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Packaging — Reuse — Methods for assessing the performance of a reuse system

ICS 13.030.50; 55.180.40

British Standards

National foreword

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English Version

Packaging - Reuse - Methods for assessing the performance of a reuse system

Emballage - Réutilisation - Méthode d'évaluation de la performance d'un système de réutilisation

Verpackung - Wiederverwendung - Verfahren zur Einschätzung der Leistungsfähigkeit eines Wiederverwendungssystems

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Foreword

This document (CEN/TR 14520:2007) has been prepared by Technical Committee CEN/TC 261 “Packaging”, the secretariat of which is held by AFNOR.

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Introduction

The methods set out in this Technical Report are both capable of giving realistic results in the relevant circumstances. Experience over time with the results will indicate the levels of performance that are being achieved.

1 Scope

This Technical Report gives methods of assessing the performance of a reuse system related to the proportion of reused packaging in use. This may be measured by:

— the average number of rotations during a calculation period and the lifetime; or

— the reuse ratio.

The choice of method will vary according to the type of reuse system and information available.

2 Terms and definitions

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

2.1
trip
transfer of packaging, from filling/loading to emptying/unloading. A trip can be part of a rotation

2.2
rotation
cycle undergone by reusable packaging from filling/loading to filling/loading. A rotation will always contain a trip

2.3
population
total number of a packaging type, empty or filled, in that whole reuse system

2.4
claiming company
packer/filler who is making a claim of 'reusable' for a type of packaging, in the circumstances of its intended use

2.5
reuse ratio
ratio, expressed as a percentage, of the number of movements of reused packaging to the number of movements of all the packaging at the measurement point (see definition 2.7) over the calculation period (see definition 2.6)

2.6
calculation period
period over which the number of trips or reuse ratio is calculated

NOTE This should be of adequate duration to smooth out the effects of seasonal variation, product lifetime, packaging inputs and other factors which can affect the calculation.

2.7
measurement point
point in the rotation loop at which the information for the calculation is gathered

NOTE Examples of some possible measurement points are given in 4.2.

2.8
newly manufactured packaging
newly purchased packaging entering the system for the first time to increase the population or replace all types of losses

2.9
system adjustment
increase or decrease of population of a packaging type due to market fluctuation

2.10
system losses
all types of losses of packaging from the system

2.11
closed loop system
system in which reusable packaging is circulated by a company or a co-operating group of companies

2.12
open loop system
system in which reusable packaging circulates amongst unspecified companies

2.13
hybrid system
system consisting of two parts:

a) reusable packaging, remaining with the end user, for which there exists no redistribution system leading to commercial refilling;

b) one way packaging, used as an auxiliary product to transport the contents to the reusable packaging

2.14
lifetime
period from the first use of the packaging until it is no longer in use and becomes waste

3 Methods of calculation

3.1 Open and closed loop systems

3.1.1 Principle

The performance of a reuse system can be evaluated by calculating either the average number of rotations (see definition 2.2) or the reuse ratio. The population figure needs to be known accurately to perform the calculation of the average number of rotations. In the cases where this value can not be known, which includes most open loop systems, only the reuse ratio can be calculated.

NOTE The packer/filler making the calculation will require the co-operation of all other partners in the system for that product. See EN 13429:2004, 5.1.

3.1.2 Calculation of average number of rotations in the system during the calculation period

The simple equation to determine the average number of rotations of packaging in the system during the calculation period is:

$$N_{\mathrm{p}} = \frac{Q_{\mathrm{sp}}}{P_{\mathrm{t}}}$$

where

N_{p} is the average number of rotations during the calculation period;

Q_{sp} is the total number of movements of packaging through the measurement point during the calculation period;

NOTE 1 For pool systems this is the sum of all the packaging from all the packer/fillers.

P_t is the average population during the calculation period.

Q_{sp} can often be easily calculated from the number of despatches or output from the packer/filler etc. However P_t is rarely directly known and has to be calculated. A simplified version of this calculation is:

$$P_t = P_{in} + \frac{P_{new}}{2} - \frac{P_{loss}}{2} - \frac{P_{adj}}{2}$$

where

P_t is the average population during the calculation period;

P_{in} is the population at the start of the calculation period;

P_{new} is the total of newly manufactured packaging entering the system during the calculation period;

P_{loss} is the system losses during the calculation period;

P_{adj} is the system adjustments during the calculation period.

NOTE 2 System adjustments take place when packaging is deliberately withdrawn from the system, for instance in the case of a fall in demand.

P_{new}, P_{loss} and P_{adj} are divided by two to give an approximate average over the calculation period. Where possible a more accurate average should be used.

P_{new} and P_{adj} are often known, however P_{loss} generally has to be assessed. Under long term steady state conditions, P_{loss} is approximately equal to P_{new}.

3.1.3 Calculation of reuse ratio

$$R_r = \frac{Q_{reuse}}{Q_{sp}} \times 100$$

where

R_r is the reuse ratio;

Q_{reuse} is the total number of movements of reused packages through the measurement point during the calculation period;

Q_{sp} is the total number of movements of packaging through the measurement point during the calculation period.

In systems where only the reuse ratio can be calculated it should be noted that any percentage greater than zero is evidence of reuse.

3.1.4 Calculation of average number of rotations in the system during the packaging lifetime

With long term experience, the average percentage loss per rotation and the average age of the population can be estimated.

By multiplying the average number of rotations per year by the average age of the population an approximate figure for the number of rotations per lifetime can be calculated as follows:

$$N_l = N_y \times A_a$$

where

N_l is the approximate number of rotations per lifetime;

N_y is the average number of rotations per year;

A_a is the average age of population.

The percentage loss per calculation period $L_{\%}$ can be calculated by:

$$L_{\%} = \frac{P_{loss}}{P_t} \times 100$$

P_t is the average population during the calculation period;

P_{loss} is the system losses during the calculation period;

For estimating the percentage losses per rotation, the calculation period could be chosen to be one rotation.

The inverse of the average percentage loss ($L_{\%}$) per rotation, gives an approximation of the number of rotations for the unit of packaging per lifetime.

N_l can be calculated by $N_l = \frac{100}{L\%}$

3.2 Hybrid system

In a hybrid system the only quantities which are known are the number of reusable packages sold and the number of refills sold over the calculation period. This ratio can only provide an approximation to the reuse ratio. It is therefore not appropriate to attempt to calculate the reuse ratio for the reusable component in a hybrid system.

4 Factors influencing the calculation

4.1 Selection of calculation period

This should be of adequate duration and have a suitable start date to smooth out the effects of seasonal variation, product lifetime, packaging inputs and other factors which may affect the calculation. It is important that the period and start and end points chosen are used consistently for all future calculations of the ratio.

4.2 Selection of measurement point

The measurement point should be chosen to provide the greatest amount of information for the calculation. Examples are:

— point of sale;

— point of filling;

— completion of refurbishment;

— warehousing;

— third party warehousing;

or any other convenient point in the system. The measurement point should be chosen so that it allows the differentiation of new and used packaging. It is important that the measurement point chosen is used consistently for all future calculations of the ratio.

NOTE The measurement point is a point in the cycle, not necessarily a single physical location.

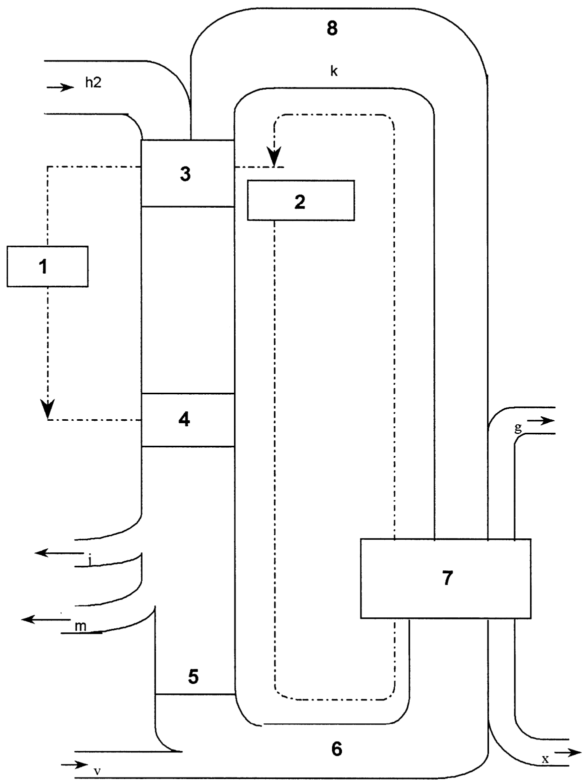
4.3 Market fluctuation and product lifecycle

A careful assessment of the state of the market for the product should be made and also for the development in that market of the product. These factors will influence the conclusions on the results of the calculations.

Annex A
(informative)

Trips and rotations

The concepts of trips and rotations in reuse terms are defined in 3.3 and 3.4 of EN 13429:2004 and form the basis for any determination of effectiveness of any given reuse system.



NB The size of flows do not correspond to the volumes of the flows.

Key

1	trip	g	packaging waste from reconditioning to material recycling
2	rotation	h2	packaging designed for refill/reuse and supplied for the first filling/packaging
3	filling	j	used packaging lost and not collected due to litter and/or other factors
4	emptying	k)	used and reconditioned packaging for filling/packaging again
5	C/S Collection/Sorting	m)	used packaging designed for refill/reuse leaving the refill/reuse loop for waste management
6	for refill/reuse	v	packaging returned after collection/sorting of used one way packaging in the refill/reuse loop and used again (e.g. wooden crates)
7	reconditioning	x)	material loss
8	reusable		

NOTE 1 Losses may occur anywhere in the loop.

NOTE 2 This flow chart is an extract from EN 13437 and is introduced to clarify the terms “trip” and “rotation”.

Figure A.1 — Reuse process flow chart

Annex B
(informative)

Examples of average number of rotations and reuse ratio calculations

B.1 Average number of rotations

B.1.1 Example 1

A system with no losses, adjustments and therefore no new packaging.

If we have:

P_{in} = 100 units of packaging and

Q_{sp} = 1 000 throughputs at the measurement point during the calculation period (for example, one year)

P_{new} and P_{loss} and P_{adj} are zero;

For the calculation of P_t we apply the following equation: $P_t = P_{in} + \frac{P_{new}}{2} - \frac{P_{loss}}{2} - \frac{P_{adj}}{2}$:

Therefore $P_t = P_{in}$

The average number of rotations $N_p = \frac{Q_{sp}}{P_t}$ will be:

N_p = 1 000/100 = 10

B.1.2 Example 2

A balanced system with losses replaced by new input.

If we have:

P_{in} = 100 units of packaging,

Q_{sp} = 1 000 throughputs at a measurement point and

losses and broken packaging P_{loss} = 10

an equivalent number of new packaging P_{new} = 10

P_{adj} is zero

For the calculation of P_t we apply the following equation: $P_t = P_{in} + \frac{P_{new}}{2} - \frac{P_{loss}}{2} - \frac{P_{adj}}{2}$ which will give:

P_t = 100 + 10/2 – 10/2

P_t = 100

The average number of rotations will be according to the following equation: $N_p = \frac{Q_{sp}}{P_t}$

N_p = 1 000/100 = 10

B.1.3 Example 3

A system being reduced by adjustments and no replacement of losses.

An alternative system requirement to example 3: showing a constant throughput, but resulting in higher rotations.

If we have:

P_{in} = 100 units of packaging

Q_{sp} = 1 000 throughputs at a measurement point and

a lot of losses and broken packaging P_{loss} = 10

number of new packaging P_{new} = 0

P_{adj} is 30

For the calculation of P_t we apply the following equation: $P_t = P_{in} + \frac{P_{new}}{2} - \frac{P_{loss}}{2} - \frac{P_{adj}}{2}$ which will give:

P_t = 100 – 10/2 – 30/2

P_t = 80

The average number of rotations will be according to the following equation: $N_p = \frac{Q_{sp}}{P_t}$

N_p = 1 000/80 = 12,5

B.1.4 Example 4

A system being reduced by adjustments and no replacement of losses.

Showing a constant average number of rotations and reduced throughputs.

If we have:

P_{in} = 100 units of packaging

Q_{sp} = 800 throughputs at a measurement point and

a lot of losses and broken packaging P_{loss} = 10

number of new packaging P_{new} = 0

P_{adj} is 30

For the calculation of P_t we apply the following equation: $P_t = P_{in} + \frac{P_{new}}{2} - \frac{P_{loss}}{2} - \frac{P_{adj}}{2}$ which will give:

P_t = 100 – 10/2 – 30/2

P_t = 80

The average number of rotations will be according to the following equation: $N_p = \frac{Q_{sp}}{P_t}$

N_p = 800/80 = 10

B.2 Reuse ratio - General example:

System losses comprise 1) Un-repairable damage

2) Mislaid packaging

3) Packaging retained by users for reuse in non related systems

Assumptions: a mature product in a stable market over an extended timescale, measured at point of despatch and a repairable packaging type.

New packaging bought	40 000
Despatches Q_{sp}	100 000
Therefore reused units Q_{reuse}	60 000

Reuse ratio $R_r = \frac{Q_{reuse}}{Q_{sp}} \times 100$ = 60 000/100 000 × 100 = 60 %

B.3 Rotations during the packaging lifetime

Example 1

N_y the average number of rotations per year = 5;

A_a the average age of the population = 4.

$N_l = N_y \times A_a$

Therefore N_l the approximate number of rotations per lifetime = 20

Example 2:

L% percentage loss = 5 %.

$N_l = \frac{100}{L\%}$

Therefore N_l the approximate number of rotations per lifetime = 20

Bibliography

[1] EN 13429:2004, *Packaging — Reuse.*

[2] EN 13437:2003, *Packaging and material recycling — Criteria for recycling methods — Description of recycling processes and flow chart.*

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