



BSI Standards Publication

Packaging and the environment — Information on environmentally conscious packaging design

National foreword

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Packaging and the environment — Information on environmentally conscious packaging design

*Emballage et environnement — Informations relatives à la
conception d'emballages respectueux de l'environnement*

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC 4, *Packaging and the environment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In 2013, six standards, ISO 18601 to 18606, and two technical reports, ISO/TR 16218 and ISO/TR 17098, were issued as ISO deliverables on packaging and the environment. Thereafter, national standards corresponding to the six standards ISO 18601 to ISO 18606, which are the main and important part of the deliverables, hereinafter collectively referred to as the standards on packaging and the environment, were issued in some countries, while, in Europe, European Standards (EN) served as the basis for establishing the packaging and environment standards. Under these circumstances, the standards on packaging and the environment are expected to work as international standards to be used globally.

The environmentally conscious packaging design principles laid in the standards on packaging and the environment require environmental consideration while ensuring the inherent packaging functions be maintained. For example, if the packaging reduction principle were sought excessively, it will not be possible to maintain the basic packaging function of protecting the packaged product. This would rather result in more serious burden to be inflicted on the environment.

The aim of this document is to support stakeholders in pursuing their efforts for environmentally conscious packaging design and manufacture of packaging based on the standards on packaging and the environment, and increased understanding and promotion of such design principles. Specifically, with ISO 18602, it will explain these factors clearly, using real examples. You can see the layout of this document in [Figure 1](#).

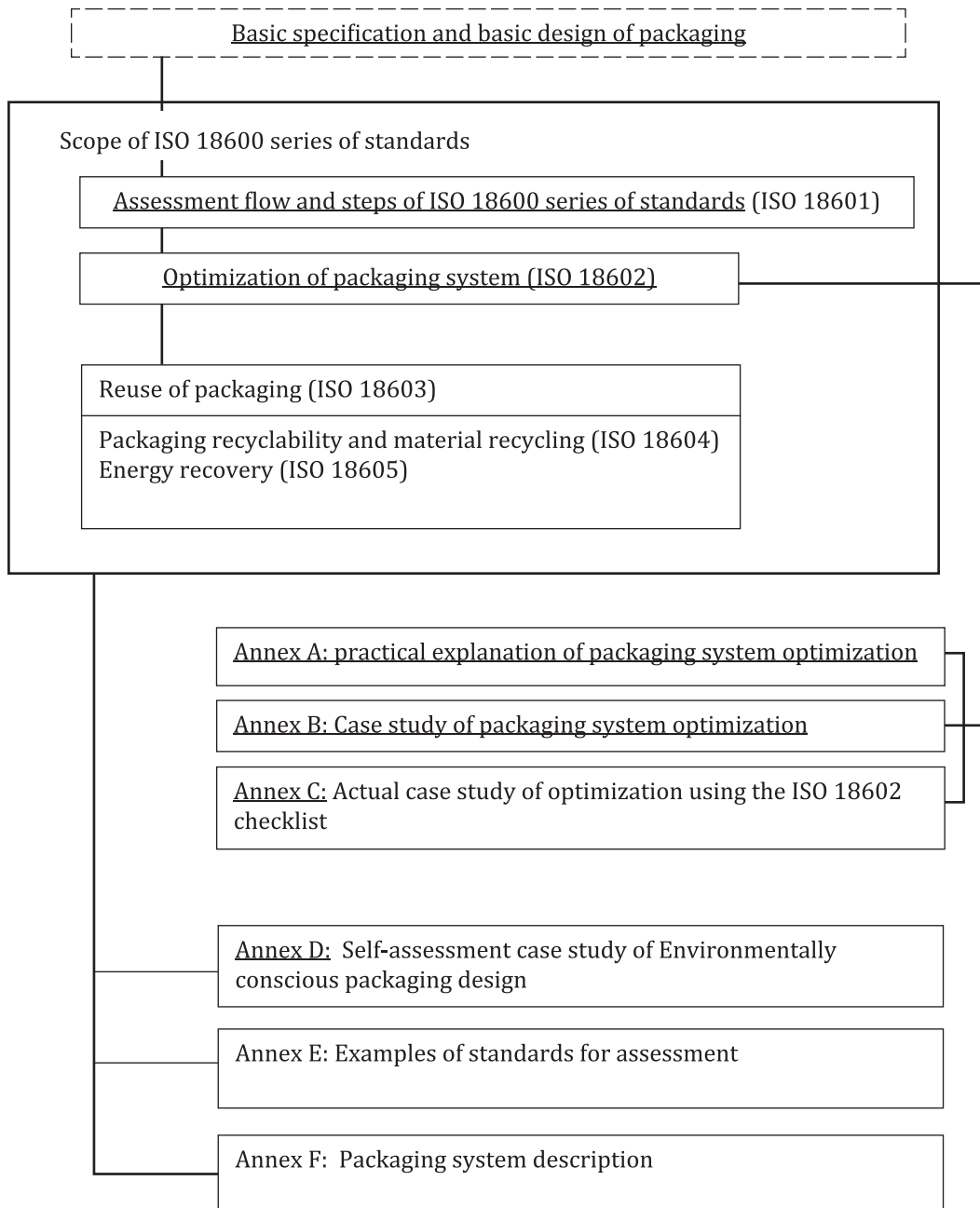


Figure 1 — Main structure of this document

NOTE 1 The scope of the standards on packaging and the environment, which this document is based on, do not include the processes for packaging basic design, including material selection, although it is necessary to review basic design specifications during designing and verification. These processes are the main factors of determining the environmental impact of the packaging. Therefore, information on these processes is described in [clause 4](#) of this document.

NOTE 2 Unless otherwise noted, the referenced clauses, figures, tables, and Annexes numbers refer to this document.

Packaging and the environment — Information on environmentally conscious packaging design

1 Scope

This document gives information on environmentally conscious packaging design based on the standards on packaging and the environment. It provides essential tips on how to improve packaging through reduction processes and includes practical examples to illustrate these points.

This document is applicable to all suppliers responsible for placing packaging or packaged goods on the market.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 18601, *Packaging and the environment — General requirements for the use of ISO standards in the field of packaging and the environment*

ISO 18602, *Packaging and the environment — Optimization of the packaging system*

ISO 18603, *Packaging and the environment — Reuse*

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

ISO 18605, *Packaging and the environment — Energy recovery*

ISO 18606, *Packaging and the environment — Organic recycling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18601, ISO 18602, ISO 18603, ISO 18604, ISO 18605, and ISO 18606 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Basic packaging specification and design, and relationship with standards on packaging and the environment

The basic packaging specifications and design are determined through various evaluations during the development phase, and the accuracy is improved by going back and re-examining the steps, if necessary, as shown in [Figure 2](#). This cyclic approach of plan-do-check-act brushes up the basic package specification and design to contribute to reducing the environmental impact of the packaging.

Key specifications, which include type of packaging, packaging materials, structure, size and dimension, closure type and functions are decided in this development phase, when companies compete for originality and their technologies. After the development phase is completed, the standards on packaging and the

environment are applied to conduct assessments for environmentally conscious packaging design. These processes are shown in [Figure 2](#).

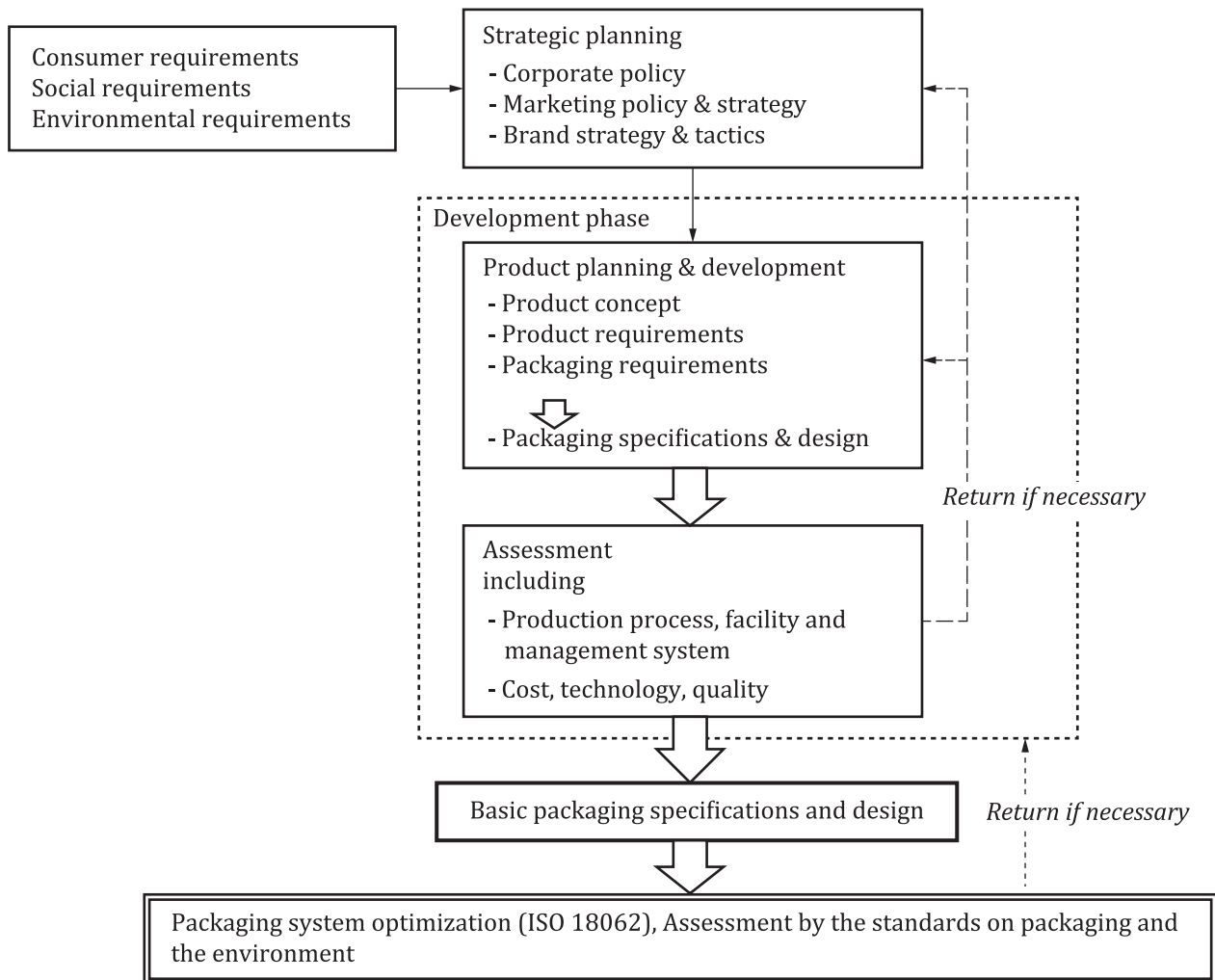


Figure 2 — Cyclic approach to brush up basic package specification and design

5 Assessment flow and procedure of the standards on packaging and the environment

5.1 General requirements of the standards on packaging and the environment

5.1.1 General

ISO 18601 specifies requirements and procedures of ISO 18602, ISO 18603, ISO 18604, ISO 18605 and ISO 18606.

5.1.2 Assessment procedure of ISO 18601

The procedure of ISO 18601 is given in [Figure 3](#) with some explanations.

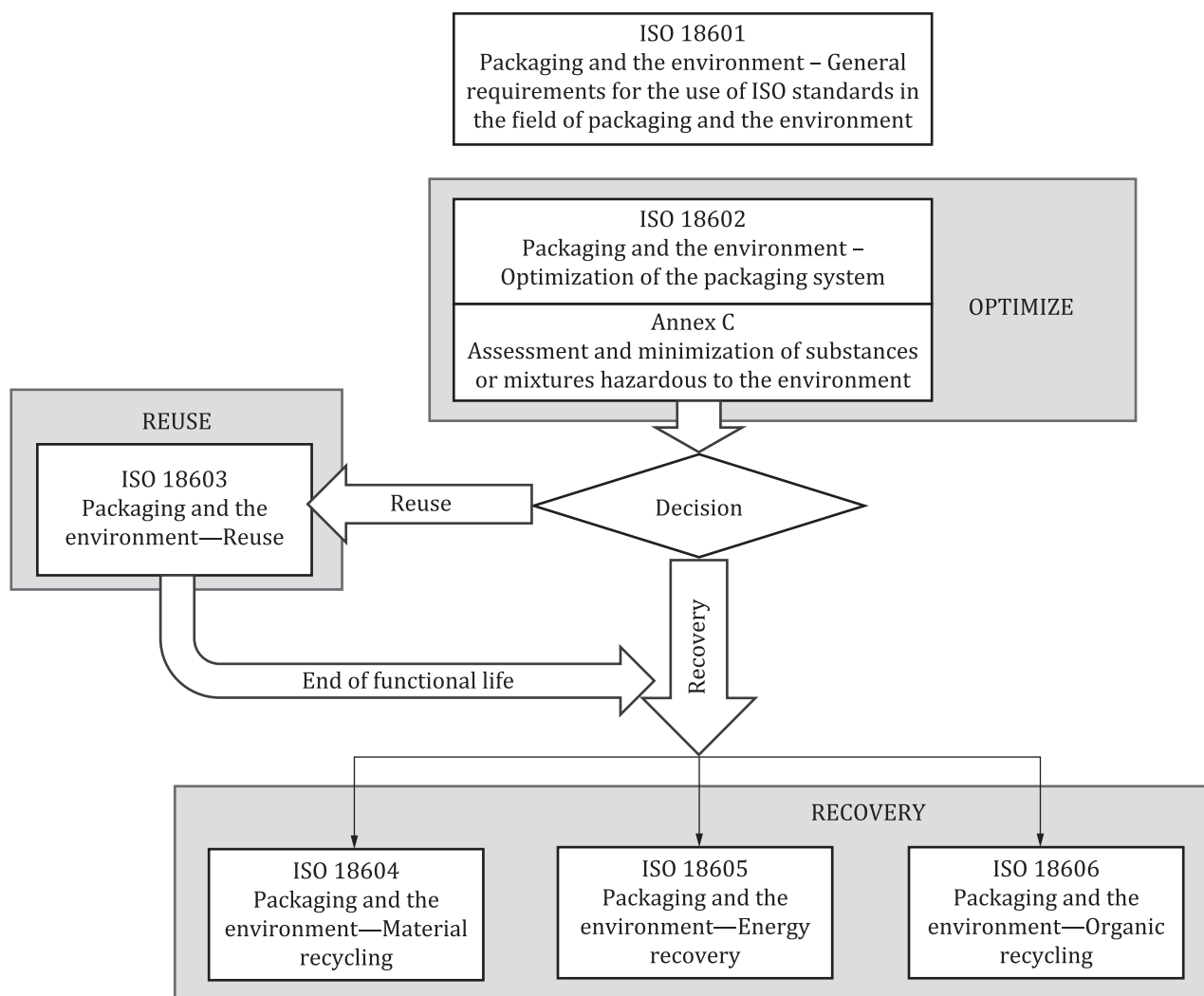


Figure 3 — Relationship of the standards on packaging and the environment

- ISO 18602 describes four heavy metals that are identified and minimized in accordance with the requirements and processes listed therein.
- In a similar manner, ISO 18602 requires any hazardous substances and mixtures to the environment be identified and minimized according to the requirements and processes listed therein.
- Likewise, ISO 18602 requires that weight or volume of the packaging system be minimized.
- ISO 18603 requires that in case packaging is intended for reuse, requirements of ISO 18603 are assessed.
- ISO 18601 states that regardless of whether the packaging is intended for reuse or not, used packaging is assessed according to the requirements shown in at least one of the three standards; ISO 18604 on material recycling, ISO 18605 on energy recovery or ISO 18606 on organic recycling.
- ISO 18601 states that the results of the above assessment processes are recommended to be recorded in accordance with the provisions in the related standards. An example of a form that suppliers can use to confirm compliance with the requirements of these standards is provided in ISO 18601:2013, Annex B

5.2 Optimization of packaging system

5.2.1 General

ISO 18602 specifies requirements and the procedure for assessment of packing to ensure that the weight or volume of its material content is optimized and is consistent with the inherent functions of packaging. It further provides methodologies and procedures for determining the amount and minimization of substances or mixtures hazardous to the environment. It also determines the amount of four heavy metals, e.g. lead, cadmium, mercury, hexavalent chromium, in packaging and assure that it matches the requirement of national or regional regulations.

5.2.2 Assessment procedure of ISO 18602

The flow of assessment procedure is described in [Figure 4](#) with some explanations.

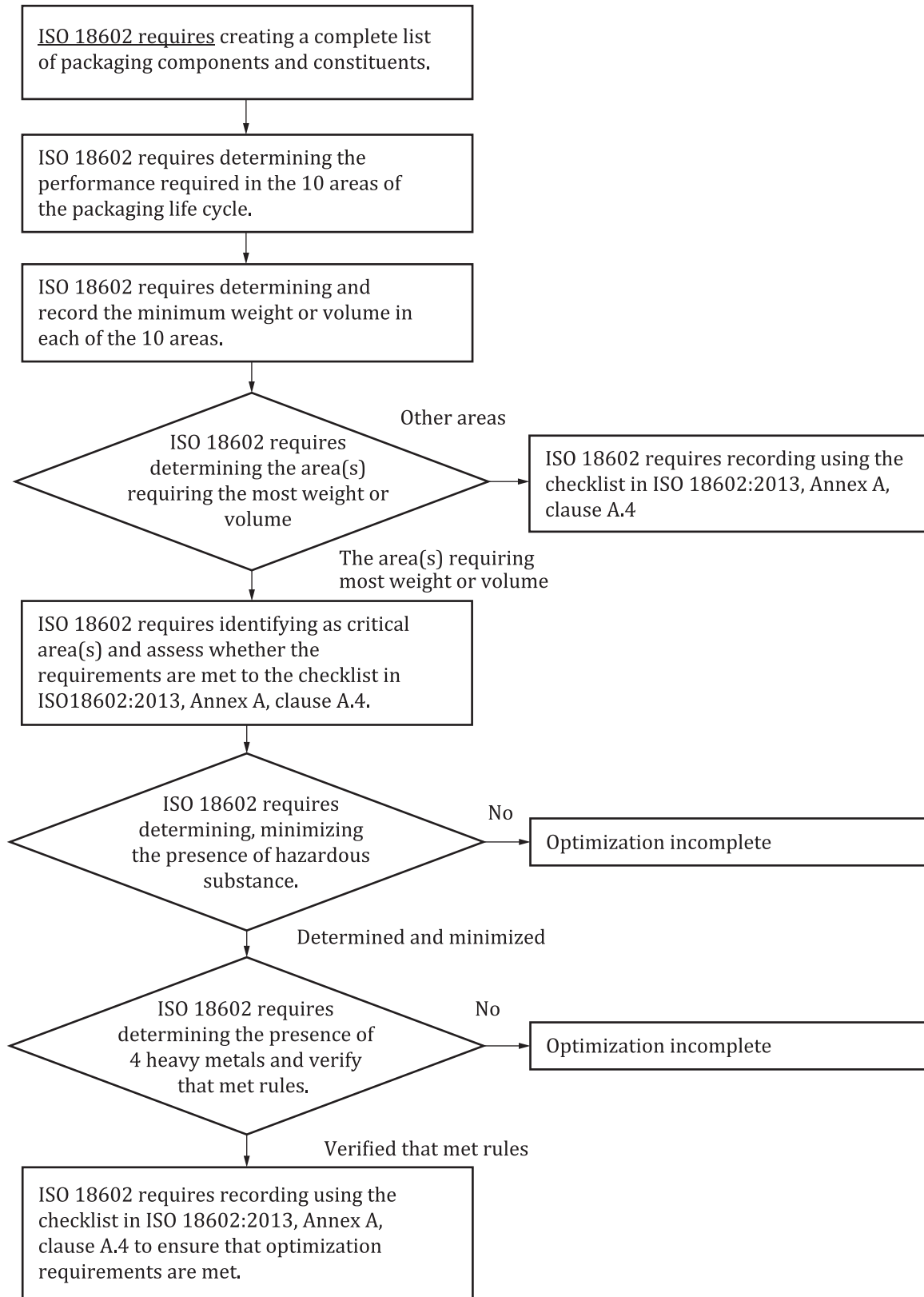


Figure 4 — Assessment procedure of ISO 18602 packaging system optimization

ISO 18602 requires assessing compliance with the following requirements and demonstrate that they have been met with the standard using the checklist in ISO 18602:2013, Annex A.

- a) ISO 18602 requires creating a complete list of packaging components and constituents for each packaging throughout the entire packaging system. An explanation of a packaging system is shown in [Annex F](#).
- b) ISO 18602 requires determining the performance required in the 10 areas of the packaging life cycle as identified in ISO 18602:2013, Clause 5 for all listed packaging, packaging components, packaging constituents, and packaging systems.

NOTE The performance criteria for packaging refer to protection of goods, packaging manufacturing process, filling process, logistics, presentation and marketing of goods, user or consumer acceptance, information, safety, legislation, and other issues. Examples are shown in ISO 18602:2013, Annex A, clause A.3

- c) ISO 18602 requires determining and recording the minimum weight or volume that satisfies performance in each of the 10 areas for each listed packaging, packaging component, packaging constituent or packaging system.
- d) Among them, the areas requiring the most weight or volume for all packaging, packaging parts, packaging components, and packaging systems are identified as critical areas and recorded. ISO 18602 requires that at least one be specified.

NOTE A practical explanation of packaging system optimization is shown in [Annex A](#) and case study of packaging system optimization is shown in [Annex B](#).

- e) ISO 18602:2013, Annex A, clause A.4 contains a checklist to ensure that optimization requirements are met.

NOTE A case study on optimization of packaging using the checklist of ISO 18602:2013, Annex A, Clause A.4 provided by Japan (JISC) is shown in [Annex C](#).

- f) ISO 18602 requires determining, minimizing, and documenting the presence of hazardous substances or mixtures that may be released into the environment when used packaging is processed by means of material recycling, energy recovery or organic recycling.
- g) ISO 18602 requires determining whether any one of the four named heavy metals (lead, cadmium, mercury, and hexavalent chromium) is present in the packaging, and in case the presence of it is confirmed, ensure that it has been assessed as required by national or regional regulations where the packaging is intended to be used. ISO 18602:2013, Annex C provides guidance as to how this can be done.

5.3 Reuse

5.3.1 General

Reuse is to continue to use the same packaging for the same purposes. In case packaging is intended for reuse, ISO 18603 requires assessing its requirements. The requirements of ISO 18603 include to evaluate whether the packaging is designed to accomplish the number of trips or rotations normally predictable conditions of use. Then, ISO 18603 requires evaluating the existence of a well-managed reuse system including reconditioning.

5.3.2 Assessment procedure of ISO 18603

These assessment procedures are described in ISO 18603:2013, Clause 4 and Figure 5 with some explanations.

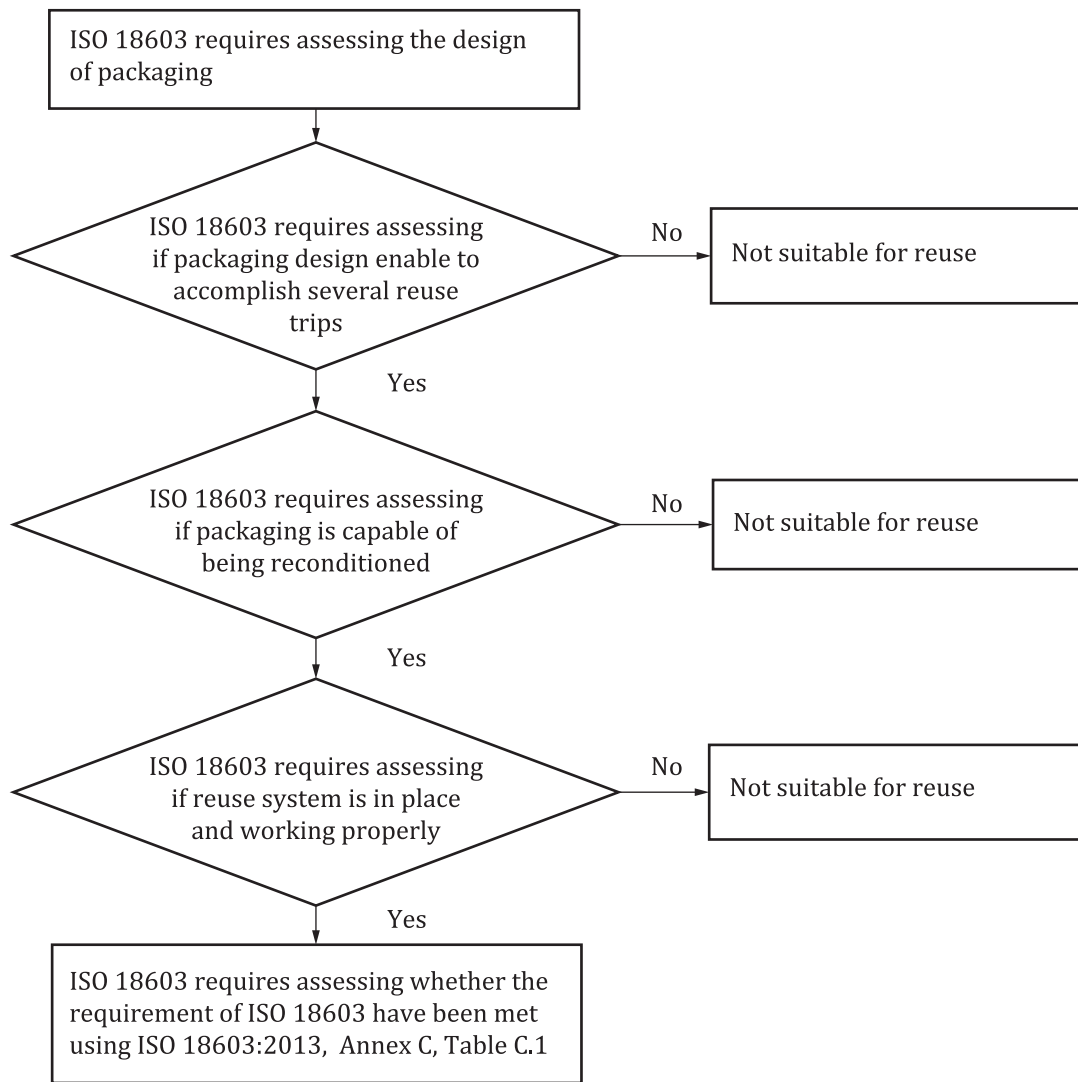


Figure 5 — Assessment procedure of reuse

In case packaging is intended for reuse, ISO 18603 requires assessing the fulfilment of the following requirements:

- a) The packaging is designed to accomplish the number of trips or rotations in normally predictable conditions of use;
- b) The packaging is capable of being successfully reconditioned (to restore the original state so that the packaging can be put for further use). A list of elements to choose from to build a suitable reconditioning system can be found in ISO 18603:2013, Annex B;
- c) The reuse system is in place and working properly on the market and it is possible to properly handle the packaging concerned on the system.

Assessment of whether the requirements of ISO 18603 have been met is carried out using ISO 18603:2013, Annex C, Table C.1.

5.4 Material recycling

5.4.1 General

ISO 18604 specifies the requirements for packaging to be classified as recoverable in the form of material recycling while accommodating the continuing development of both packaging and recovery technologies and sets out procedures for assessment of meeting the requirements of ISO 18604.

In ISO 18604, recyclability is specified by the percentage of a used packaging material recyclable into a product, a component incorporated into a product, or recycled raw material, by means of an appropriate manufacturing process. Also, ISO 18604 requires that the intended material recycling stream be made clear.

5.4.2 Assessment procedure of ISO 18604

The basic flow of procedures for assessment of meeting the requirements for material recycling is given in [Figure 6](#) with some explanations.

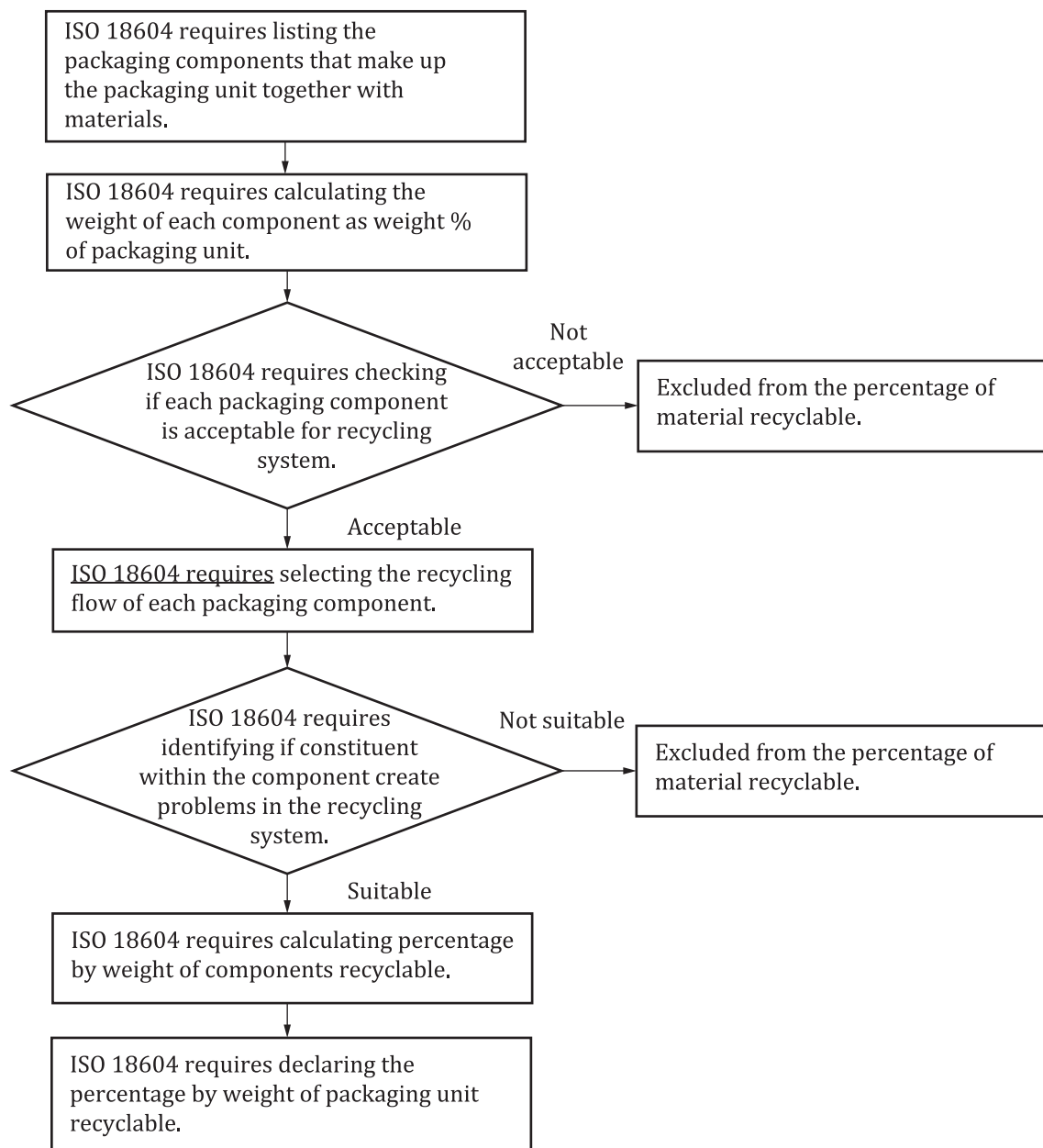


Figure 6 — Assessment procedure of material recycling

- a) ISO 18604 requires that assessment of the recyclability is carried out for each packaging unit. See ISO 18604:2013, Annex C, Table C.2, line number 1 and 2.

NOTE Packaging unit is defined as unit which serves a packaging function such as the containment, protection, handling, delivery, storage, transport, and presentation of goods.

- b) ISO 18604 requires following the provisions laid out in ISO 18604:2013, Annex C Table C.2, line number 3
- c) ISO 18604 requires that the packaging marketed in different countries and regions meet the specific requirements of the recycling systems and facilities in those countries and regions. Assessment, including these requirements are carried out according to ISO 18604:2013, Annex A and Annex B.
- d) ISO 18604 requires selecting available and appropriate recycling streams such as glass, paper and cardboard, plastics, Steel, Aluminium amongst others. See ISO 18604:2013, Annex C, Table C.2, line number 5.
- e) ISO 18604 requires checking if each packaging component is acceptable for standards or specifications of recycling system of national, regional, international, or commercial. See ISO 18604:2013, Annex C, Table C.2, line number 4, 6, 7 and 8.
- f) For each component, ISO 18604 requires identifying such components either 100 % or 0 % of by weight of components recyclable. See ISO 18604:2013, Annex C, Table C.2, line number 9.
- g) For each component, ISO 18604 requires multiplying the weight of component as % of total packaging unit and the percentage by weight of component recyclable to obtain the percentage by weight of packaging unit recyclable. See ISO 18604:2013, Annex C, Table C.2, line number 10.
- h) ISO 18604 requires that the percentages by weight of recyclable packaging units be calculated and then summed to determine the total percentage of recyclability. See ISO 18604:2013, Annex C, Table C.2, line number 11)

ISO 18604 states that the supplier shall be able to demonstrate that the procedures defined in ISO 18604:2013, normative [Annex A](#) and [B](#) have been followed in arriving at the final design of the finished packaging such that a certain percentage of the packaging materials can be claimed to be recyclable.

[Annex A](#) shows the points to be considered at each packaging life cycle step in relation to each of the following features: control of packaging construction and composition and processing, suitability for available recycling technologies, and releases to the environment caused by the recycling of used packaging.

[Annex B](#) specifies design, production, utilization, and collection and sorting criteria for the procedure of recyclability assessment.

ISO 18604 requires that the supplier shall declare the percentage by weight of the packaging unit of packaging that is recyclable, identifying the intended material recycling streams(s), in accordance with ISO 18604:2013, Annex C.

5.5 Energy recovery

5.5.1 General

ISO 18605 specifies the requirements for packaging to be classified as recoverable in the form of energy recovery and sets out assessment procedures for fulfilling the requirements of ISO 18605.

Energy recovery is defined as the production of useful energy through direct and controlled combustion and is generally achieved by the incineration of solid waste to produce hot water, steam or electricity. To allow energy recovery in a real industrial system, calorific gain needs to be well above zero.

5.5.2 Assessment procedure of ISO 18605

The description and calculation of calorific gain are given in [Clause 4](#) and [Annex A](#), the assessment flow that can be used industrially is given in ISO 18605:2013, Clause 5, and the data supporting it are given in ISO 18605:2013, Annex B and Figure 7 of this document with some additional explanations.

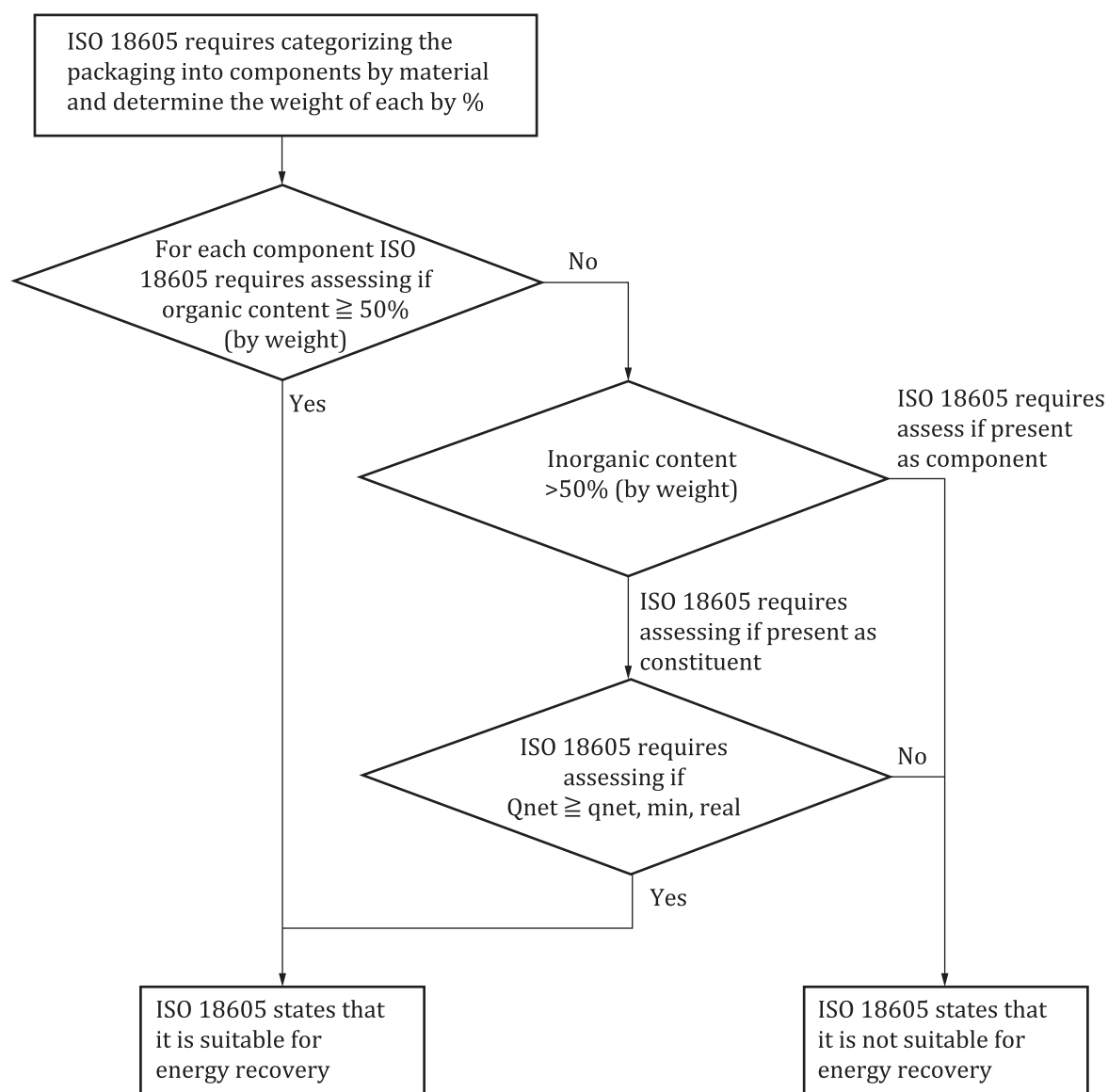


Figure 7 — Assessment flow of energy recovery

- ISO 18605 requires that the packaging is classified into parts or components by material and each weight % is determined.
- ISO 18605 states that in case organic content of the target packaging is 50 % or more, packaging is energy recoverable.
- ISO 18605 states that in case organic content of the target packaging is less than 50 % and inorganic content is greater than 50 % as component, it is not suitable for energy recovery.
- ISO 18605 states that in case organic content of the target packaging is less than 50 % and inorganic content is greater than 50 % as constituent, decision is made using the formula " $q_{net} \geq q_{net, min, real}$ ".
- ISO 18605 states that when q_{net} is greater than or equal to $q_{net, min, real}$, then packaging is assessed as suitable for energy recovery, on the other hand, q_{net} is less than $q_{net, min, real}$, packaging is not

suitable for energy recovery. Where “qnet” is the sum of the qnet for each material multiplied by its weight percent and is calculated using ISO 18605:2013, Annex D, D.2. And “qnet, min, real” is defined in ISO 18605:2013, Annex B, Table B.2.

ISO 18605 requires recording these procedures using ISO 18605:2013, Annex D.

5.6 Organic recycling

5.6.1 General

ISO 18606 specifies procedures and requirements for packaging that are suitable for organic recycling.

A packaging is considered as suitable for organic recycling if all the components are suitable for organic recycling. However, if the components can be easily separated before disposal, individual components of the packaging can be considered recoverable by organic recycling if they meet the requirements of ISO 18606.

For each of the packaging components the following four aspects are addressed:

- a) biodegradation;
- b) disintegration during the biological treatment process;
- c) negative effects on the biological process;
- d) negative effects on the quality of the resulting compost, including the presence of high levels of regulated metals and other substances hazardous to the environment.

Organic recycling is carried out in industrial composting plants or anaerobic digesters.

5.6.2 Assessment procedure of ISO 18606

Assessment procedure is described in ISO 18606:2013, Clause 5 and 6, and Figure 8 of this document with some additional explanations.

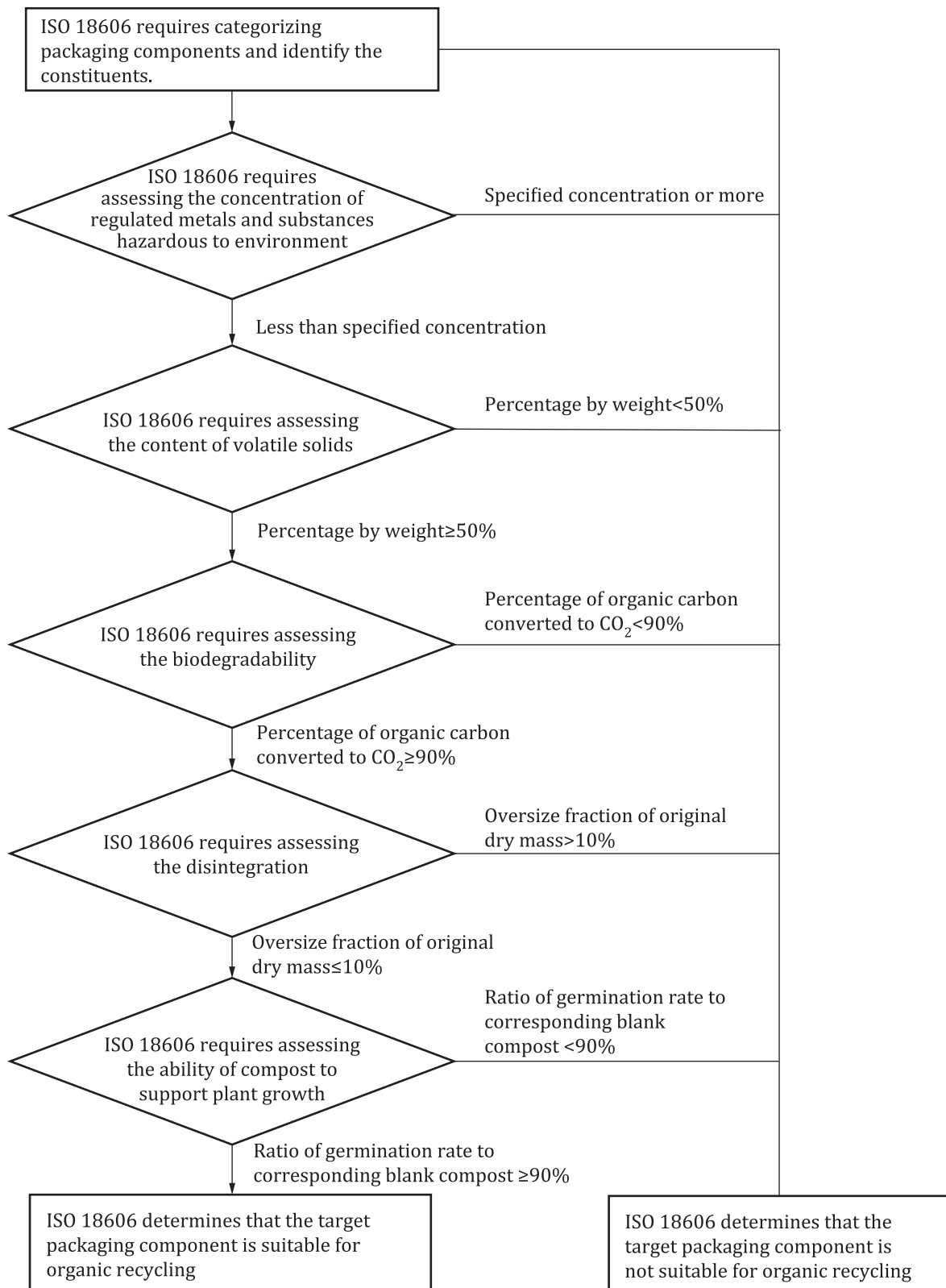


Figure 8 — Assessment procedure of organic recycling

- a) ISO 18606 requires categorizing the packaging, packaging components and identifying the constituents of each packaging materials.
- b) ISO 18606 requires determining that the concentrations of regulated metals and other substances hazardous to the environment is not exceed the limits as described in ISO 18606:2013, Annex A.