:

- CR13910 (CEN TC 261) on packaging;
- ASTM D7075 for bio-based products.

There have been attempts to include socio-economic aspects as assessment criteria. However, currently the majority of LCAs consider only direct environmental (and human) impacts and resource consumption as assessment criteria.

A number of initiatives are providing guidelines for implementation:

- The ILCD – International Life Cycle Data system has developed a handbook to provide common grounds for the implementation of LCA in order to achieve comparability of results.

- The UNEP-SETAC Life Cycle Initiative of http://lcinitiative.unep.fr.

6.4.1 Greenhouse gas emissions (GHG)

An LCA typically requires an assessment of the climate change potential of a product or process. Methodology used for this analysis refers usually to ISO 14064.

ISO 14064 considers:

- Part 1: the quantification and reporting of greenhouse gas emissions and removals

- Part 2: guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

- Part 3: the validation and verification of greenhouse gas assertions

PAS 2050 (UK) aims at providing detailed implementation for the calculation of GHG balance of products (incl. Goods and services).

6.4.2 Energy use

Energy use can be expressed into a carbon footprint in ISO 14067, in this respect similar to the potential for Greenhouse Gas emissions from ISO 14064.

6.4.3 Other LCA criteria

LCA is a field in development in ISO TC/207. Hence, several other criteria could evolve in the time to come.

— Besides the carbon footprint, water-footprints are under development.

— ISO NWIP 14046 documents studied mention that for the system boundaries, the same as for carbon footprint will be used.

— Similar limitations may also apply to the phosphorous cycle.

— Additionally other criteria like ozone depletion, eutrophication, ecotoxicity, etc. could be considered.

6.5 Sustainability

6.5.1 General

The issue of sustainability is fairly new in CEN and ISO, although parts may be considered as being dealt with by specific committees and organizations. For instance, back in 2005 ISO initiated work on a Guidance on Social Responsibility (ISO 26000). Apart from social sustainability, this guidance also describes the relations with environmental and economic management.

The standards to be developed under CEN/TC 383 – although currently focussing on energy – should also be applicable to bio-based products. Yet, when they become available, these documents should be evaluated on any limitations for bio-based products and whether additional work is to be performed. In September 2009, ISO has started a program committee on "Sustainability criteria for bioenergy". This ISO/PC 248 has a similar scope as CEN/TC 383, but at this time no active work items.

Apart from CEN and ISO, several other initiatives in the international arena[1] have developed due to the growing interest of the market and the public in guaranteeing sustainability of biofuels. Some to mention in the interest of bio products are the Roundtable on Sustainable Biofuels (RSB), the Roundtable on Sustainable Palm Oil (RSPO), the Roundtable on Responsible Soy (RTRS) and the Council on Sustainable Biomass Production (CSBP). All of these do incorporate more or less environmental, social and economic requirements in their standards under development. Besides these other initiatives already existed for non-energy products which also have a relationship with bio-products: Forest Stewardship Council (FSC) for wood-based products, Sustainable Agriculture Standard (SAN) under the Rainforest Alliance for sustainable farming.

6.5.2 Environment

6.5.2.1 CEN

The European Commission Directive 2009/28/EC on the promotion of the use of energy from renewable sources, referred to as Renewable Energy Directive (RED), addresses sustainability criteria for biofuels and bioliquids in Article 17. Land use types are identified from which raw material will not meet the requirements of the directive. However, in three of these land use types exceptions are possible. Raw material will be considered to meet the requirements if evidence is provided that its production does not interfere with the continuity of that land use type or the integrity of the ecosystem. These land use types are areas designated for nature protection purposes, highly biodiverse non-natural grassland and peatland. These issues are addressed in prEN 16214-3 of CEN/TC 383.

6.5.2.2 ISO

The ISO 14000 management systems do form a basis for environmental sustainability, but they do not exactly include requirements towards cultivation, production or usage. Especially when it comes to bioproducts. ISO 26000 gives some additions, but it seems that more precise standards needs to come from ASTM, CEN or the international initiatives like RSB or RSPO.

6.5.2.3 Indirect land use change

California (CARB), the United States Government (US EPA) and the European Commission are currently working on the integration of land use change factors into their evaluation of Green House Gas (GHG) reduction from biofuels and conventional fuels. Countries across the globe are looking at these developments to address the same issue in their own low carbon fuels and/or biofuels policy.

The greatest uncertainty and complexity regarding land use change applies to biofuels. This necessitates a full understanding not only of feedstock practices and land use change factors but also of potential impacts from land used for food vs. the same land used for energy or bioproduct crops. One of the greatest challenges relates to modelling these changes in existing GHG life cycle models. More specific CEN/TC 383 has a working group active in this arena.

6.5.3 Economic

This is covered in the principles of the RSB and the RSPO for instance. The Organisation for Economic Co-operation and Development (OECD) has produced many reports and guidance on this, but not yet to a level of requirements and certifiable matters. CEN/TC 383/WG 4 is covering this issue, but no committee draft has been produced so far.

[1] National initiatives like RTFO in the UK, BSO in Germany or NTA 8080 in the Netherlands are not further described in this document.

6.5.4 Social

ISO 26000 is the main initiative on this. Of course, this standard refers to global agreements under the UN or by the International Labour Organization (ILO) for instance. It seems that all standards to be published will refer in their criteria and indicators towards these basic agreements.

6.5.5 Overall

Except for GHG and biodiversity, sustainability criteria do not overlap with LCA. Work on sustainability should be aligned with outcomes from CEN/TC 383 at any time.

7 Conclusions

This Technical Report gives an overview of existing standards and documents on bio-based products and their relevance for certain criteria. From the evaluations, gaps in existing regulations, codes and standards can be determined. Conclusions on such gaps on the basis of this report, and further needs for the development of additional (umbrella) standards, will be evaluated by CEN BT/WG209.

Overall, there is a need for a useful set of EN/ISO umbrella standards that can be applied to any kind of bio-based product. Where relevant standards already exist (for products in general), only the parts that are missing for bio-based products specifically should be elaborated. Options for those umbrella standards are sampling, bio-based content, application of and correlation towards LCA and sustainability of biomass used.

The expanding collection of labels and certification concerning bio-based content, environmentally friendliness and biodegradation or compostability is one of the major issues that should be tackled in terms of standardization.

Annex A
(informative)

End-of-Life standards

Below is a list of End-of-Life related standards, ordered by origin. This list is not intended as being exhaustive.

ASTM

ASTM D2020-92(2003) Standard Test Methods for Mildew (Fungus) Resistance of Paper and Paperboard

ASTM D5210-92(2007) Standard Test Method for Determining the Anaerobic Biodegradation of Plastic Materials in the Presence of Municipal Sewage Sludge

ASTM D5271-02 Standard Test Method for Determining the Aerobic Biodegradation of Plastic Materials in an Activated-Sludge-Wastewater-Treatment System

ASTM D5338-98(2003) Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions

ASTM D5511-02 Standard Test Method for Determining Anaerobic Biodegradation of Plastic Materials Under High-Solids Anaerobic-Digestion Conditions

ASTM D5819-05 Standard Guide for Selecting Test Methods for Experimental Evaluation of Geosynthetic Durability

ASTM D5864-05 Standard Test Method for Determining Aerobic Aquatic Biodegradation of Lubricants or Their Components

ASTM D5929-96(2004) Standard Test Method for Determining Biodegradability of Materials Exposed to Municipal Solid Waste Composting Conditions by Compost Respirometry

ASTM D5951-96(2002) Standard Practice for Preparing Residual Solids Obtained After Biodegradability Standard Methods for Plastics in Solid Waste for Toxicity and Compost Quality Testing

ASTM D5970-09 Standard Test Method for Deterioration of Geotextiles from Outdoor Exposure

ASTM D5988-03 Standard Test Method for Determining Aerobic Biodegradation in Soil of Plastic Materials or Residual Plastic Materials After Composting

ASTM D6002-96(2002)e1 Standard Guide for Assessing the Compostability of Environmentally Degradable Plastics

ASTM D6006-97a(2008) Standard Guide for Assessing Biodegradability of Hydraulic Fluids

ASTM D6046-02(2006) Standard Classification of Hydraulic Fluids for Environmental Impact

ASTM D6081-98(2004) Standard Practice for Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results Interpretation

ASTM D6094-97(2004) Standard Guide to Assess the Compostability of Environmentally Degradable Nonwoven Fabrics (Withdrawn 2008)

ASTM D6139-00(2005) Standard Test Method for Determining the Aerobic Aquatic Biodegradation of Lubricants or Their Components Using the Gledhill Shake Flask

ASTM D6340-98(2007) Standard Test Methods for Determining Aerobic Biodegradation of Radiolabeled Plastic Materials in an Aqueous or Compost Environment

ASTM D6400-04 Standard Specification for Compostable Plastics

ASTM D6691-01 Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials in the Marine Environment by a Defined Microbial Consortium

ASTM D6692-01 Standard Test Method for Determining the Biodegradability of Radiolabeled Polymeric Plastic Materials in Seawater

ASTM D6731-01(2005) Standard Test Method for Determining the Aerobic, Aquatic Biodegradability of Lubricants or Lubricant Components in a Closed Respirometer

ASTM D6776-02 Standard Test Method for Determining Anaerobic Biodegradability of Radiolabeled Plastic Materials in a Laboratory-Scale Simulated Landfill Environment

ASTM D6868-03 Standard Specification for Biodegradable Plastics Used as Coatings on Paper and Other Compostable Substrates

ASTM D6954-04 Standard Guide for Exposing and Testing Plastics that Degrade in the Environment by a Combination of Oxidation and Biodegradation

ASTM D7081-05 Standard Specification for Non-Floating Biodegradable Plastics in the Marine Environment

ASTM E943-08 Standard Terminology Relating to Biological Effects and Environmental Fate

ASTM E1720-01(2008) Standard Test Method for Determining Ready, Ultimate, Biodegradability of Organic Chemicals in a Sealed Vessel CO2 Production Test

ASTM G21-96 (2002) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

ASTM G22-76 (1997) 5tandard Practice for Determining Resistance of Plastics to Bacteria

ASTM G160-03(2009) Standard Practice for Evaluating Microbial Susceptibility of Nonmetallic Materials by Laboratory Soil Burial

ASTM G162-99(2004) Standard Practice for Conducting and Evaluating Laboratory Corrosions Tests in Soils

EN

EN 12224 Geotextiles and geotextile-related products - Determination of the resistance to weathering

EN 12225 Geotextiles and geotextile-related products - Method for determining the microbiological resistance by a soil burial test

EN 12280-1 Rubber- or plastic- coated fabrics - Accelerated ageing tests - Part 1: Heat ageing

EN 12280-2 Rubber- or plastics-coated fabrics - Accelerated ageing tests - Part 2: Physical ageing: effect of light or weathering

EN 12280-3 Rubber- or plastic-coated fabrics - Accelerated ageing tests - Part 3: Environmental ageing

EN 13432:2000 Packaging - Requirements for packaging recoverable through composting and biodegradation - Test scheme and evaluation criteria for the final acceptance of packaging

EN 14045:2003 Packaging - Evaluation of the disintegration of packaging materials in practical oriented tests under defined composting conditions

EN 14046:2003 Packaging - Evaluation of the ultimate aerobic biodegradability of packaging materials under controlled compositing conditions - Method by analysis of released carbon dioxide

EN 14047:2003 Packaging - Determination of the ultimate aerobic biodegradability of packaging materials in an aqueous medium - Method by analysis of evolved carbon dioxide

EN 14048:2003 Packaging - Determination of the ultimate aerobic biodegradability of packaging materials in an aqueous medium - Method by measuring the oxygen demand in a closed respirometer

EN 14735:2005 Characterization of waste - Preparation of waste samples for ecotoxicity tests

EN 14995:2006 Plastics - Evaluation of compostability - Test scheme and specifications

ISO

ISO 7827:1994 Water quality - Evaluation in an aqueous medium of the "ultimate" aerobic biodegradability of organic compounds - Method by analysis of dissolved organic carbon (DOC)

ISO 9408:1999 Water quality - Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium by determination of oxygen demand in a closed respirometer

ISO 9439:1999 Water quality - Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium - Carbon dioxide evolution test

ISO 9887:1992 Water quality - Evaluation of the aerobic biodegradability of organic compounds in an aqueous medium - Semi-continuous activated sludge method (SCAS)

ISO 9888:1999 Water quality - Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium - Static test (Zahn-Wellens method)

ISO/DIS 10210:2009 Plastics - Preparation of samples for biodegradation testing

ISO 10634:1995 Water quality - Guidance for the preparation and treatment of poorly water-soluble organic compounds for the subsequent evaluation of their biodegradability in an aqueous medium

ISO 10707:1994 Water quality - Evaluation in an aqueous medium of the "ultimate" aerobic biodegradability of organic compounds - Method by analysis of biochemical oxygen demand (closed bottle test)

ISO 10708:1997 Water quality - Evaluation in an aqueous medium of the ultimate aerobic biodegradability of organic compounds - Determination of biochemical oxygen demand in a two-phase closed bottle test

ISO 11721-1 Textiles - Determination of the resistance of cellulose containing textiles to micro-organisms - Soil burial test - Part 1: Assessment of rot-retardant finishing

ISO 11721-2 Textiles - Determination of resistance of cellulose-containing textiles to micro-organisms - Soil burial test - Part 2: Identification of long-term resistance of a rot retardant finish

ISO 11733:2004 Water quality - Determination of the elimination and biodegradability of organic compounds in an aqueous medium - Activated sludge simulation test

ISO 11734:1995 Water quality - Evaluation of the "ultimate" anaerobic biodegradability of organic compounds in digested sludge - Method by measurement of the biogas production

CR-ISO 13434 Guidelines on durability of geotextiles and geotextile-related products

ISO/TS 13434 Geosynthetics - Guidelines for the assessment of durability

ISO 13437 Geotextiles and geotextile-related products - Method for installing and extracting samples in soil, and testing specimens in laboratory

ISO 13438 Geotextiles and geotextile-related products - Screening test method for determining the resistance to oxidation

ISO 14592-1:2002 Water quality - Evaluation of the aerobic biodegradability of organic compounds at low concentrations - Part 1: Shake-flask batch test with surface water or surface water/sediment suspensions

ISO 14592-2:2002 Water quality - Evaluation of the aerobic biodegradability of organic compounds at low concentrations - Part 2: Continuous flow river model with attached biomass

ISO 14593:1999 Water quality - Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium - Method by analysis of inorganic carbon in sealed vessels (CO_2 headspace test)

ISO 14851:1999+C1:2005 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium - Method by determining the oxygen demand in a closed respirometer

ISO 14852:1999+C1:2005 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium - Method by analysis of evolved carbon dioxide

ISO 14853:2005 + C1:2009 Plastics - Determination of the ultimate anaerobic biodegradation of plastic materials in an aqueous system - Method by measurement of biogas production

ISO 14855-1:2005 + C1:2009 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide - Part 1: General method

ISO 14855-2:2007 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions - Method by analysis of evolved carbon dioxide - Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test

ISO/TR 15462:2006 Water quality - Selection of tests for biodegradability

ISO 15985:2004+C1:2007 Plastics - Determination of the ultimate anaerobic biodegradation and disintegration under high-solids anaerobic-digestion conditions - Method by analysis of released biogas

ISO 16221:2001 Water quality - Guidance for determination of biodegradability in the marine environment

ISO 16929:2002 Plastics - Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test

ISO 17556 Plastics - Determination of the ultimate aerobic biodegradability in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved

ISO 18749:2004 Water quality - Adsorption of substances on activated sludge - Batch test using specific analytical methods

ISO 20200:2004 Plastics - Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test

OECD

OECD 301 A: DOC Die-Away

OECD 301 B: CO2 Evolution (Modified Sturm Test)

OECD 301 C: MITI (I) (Ministry of International Trade and Industry, Japan)

OECD 301 D: Closed Bottle

OECD 301 E: Modified OECD Screening

OECD 301 F: Manometric Respirometry

OECD 302 A: Inherent Biodegradability: Modified SCAS Test

OECD 302 B: Inherent Biodegradability: Zahn-Wellens/ EVPA Test

OECD 302 C: Inherent Biodegradability: Modified MITI Test (II)

OECD 303 A: Simulation Test - Aerobic Sewage Treatment - Activated Sludge Units

OECD 303 B: Simulation Test - Aerobic Sewage Treatment - Biofilms

OECD 304 A: Inherent Biodegradability in Soil

OECD 305: Bioconcentration: Flow-through Fish Test

OECD 306: Biodegradability in Seawater

OECD 307: Aerobic and Anaerobic Transformation in Soil

OECD 308: Aerobic and Anaerobic Transformation in Aquatic Sediment Systems

OECD 309: Aerobic Mineralisation in Surface Water - Simulation Biodegradation Test

OECD 310: Ready Biodegradability - CO2 in sealed vessels (Headspace Test)

OECD 311: Anaerobic Biodegradability of Organic Compounds in Digested Sludge: by Measurement of Gas Production

OECD 312: Leaching in Soil Columns

OECD 313: Estimation of Emissions from Preservative - Treated Wood to the Environment: Laboratory Method for Wooden Commodities that are not Covered and are in Contact with Fresh Water or Seawater

OECD 314: Simulation Tests to Assess the Biodegradability of Chemicals Discharged in Wastewater

OECD 315: Bioaccumulation in Sediment-dwelling Benthic Oligochaetes

OECD 316: Phototransformation of Chemicals in Water - Direct Photolysis

Annex B
(informative)

Related Technical Committees

Below is a list of International and European Technical Committees on standardisation, that may have an overlap with bio-based products.

ISO TC 6 Paper, board and pulps (SCC (Canada))

ISO TC 28 Petroleum products and lubricants (ANSI (USA))

ISO TC 61 Plastics (ANSI (USA))

ISO TC 122 Packaging (JISC (Japan))

ISO TC 207 Environmental Management, including SC 1-7 (SCC (Canada))

ISO TC 238 Solid Biofuels (SIS (Sweden))

ISO PC 248 Sustainibility criteria for bioenergy (DIN (Germany))

CEN/SS/NO2 Solid fuels (CCMC)

CEN/TC38 Durability of wood and wood based products (AFNOR (France))

CEN/TC19 Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin (NEN (NL))

CEN/TC139 Paints and varnishes (DIN (Germany))

CEN/TC172 Pulp, paper and board (DIN (Germany))

CEN/TC249 Plastics (NBN (Belgium))

CEN/TC261 Packaging (AFNOR (France))

CEN/TC307 Oilseeds, vegetable and animal fats and oils and their by-products - Methods of sampling and analysis (AFNOR (France))

CEN/TC335 Solid Biofuels (SIS (Sweden))

CEN/TC343 Solid recovered fuels (SFS (Finland))

CEN/TC383 Sustainably produced biomass for energy applications (NEN (NL))

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[2] CEN/TR 15932, Plastics - Recommendation for terminology and characterisation of biopolymers and bioplastics

[3] EN 13300:2001, Paints and varnishes - Water-borne coating materials and coating systems for interior walls and ceilings - Classification

[4] EN 50242:1999, Electric dishwashers for household use - Test methods for measuring the performance

[5] EN ISO 6504 (all parts), Paints and varnishes - Determination of hiding power

[6] ISO 14025, Environmental labels and declarations - Type III environmental declarations - Principles and procedures

[7] ISO 14040 (all parts), Environmental management - Life cycle assessment - Principles and framework

[8] ISO 14064-1:2006, Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals

[9] ISO 15380:2002 Lubricants, industrial oils and related products (class L) - Family H (Hydraulic systems) -- Specifications for categories HETG, HEPG, HEES and HEPR

[10] ISO 19378:2003, Lubricants, industrial oils and related products (class L) - Machine-tool lubricants - Categories and specifications

[11] ISO 22621 (all parts), Plastics piping systems for the supply of gaseous fuels for maximum operating pressures up to and including 2 MPa (20 bar) - Polyamide (PA)

[12] ISO/NP 14046, Water footprint - principles, requirements and guidance

[13] ISO/WD 14067-1, Carbon footprint of products

[14] ISO/WD 14067-2 Carbon footprint of products -- Part 2: Communication

[15] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC

[16] Directive 2005/360/EC: Commission Decision of 26 April 2005. Ecological criteria and the related assessment and verification requirements for the award of the Community eco-label to lubricants

[17] Directive 2005/344/EC Establishing ecological criteria for the award of the European Community eco-label to all-purpose cleaners and cleaners for sanitary facilities.

[18] ASTM D6866-06a, Standard Test Methods for Determining the Bio-based Content of Natural Range Materials Using Radiocarbon and Isotope Ratio Mass Spectrometry Analysis

[19] ASTM D7026-04 Standard Guide for Sampling and Reporting of Results for Determination of Bio-based Content of Materials via Carbon Isotope Analysis

[20] ASTM D5338, Test method for determining aerobic biodegradation of Plastic materials under controlled composting conditions.

[21] ASTM D6852,Standard Guide for Determination of Bio-based Content, Resources Consumption, and Environmental Profile of Materials and Products

[22] ASTM D7075, Standard Practice for Evaluating and Reporting Environmental Performance of Bio-based Products

[23] NF 082, Plastic waste bags

[24] NF U 52-001, Biodegradable materials for use in agriculture and horticulture — Mulching products — Requirements and test methods

[25] PAS 2050, Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

[26] CR 13910, Packaging — Report on criteria and methodologies for life cycle analysis of packaging

[27] ILCD/ELCD, Int Life Cycle Data system handbook and European database

[28] NTA 8080, Sustainability criteria for biomass for energy purposes

[29] VDI 4431, Life-cycle management in the manufacturing industry

[30] BEES, USDA green public procurement

[31] Blue Angel, RAL-UZ-48 Readily Biodegradable Chain Lubricants for Power Saws

[32] Blue Angel, RAL-UZ 64 Lubricants & Forming oils

[33] Blue Angel, RAL-UZ 79 Hydraulic Fluids

[34] DIN 51828-1 , Testing of lubricants and related products - Determination of the rapid biodegradability - Part 1: General

[35] SS155470, Lubricants, industrial oil and related products (Class L) Specifications for family X (Greases)

[36] SS155434, Hydraulic fluids - Requirements and test methods

[37] XP T 25-501, Reinforcement fibres - Flax fibres for plastics composites

[38] ANSI/ASABE S 593:2006, Terminology and Definitions for Biomass Production, Harvesting and Collection, Storage, Processing, Conversion and Utilization

[39] ISO 15928, Houses - Description of performance

[40] ISO 14024, Environmental labels and declarations - Type I environmental labelling - Principles and procedures

[41] EN 13193, Packaging - Packaging and the environment - Terminology

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