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Manually portable forest machinery — Recyclability and recoverability — Calculation method

Machines forestières portatives à main — Recyclabilité et possibilité de récupération — Méthodes de calcul

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Foreword

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ISO 17314 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 17, *Manually portable forest machinery*.

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Introduction

End-of-life machines contribute to the total volume of waste to be treated. As part of the machine life cycle, it is essential that recovery issues be taken into consideration during the design phase to ensure environmentally sound treatment.

Today, recycling has to be taken into account in addition to safety, emissions and fuel consumption when designing a machine. Consequently, there is need for an indicator to evaluate the ability and potential of new machines to be recovered/recycled.

The method for calculating recyclability and recoverability rates specified by this International Standard (similar to the method specified in ISO 22628:2002 for road vehicles) is based on four main stages inspired by the treatment of end-of-life machines. Recyclability/recoverability rates depend on the design and material properties of new machines and on the consideration of proven technologies — those technologies which have been successfully tested, at least on a laboratory scale, in this context.

The calculation method of this International Standard cannot in detail reflect the real process that will be applied to the machine at the end of its life.

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Manually portable forest machinery — Recyclability and recoverability — Calculation method

1 Scope

This International Standard specifies a method for calculating the recyclability rate and the recoverability rate of manually portable forest machinery, with each rate being expressed as a percentage by mass (mass fraction in percent) of the machine.

The calculation can be performed by the machine manufacturer when a machine is initially put on the market. It does not include fluids.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply. See Figure 1.

2.1
re-use, noun
any operation by which component parts of end-of-life machines are used for the same purpose for which they were conceived

NOTE 1 Adapted from ISO 22628:2002, definition 3.2.

NOTE 2 See Figure 1.

2.2
recycling
reprocessing in a production process of the waste materials for the original purpose or for other purposes, excluding processing as a means of generating energy

[ISO 22628]

NOTE See Figure 1.

2.3
recovery
reprocessing in a production process of the waste materials for the original purpose or for other purposes, together with processing as a means of generating energy

[ISO 22628]

NOTE See Figure 1.

2.4
dismantlability
ability of component parts to be removed from the machine

NOTE Adapted from ISO 22628:2002, definition 3.5.

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2.5
reusability
ability of component parts that can be diverted from an end-of-life stream to be reused

[ISO 22628]

2.6
recyclability
ability of component parts, materials or both that can be diverted from an end-of-life stream to be recycled

NOTE Adapted from ISO 22628:2002, definition 3.7.

2.7
recyclability rate
R_{cyc}
percentage by mass (mass fraction in percent) of the new machine potentially able to be recycled, reused or both

NOTE 1 Adapted from ISO 22628:2002, definition 3.8.

NOTE 2 See Figure 1.

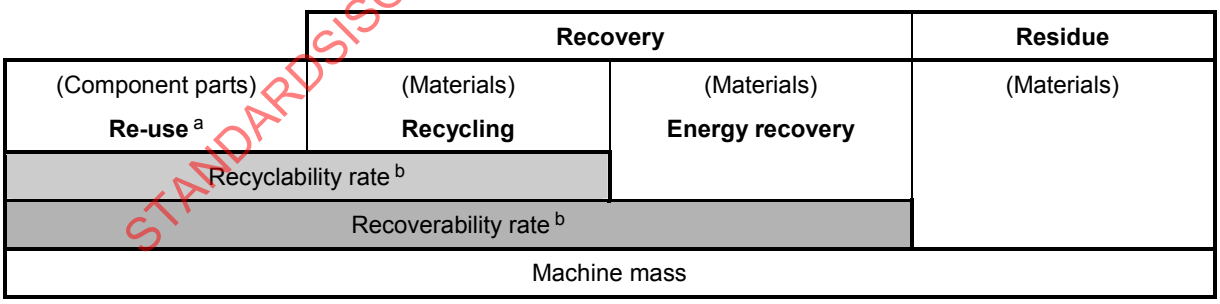
2.8
recoverability
ability of components or materials that can be diverted from an end-of-life stream to be recovered

NOTE Adapted from ISO 22628:2002, definition 3.9.

2.9
recoverability rate
R_{cov}
percentage by mass (mass fraction in percent) of the new machine potentially able to be recovered or reused

NOTE 1 Adapted from ISO 22628:2002, definition 3.10.

NOTE 2 See Figure 1.



a For machines covered by this International Standard, there are normally no components for re-use.
b As a percentage of machine mass.

Figure 1 — Key terms — Overview

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3 Masses and their symbols

Table 1 describes the symbols of the mass variables used in calculating the recyclability and recoverability rates.

Table 1 — Masses and symbols

Symbol	Description
$m_{D,R}$	mass of materials taken into account for recycling at the dismantling step
$m_{D,E}$	mass of materials taken into account for energy recovery at the dismantling step
$m_{S,R}$	mass of materials taken into account for recycling at the shredding step
$m_{S,E}$	mass of materials taken into account for energy recovery at the shredding step
m_{Tot}	total mass of the complete machine with empty tanks, including cutting tool and cover and, if available, extra equipment such as a spiked bumper for chain saws [a]
NOTE 1 All masses are expressed in kilograms.	
[a] Under normal circumstances, the tanks of portable forest machinery that is left to be recycled will be *approximately* empty.	

4 Calculation method

4.1 General

The recyclability and recoverability rates of a new machine are calculated through the following two steps, with components or materials able to be taken into account at each step.

Step 1: dismantling ($m_{D,R}$ and $m_{D,E}$).

Step 2: shredding ($m_{S,R}$ and $m_{S,E}$).

For the determination of partial mass only, mass fractions of 10 g or more are reported.

NOTE The dismantlability of the machines is usually limited to easily accessible components such as the cutting equipment. For metals separation and non-metallic residue of the remaining parts of a product, shredding is deemed to be the predominant method.

4.2 Materials breakdown

The materials breakdown of the machine is established by classifying all the materials composing the machine into the following three categories:

a) metals;

b) non-metals;

c) other — components, materials or both, for which a detailed material breakdown cannot be established (compounds, electronics, electrics).

This breakdown may be done at each step of the calculation for each partial mass mentioned in 4.1.

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4.3 Calculation of recyclability/recoverability rate

4.3.1 Recyclability rate

Calculate the recyclability rate, R_{cyc}, of the machine, as a percentage by mass (mass fraction in percent), using the formula:

$$R_{cyc} = \frac{m_{D,R} + m_{S,R}}{m_{Tot}} \times 100$$

4.3.2 Recoverability rate

Calculate the recoverability rate, R_{cov}, of the machine, as a percentage by mass (mass fraction in percent), using the formula:

$$R_{cov} = \frac{m_{D,R} + m_{S,R} + m_{D,E} + m_{S,E}}{m_{Tot}} \times 100$$

NOTE Technologies for energy recovery of polymers and elastomers are industrialized on a large scale worldwide. Therefore, polymers, elastomers and other modified organic natural materials can potentially be recovered through those technologies.

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Annex A
(informative)

Example of recyclability and recoverability calculations for a mid-sized chain saw

A.1 Mass fractions of the chain-saw

Table A.1 presents an example of mass fractions calculated for different materials in the case of a typical mid-sized chain saw with a total machine mass, m_{Tot}, of 8,10 kg.

Table A.1 — Mass fractions, in kilograms, for different materials

		Recycling	Energy recovery	Residue
Step 1: dismantling				
Cutting equipment, steel		1,50		
Cutting equipment cover, PE			0,35	
Cylinder cover, PA			0,20	
	Sum $m_{D,R}$	**1,50**		
	Sum $m_{D,E}$		**0,55**	
Step 2: shredding				
Steel		2,26		
Aluminium		1,24		
Magnesium		0,96		
Copper		0,07		
Plastics:	PA		1,15	
	PBT		0,02	
	PE		0,02	
	POM		0,12	
	PVC		0,08	
Rubber			0,08	
	Sum $m_{S,R}$	**4,53**		
	Sum $m_{S,E}$		**1,47**	
Recyclability rate: $R_{cyc} = \frac{1,5 + 4,53}{8,10} \times 100 = 74\ \%$				
Recoverability rate: $R_{cov} = \frac{1,5 + 4,53 + 0,55 + 1,47}{8,10} \times 100 = 99\ \%$				
NOTE Normally, there are some materials missing in the above total material balance.				

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