
Transport packaging — Temperature-controlled transport packages for parcel shipping —

**Part 1:
General requirements**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 122, *Packaging*.

A list of all parts in the ISO 22982 series can be found on the ISO website.

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

This document is developed in reflection of the situation where producers and users experience confusion regarding the test procedures of temperature-controlled transport packages for parcel shipping. Despite the increasing international attention to product safety and quality of cold chain parcel shipping through e-commerce, an International Standard that addresses the variations in the use of proper package testing has been missing. This document should be directly applicable to less developed countries as well as developed countries in terms of cold chain system or temperature-controlled supply chain.

The purpose of this document is to specify the general requirements of temperature-controlled packaging systems for transport packaging during parcel shipping. The packages are delivered under temperature-controlled supply chain on the purpose of controlling products' qualities, safety and services.

In certain circumstances, however, agreements can be made among stakeholders under the conditions, including but not limited to the following:

- a) when products weigh heavily;
- b) when dry ice or possible hazardous materials are present inside the package; or
- c) when there is any specific temperature requirement.

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Part 1: General requirements

1 Scope

This document specifies the general requirements of transport packaging, especially the containers, which are formed or prepared for the temperature-controlled transport services of parcel shipping. Safety or sanitation is not covered in this document.

This document set outs the general requirements for transport packaging for safe storage and distribution of temperature-sensitive products.

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 4898, *Rigid cellular plastics — Thermal insulation products for buildings — Specifications*

ISO 9229, *Thermal insulation — Vocabulary*

ISO 18616-1, *Transport packaging — Reusable, rigid plastic distribution boxes — Part 1: General purpose application*

ISO 21067-1, *Packaging — Vocabulary — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21067-1, ISO 9229 and ISO 18616-1 and the following apply.

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

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

3.1

temperature-controlled packaging

packaging/container that is designed or prepared for the purpose of maintaining specific temperature ranges

3.2

temperature-controlled packaging system

packaging system including all the means used to ensure a constant temperature within the desired temperature range for a product that is unstable in the outside temperature from manufacture to use

3.3

active packaging system

packaging system able to control the desired temperature by supplying power such as batteries, fuel, etc.

3.4 passive packaging system

packaging system able to control the desired temperature without any power sources

3.5 thermal resistance

R
heat property and temperature difference by which an object or material resists a heat flow

Note 1 to entry: Usually expressed in K/m²·W.

3.6 room temperature

any temperature between 4 °C and 40 °C (40 °F and 104 °F), i.e. temperature corresponding to the test conditions of the material

[SOURCE: ISO 13628-7:2005, 3.1.159]

4 Classifications

4.1 Temperature-controlled packaging systems

4.1.1 Passive packaging system

A passive packaging system is designed to maintain the specific temperature of contents with specific volume for a certain period of time by using heat resistant materials such as expanded polystyrene, expanded polypropylene, expanded polyurethane and/or vacuum insulated panel, etc. The containers shall be designed to remain at a certain temperature without any other power sources outside. The general characteristics of the material are as follows.

Table 1 — Commonly used heat resistant materials for passive packaging system

Material name	Abbreviation	Characteristics
Expanded polystyrene	EPS	Rigid cellular plastics insulation material manufactured by moulding beads of expandable polystyrene or one of its co-polymers and that has a substantially closed-cell structure, filled with air.
Expanded polypropylene	EPP	A highly versatile closed-cell bead polypropylene foam that provides a unique range of properties, including outstanding energy absorption, multiple impact resistance, thermal insulation, buoyancy, water and chemical resistance, exceptionally high strength to weight ratio and 100 % recyclability.
Extruded expanded polystyrene	XPS	Polystyrene that is produced on extruding machines in the form of continuous foam and consists of closed cells as a hard foam with rougher surfaces and higher stiffness.
Expanded polyurethane	EPU	Plastic material based on the reaction of isocyanates and polyols. It is the foam of large blocks of foam, which are cut up for use in thermal insulation.
Vacuum insulated panel	VIP	Panel of thermal insulation consisting of a gas tight enclosure surrounding a rigid core. It consists of membrane walls and thin layers of aluminium to prevent air entering the panel.

4.1.2 Active packaging system

An active packaging system is able to control accurate temperatures by supplying energy with devices such as batteries, fuel, etc., and operated on lease and rental. Systems of cooling or heating are attached to keep the temperature constantly. This type applies to the cases of pallet units, large cargos and

containers for long-term deliveries because it is advantageous to maintain temperature, humidity and security.

NOTE Currently, most parcels do not have active packaging systems with few exceptions.

Users can choose a pertinent temperature-controlled packaging system depending on product type, distribution environment and other performance requirements agreed by stakeholders (see [Annex A](#) for some examples of temperature-controlled packaging systems available).

4.2 Using phase changing material for temperature-controlled packaging system

Phase changing material (PCM) is a material with a high heat of fusion that allows it to store or release thermal energy as a form of melting and solidifying at a certain temperature.

During delivery, PCM is used to maintain the temperature inside packages/containers. PCM shall not affect the contents and not be toxic in terms of apparatus, containers and packaging. Leakage of PCM shall not be allowed by any expected stress such as shock or pressure during intended parcel shipping process. The statement should be made about the details of PCM including material types, chemical information, expected performance such as temperature range, after-use information, etc.

5 Packaging dimensions

5.1 Plan view dimension

In principle, the dimensions are recommended based on the standard module set by ISO 3394. However, they can be modified depending on the required insulation or size of the content.

5.2 Tolerance of thickness

Tolerance of thickness should be as set by ISO 4898 and [Table 2](#).

Table 2 — Tolerance of packaging thickness

Dimensions in millimetres

Thickness	Tolerance ^a
<50	±2
50 – 75	±3
75 – 100	±4
>100	As agreed between providers and users

^a Agreement is necessary when the strict tolerance is required.

6 Safety

6.1 General handling

The containers shall not have any sharp protrusion or edge to prevent any injuries.

The following instruction shall be observed when using dry ice as coolants for frozen contents:

- a) wear gloves when handling with hands, as they can cause frostbites;
- b) do not leave young children unattended when it is around;
- c) when used in a closed space, the ventilation holes shall be secured in order to prevent breathing difficulties or suffocation; and

- d) when completely sealed in an individual package, the packaging containers can be deformed or busted due to high inner pressure by the sublimation property. Use non-woven materials (e.g. non-woven fabric or newspaper) or loosen the opening of the wrapping paper.

6.2 Stacking

When stacked as a unit load or single load, the container should pass the test set by ISO/PRF 22982-2 to avoid any risk from collapsing of loaded containers.

6.3 Use of phase changing material

In case of using PCMs, they shall be composed of food grade chemicals that do not contain toxic contents, but are environmentally safe.

6.4 Dry ice safety precautions

If dry ice is packed in a package/container, it shall be labelled appropriately. Handle dry ice in ventilated areas to avoid asphyxiation due to low oxygen levels. Use appropriately insulated gloves to avoid burns/frostbites to the skin. Dry ice shall be packaged in a container that allows the release of CO₂. If dry ice is tightly sealed in a package/container, the gas can build up inside and become explosive.

7 Performance

7.1 Surface

Containers shall not have any damage that affects its performance or use. The finely roughened or fine surfaces produced by the process are acceptable if they are properly manufactured so that they do not adversely affect their use.

7.2 Tolerance for weight

The tolerance for nominal purpose weight shall not exceed 3 %.

7.3 Measurement of capacity

The capacity of the thermal insulation container is obtained by subtracting the weight of the product without water from the weight of the water filled to full water level. The minimum unit is 50 g and 1 g of water is converted into 0,001 L.

7.4 Sanitation

If the content is a food product, the property of the packaging and accessory materials in contact with the food shall conform to the relevant applicable standards and specifications.

7.5 Thermal performance

7.5.1 Temperature consistency

A packaging system shall maintain the contents within the temperature range specified or indicated on the surface of the container by packaging manufacturers or service providers as measured by the test evaluation method stated in ISO/PRF 22982-2 for the shipping container for parcel services.

EXAMPLE For containers marked as "2 – 8 °C/24 h", the internal temperature of the container should not deviate from 2 °C to 8 °C during a predetermined temperature profile for 24 h.

7.5.2 Thermal property of material

The quality of the material shall meet the requirements of ISO 4898 and agreement between stakeholders is required if separate standards are necessary. [Formula \(1\)](#) can be used for calculating the thermal resistance of the material.

$$R = D / C_t \quad (1)$$

where

R is the thermal resistance in $\text{K}/\text{m}^2\cdot\text{W}$;

D is the thickness of material in m ;

C_t is the thermal conductivity of the material in $\text{W}/\text{m}\cdot\text{K}$.

8 Symbol and labelling

8.1 General

Containers may display on their surface the specific symbols (e.g. recycling marks) or information by agreement among stakeholders.

Packages or containers should have areas for both permanent and temporary labelling.

The location of the labels should permit automatic fixing and not restrict scanning by barcode reader.

Where required, the labelling area should have a texture to allow the easy removal of adhesive labels used for temporary identification.

8.2 Labelling position

The position of the label should be as illustrated in ISO 18616-1. For protection against mechanical damage, label areas may be inserted or produced with an embossed border.

Annex A (informative)

Types of temperature-controlled packaging systems

A.1 Selection of temperature-controlled packaging system

[Table A.1](#) compares advantages and disadvantages of two different packaging systems that can be used for temperature-controlled packaging.

Table A.1 — Comparison of temperature-controlled packaging systems

Packaging system	Active	Passive
Advantages	<ul style="list-style-type: none"> — High safety and security — Quick loading or unloading, less labour intensive — Environmentally friendly alternative 	<ul style="list-style-type: none"> — Easy to control temperature accurately — Disposable, able to reuse — No need to supply energy, wide applications
Disadvantages	<ul style="list-style-type: none"> — Availability issues from high rental prices — Limited lane segments because of energy supply — Possibility of damaging the batteries by the change of temperature and humidity — Less cost-effective to small cargo in a short distance 	<ul style="list-style-type: none"> — Warehousing from stocks — Understanding the knowledge of coolant and packaging systems — Can be complicated for long distance delivery
Applications	<ul style="list-style-type: none"> — High prices product that needs accurate temperature controlling such as pharmaceuticals or bio-products 	<ul style="list-style-type: none"> — Products at mid and low price for short distance delivery (fresh market, etc.)

A.2 Examples of temperature-controlled packaging systems

[Table A.2](#) and [Table A.3](#) show some examples of passive and active packaging systems that can be used for temperature sensitive products.

Table A.2 — Examples of passive packaging system

Packaging types, materials and parts	Examples	Applications
1. EPS containers		General and low-priced products
2. Corrugated box		Fruits and vegetables
3. Corrugated box (outer)+EPS (inner container or panel)		General and low-priced products

Table A.2 (continued)

Packaging types, materials and parts	Examples	Applications
<p>4. Corrugated box (outer)+EPU (inner container or panel)</p>		<p>High priced products such as pharmaceuticals</p>
<p>5. Foil laminated corrugated box</p>		<p>General and low-priced products</p>
<p>6. Foil laminated corrugated box + plastic bag</p>		<p>General and low-priced products</p>