

Packaging Requirements by Inventronics

This guideline provides standards for packaging into Inventronics Facilities and Logistic Center. Prepared by the Inventronics packaging department.

Objective

- The purpose of this document is to ensure safe transportation, the quality of packaging, the use of sustainable materials and smooth and cost-optimized implementation of packaging components.
- The responsibility for ensuring the quality of the shipped product including packaging remains with the supplier during the entire supply chain.
- All local regulations must be complied with.

Scope and validity

- **Geographically** Global
- **Organization** Inventronics GmbH

Contacts and validity

- **Owner** Franziska Friedrich, Packaging Coordinator EURASIA
- **Valid from** 2024-01-01
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1. General

1.1. Description

Inventronics' Global Packaging Requirements and the Standards for Delivery of Goods to Global Supply Centre define the packaging /shipping standards for material being packed and shipped to Inventronics.

The requirements in this document are considered as an addendum to Inventronics Purchasing Terms & Conditions. Unless otherwise agreed in writing, in case of any conflict between this document and Inventronics Purchasing Terms & Conditions, the Purchasing Terms & Conditions shall prevail.

1.2. Applicability & Scope

This Standard shall apply to all worldwide activities of Inventronics and all deliveries to worldwide destinations of Inventronics. This document is part of the currently valid purchasing agreement between the supplier and Inventronics and states binding requirements for supply chain processes and procedures. Except otherwise explicitly specified in the currently valid purchasing agreement, the supplier shall undertake to meet the requirements stated in this standard.

If any of the provisions of this document is ineffective, the other provisions of this document shall remain in full force and effect.

These requirements apply to:

- Packaging departments at Inventronics,
- Other departments at Inventronics, which source packaging or packed products,
- External suppliers (packaging or packed products) and
- Contract packers, which source packaging or packed products.

1.3. Responsibilities

- The supplier is responsible for the quality and delivery of the products and therefore also for compliance with these packaging requirements. In order to ensure safe handling (in accordance with accident prevention and other regulations) and smooth operations, it is essential for all goods to be delivered in accordance with the requirements stated in this document.
- This document defines packaging procedures and functions. It describes the most important requirements for packaging material and the aspects to be considered when creating/ developing packaging concepts.
- It is the supplier's responsibility to provide individual and/ or collective packaging for the goods. The packaging provided by the supplier must ensure that the goods reach their destination in sufficient condition.
- The packaging must, among other things, protect the goods in transit from damage and from deterioration caused by environmental influences. The packaging must also protect personnel against hazards resulting from the goods themselves (e.g. regulations concerning the handling of hazardous goods).

2. Quality and Tolerances for Packaging Material

- For Inventronics packaging and packaging components certain general tolerances must be met. This is due to a variety of conditions, which may occur during the production process. The tolerances must not be taken into account when determining the internal dimensions, as the internal dimensions are defined as minimum dimensions. The supplier must set the tools/settings so that the internal dimensions are achieved taking into account his manufacturing tolerances.
- The tolerances are used only as acceptance criteria for quality control and not used for palletizing schemes. For palletizing and classification of materials the nominal values are used as before. This tolerance applies only to the outer dimensions and tooling lines, measured under standard climate (23 °C/ 50 % humidity).
- These tolerances apply to standard packaging. Special requirements for tolerances are described in the packaging specification. Values written in the packaging specification overrule these general tolerances. Parts made from foam or handmade parts require such special tolerance values.

2.1. Boxes made from corrugated cardboard or corrugated plastic

- **Creasing tolerances**
Distance between 2 parallel lines
 - up to 300 mm: ± 2 mm *(up to 11,8 inch: ± 0,08 inch)*
 - 301-700 mm: ± 3 mm *(11,8 inch - 27,6 inch: ± 0,12 inch)*
 - over 700 mm: ± 0,5 % *(over 27,6 inch: ± 0,5 %)*
- **Gluing tolerances**
Of die cut
 - BC flute: - 4 mm to + 6 mm *(0,16 inch – 0,24 inch)*
 - C flute: ± 4 mm *(± 0,16 inch)*
 - B flute: ± 3 mm *(± 0,12 inch)*
 - E flute: ± 2 mm *(± 0,08 inch)*
- **Size tolerances**
Of the die cut due to production method
 - Flat bed die cut: ± 2 mm *(± 0,08 inch)*
 - Rotary cut: ± 3 mm *(± 0,12 inch)*
 - Inline (slotted): ± 3 mm *(± 0,12 inch)*

2.2. Boxes made from paperboard or solid cardboard

In general, a tolerance of ± 0,5 % applies to all thicknesses and materials, but a maximum of ± 1 mm (*± 0,04 inch*), due to gluing and production.

2.3. Parts and sheets made from plastic

Applicable for all shapes and production methods (without gluing).
All thicknesses and materials according to ISO 2768-1 Table 1: Permissible deviations for linear dimensions (tolerance classes: f, m, c, v).

2.4. Other packaging materials

According to specification defined or agreed by Inventronics packaging department.

3. Sustainability

3.1. General

For Inventronics it is important to continuously improve and harmonize the packaging material in cooperation with our suppliers. Whenever a supplier identifies an improvement opportunity to reduce and avoid packaging material, this must be brought to the attention to Inventronics packaging department.

- Inventronics tries to avoid packaging material wherever possible.
- Generally, parts must be packed in such a way that the use of packaging material is kept to a minimum while adequately protecting the product.
- Inventronics has clear guidelines for the design and procurement of packaging:
 - All packaging should be made of environmentally friendly materials or recycled raw materials that can be easily recycled or disposed of.
 - Whenever possible paper-based packaging should be preferred to plastic packaging.
 - Whenever possible reusable packaging should be preferred to single use packaging.
 - In general, we follow the principle of the circular economy, in which recycling is an essential component.

3.2. Packaging materials

Below overview lists the different materials used in relation to packaging.

Preferred materials, materials to be avoided and prohibited materials are listed.

Not approved materials need special approval by the Inventronics packaging department.

ITEM	Approved	To avoid	Not Approved
Material in general			
Plastic	<ul style="list-style-type: none"> - Preferred from recycled material - Mono-Material 	<ul style="list-style-type: none"> - Foamed plastic - PS 	<ul style="list-style-type: none"> - PUR - PVC - EPS (2022) - Oxidatively degradable plastic - Not separable materials as PET-GAG - Plastic with graphite for end consumer packaging
Paper based materials	<ul style="list-style-type: none"> - Preferred from recycled material like FSC Recycled, FSC Mix 	<ul style="list-style-type: none"> - Virgin fiber but FSC-certified 	<ul style="list-style-type: none"> - Virgin fiber but not FSC-certified - Laminated paper/ cardboard
Inks/ Lacquers	<ul style="list-style-type: none"> - Vegetables based inks 		<ul style="list-style-type: none"> - Solvent inks/ lacquers - Lead containing inks - Mineral oil based inks

ITEM	Approved	To avoid	Not Approved
Packaging types			
Boxes	<ul style="list-style-type: none"> - GD/ GT paperboard - Corrugated cardboard - Reusable shipping boxes made from plastic (PP) 	<ul style="list-style-type: none"> - Virgin fiber but FSC-certified 	<ul style="list-style-type: none"> - Virgin fiber but not FSC-certified - Not water-soluble coatings or adhesives - Laminated paper - See “<i>plastic</i>”
Blister	<ul style="list-style-type: none"> - PET - Preferred from recycled material 	<ul style="list-style-type: none"> - Composites are to be avoided in general 	<ul style="list-style-type: none"> - Not separable materials need special approval by the packaging department
Trays	<ul style="list-style-type: none"> - PS, PP, PET - Paperboard/ corrugated fiberboard - Paper Pulp 	<ul style="list-style-type: none"> - EPE - EPP 	<ul style="list-style-type: none"> - PUR - PVC - EPS (2022) - See “<i>plastic</i>”
Shrink/stretch wrapping	<ul style="list-style-type: none"> - PE - PP 		<ul style="list-style-type: none"> - PVC - Film with graphite
Bags/ sacks	<ul style="list-style-type: none"> - PE, PP, paper 		<ul style="list-style-type: none"> - Labelling made from foreign materials as the substrate
Labels, adhesive tapes	<ul style="list-style-type: none"> - Paper removable acc. QT504 “Glue-Separation Test” - PE, PP, PET, PS same material as product 	<ul style="list-style-type: none"> - PE/ PP or PET - not same material as product but easily removable 	<ul style="list-style-type: none"> - PE/ PP/ PET/ paper not easily removable stickers and adhesive tape made from foreign material
Cushion/ Inlays	<ul style="list-style-type: none"> - Paperboard / corrugated cardboard - Paper Pulp 	<ul style="list-style-type: none"> - EPE, EPP 	<ul style="list-style-type: none"> - PUR - EPS (2022)
Straps	<ul style="list-style-type: none"> - PP 		<ul style="list-style-type: none"> - Steel straps
Cushioning material	<ul style="list-style-type: none"> - Paper-chips - Paper-cushion 		<ul style="list-style-type: none"> - EPS-Chips - Air-bubble foils - Organic cushioning material (beside paper fibers)
Wire	Only with approval from Inventronics packaging department (e.g. for labels, etc.)		
Clamps/ staples	Only with approval from Inventronics packaging department		

3.3. Recycling Marking

This section deals with the mandatory labelling of the packaging/ components. For product related labelling there are additional requirements (see e.g. WEEE).

The supplier must fulfill all requirements according to packaging directives 94/62/EC and (EU) 2018/852 “on packaging and packaging waste”.

Each packaging component must be identified by the recycling code. The symbol consists of a triangular circuit logo, the alphanumeric code and the corresponding material abbreviation.



This helps the consumer in separate waste and thus contributes to proper return to the recycling cycle. The instructions for detailed printing can be found in the following documents: ZGR 2824326, ZGR 2837939, ZGR 4504531.

3.4. REACH Regulation/ SVHC (Substance of Very High Concern)

REACH is the acronym for Registration Evaluation Authorisation and Restriction of Chemicals Regulation 1907/2006 (as amended).

According to Art 33 of the REACH Regulation the Candidate List of substances of very high concern (SVHC) is published by ECHA (European Chemicals Agency).

As required by Art. 33 supplier will inform Inventronics, if packaging materials contain one or more of these substances in a concentration exceeding 0.1 % weight per article.

More information can be found under <https://echa.europa.eu/candidate-list-table>.

The supplier must find a substitution immediately and is obliged to inform Inventronics immediately in written form.

3.5 Substance restrictions in packaging materials

The following EU regulations restricting the use of certain hazardous substances are relevant for packaging and printing materials. The requirements must be fulfilled.

- Directive 94/62/EC (“Packaging Directive”)
- Regulation (EC) No 1907/2006 (“REACH”) Annex XVII
- Regulation (EU) 2019/1021 (Persistent Organic Pollutants, POP)
- Article 112 of the French Law No. 2020-105 of 10 February 2020 on certain mineral oils (MOSH, MOAH)

This applies to any kind of packaging material regardless of the packaging level (primary, secondary, tertiary level).

The following table informs about current legal requirements relevant for Inventronics packaging and printing materials.

Chemical Name/ Group	CAS Number	Threshold Limit (ppm)	Reference Standard
Polyvinyl chlorid (PVC)	9002-86-2	Not intentionally added ¹ 900 (Cl)	company Policy
Cadmium (Cd)	7440-43-9	Sum of heavy metal content Cd+Pb+Cr+Hg < 100	EU Packaging Directive 94/62/EC and Amendment
Hexavalent chromium (Cr ⁺⁶)	18540-29-9		
Lead (Pb)	7439-92-1		
Mercury (Hg)	7439-97-6		
Mineral Oils in inks Aromatic hydrocarbons of mineral oil (MOAH) comprising 1 to 7 aromatic cycles:		For mineral oil aromatic hydro-carbons (MOAH), where the mass concentration in ink of these substances is greater than 0,1 % or the mass concentration in ink of compounds of 3 to 7 aromatic rings is greater than one part per million (ppm)	Article 112 of the French Law No. 2020-105 of 10 February 2020
Mineral oil saturated hydrocarbons (MOSH) with 16 to 35 carbon atoms.		For hydrocarbons saturated with mineral oil (MOSH), where the mass concentration in ink of these substances exceeds 0,1 %.	
Substance of Very High Concern according to REACH	Waste Framework Directive (EU Directive 2008/98/EC) as an article ² REACH (EC) 1907/2006 and amendments REACH Candidate List of SVHC (latest list link) REACH Annex XVII (link)		

¹ „Intentionally added“ means Substance deliberately used in the formulation of a material or component where the presence of the substance in the final product provides a specific characteristic, appearance or quality.

² „Articles“ as such, an object in which during production is given a special shape, surface or design which determines its function to a greater degree than does its chemical composition.

4. Primary Packaging

The packaging that comes into closest contact with the product is often referred to as "retail packaging". Its main purpose is to protect the product and inform or attract a customer.

In most cases, the primary packaging is a folding box or a divider.

4.1. Construction

- The material and construction must meet the requirements of the Inventronics specifications.
- The ECMA standard (European Carton Makers Association; www.ecma.org) should be used, in this case no further drawings must be provided in the specification.
- In case the ECMA standard can't be used, the drawings must be provided in the specification and as a dxf-file. Unless otherwise specified, the drawings always show the print side.

4.2. Printing (Offset)

For printed packaging, particularly primary packaging like folding boxes, the quality of printing (color quality and color consistency) is very important.

To avoid errors or to detect any errors early in the supply chain, Inventronics relies on a trusting cooperation with its suppliers and on the effectiveness of the quality assurance system. The term supplier refers here to the supplier of the printed packaging material.

Depending on the brand or product, the packaging is printed in only spot color or four-color (CMYK) or in a combination of spot color(s) and four-color (see table below).

Note: The measures described apply only to offset printing.

To ensure print quality with other print technologies (e.g. flexographic or gravure printing) the measures must be defined individually depending on the respective layout and the machinery available at the supplier.

If Inventronics purchases finished products from external suppliers, these suppliers must ensure that the measures described here are also followed by their packaging suppliers.

4.2.1. Actions to be taken by printer

Before printing a motif for the first time the supplier will receive the following:

- The Inventronics specification describing the material to be used and the technical definition of the corresponding die-cuts, (alternatively, if finished products are procured from external suppliers the use of existing packaging/ die-cuts can be agreed).
- The print files in the form of files (PDF/X-4).
- Reference PDF-files with low resolution.
- For packaging with the Inventronics or customer brand that is printed in four colors (CMYK) in addition to the usual spot colors, Inventronics or the agencies will provide a binding digital color proof (ISO 12647) or offset proof for checking the color quality.
- If customer brands are printed in four colors (CMYK) a machine proof of a product representative of the customer's range (provided it has the same color distribution) will be created for the respective brand and provided to the supplier.

If neither color cards nor offset proofs or digital proofs are available for customer brands in spot colors, color books (Pantone, HKS) should be used.

	Inventronics brand		Other brands	
	PMS 021 C	PMS 021 C + CMYK	CMYK	Spot colours
High-resolution printing pdf (PDF/X-4)	X	X	X	X
Low-resolution reference pdf files	X	X	X	X
Tolerance cards	X	X		
Digital proofs or offset proofs	-	X	X	optional
Colour panel spot colour (Pantone or HKS)	-	-	-	X*

**) Supplier must make sure to use current versions of Pantone and HKS panels and store them properly*

Quality control:

- The supplier must use the low-resolution PDF file to check whether the contents of the printout (texts, pictograms, symbols, brand elements, barcodes, etc.) meet the specifications. Colours and surfaces (coatings) must be checked with the aid of colour cards, proofs or colour books.
- In cases of doubt, Inventronics packaging department or the agency submitting the artwork must be contacted.

4.2.2. Legibility of barcodes on packaging components

Barcodes on printed packaging components from suppliers must meet EN ISO/IEC 15416 and the European Standard of the relevant symbology (see chapter "Standards").

The required degree of quality is "good" (EN Grade 3, ANSI Grade B).

5. Distribution packaging/ transport packaging

The distribution packaging is designed to contain one or more articles or packages, or bulk material, for the purposes of transport, handling and/ or distribution.

5.1. General

The packaging must meet at least the following requirements:

- The weight (incl. content) of the shipping box shall not exceed 12 kg in case the single product weight allows that.
- The packaging (incl. content) has to withstand the transport to the end customer. This should be verified by appropriate tests, minimum standard should be drop test, vibration test or simulated transport test (see chapter “Standards”).
- Double stacking of pallets for transport and storage must be ensured (see document “Standards for Delivery of Goods to Global Supply Centre”).
- For further tests the Inventronics packaging department must be contacted.

5.2. Construction

In most cases, the distribution packaging is a shipping box made from corrugated cardboard, so this chapter is focusing on this.

- The material and construction must meet the requirements of the Inventronics specifications.
- The FEFCO standard (FEFCO is the European Federation of Corrugated Board Manufacturers) should be used, in this case no further drawings must be provided in the specifications. If the FEFCO standard can’t be used the drawings have to be provided in the specification and as dxf-file.
- Unless otherwise specified, shipping boxes are made from corrugated cardboard with appropriate ECT-values (Edge Crush Test grading). The composite of the corrugated cardboard must meet the requested value.
- Guide to carton strength:
To ensure that outer cartons provide adequate support throughout the entire supply chain, the recommended strength parameters given here as a guide should be followed. For packaged products, size and weight usually determine the material specifications and whether paperboard or corrugated cardboard is used.

Filling weight	Bursting strength (BCT) ¹ (min)	Edge crush test (ECT) ² (min)
0,5 kg – 5 kg 1,1 lbs – 11 lbs	650 – 1.150 kPa US: 125 PSI	2,5 (kN/m) US: 23 ECT
5 kg – 10 kg 11 lbs – 22 lbs	1.000 – 1.723 kPa US: 150 PSI	3,5 (kN/m) US: 26 ECT
10 kg – 25 kg 11 lbs – 55 lbs	1.450 – 2.253 kPa US: 200 PSI	6,5 (kN/m) US: 32 ECT
25 kg – 30 kg 55 lbs – 66 lbs	2.000 kPa US: 275 PSI	11 (kN/m) US: 44 ECT
> 30 kg > 66 lbs	to be defined	special approval

¹) Indicates the ability of the carton to withstand external or internal forces and whether the carton will hold the contents intact during rough handling. (see chapter “Standards”)

²) Indicates the stacking strength of corrugated board cartons. (see chapter “Standards”)

5.3. Printing of shipping boxes

The printing is defined in an artwork (ZGR document) or in the specification (ZPC document).

Unless otherwise specified, flexographic printing is used. A good contrast of ink and print-surface is needed; black, dark brown, dark blue or dark green are the preferred colors.

Recycling Code

- A recycling logo must be printed based on the raw material (see chapter “*Recycling Marking*”).

Supplier Code

- The manufacturer of the packaging may optionally print a symbol or a code of the company on an inner flap of the box.
- China: For shipping boxes sourced and produced in China the supplier code is mandatory. This code is provided by Inventronics China.

Production Date

- A date code for the production date of the shipping box is desired.
- Preferably the format should be month/year (mm/yy).

RESY Symbol

- In case “RESY” symbol shall be used as a certificate of the manufacturer’s partnership in the German recycling-cooperation and if the position and size is not defined in the related specification the maximum height of the symbol is 40 mm and of the production code and date 24 pt.

The instructions for detailed printing can be found in the following documents: ZGR 2824326, ZGR 2837939, ZGR 4504531.

5.4. Closing of shipping boxes

In shelf-ready packaging, no printing or perforation line may be covered by adhesive tape. Paper tape or hot melt are preferred for closing.

5.5. Content label

- The content label must be designed according the Inventronics requirements.
- The content label must adhere to the front side of the shipping box (broadside as per FEFCO description).
- In case the front is too small, change side of the shipping box or place it on top.
- The content label must not be applied to printed surfaces or perforated surfaces (if covered, this must be approved by Inventronics packaging department).

6. Standards

The metric system must be used, other systems can only be used additionally.
An overview of used standards can be found in the table below:

Area	Title	Link
General	Packaging – Vocabulary	ISO 21067
	Paper, board, pulps, and related terms – Vocabulary Part 1: Alphabetical index	ISO 4046-1
	General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerance indications	ISO 2768-1
	GS1 Package Measurement Rules Standard	www.gs1.org
Paper and board	Paper and board – Determination of grammage	ISO 536
	Paper and board – Determination of bending stiffness	ISO 5628
	Testing of paper and board – Determination of the bending stiffness by the beam method	DIN 53121:2014-08
	Determination of tearing resistance	ISO 1974
	Corrugated fiberboard – Determination of edgewise crush resistance	ISO 3037:2013-12
	Testing of board – Puncture test	DIN 53142-1
	Board – Determination of bursting strength	ISO 2759
	Corrugated board – Part 1: Requirements, testing	DIN 55468-1
Box construction	FEFCO International Case Code	www.fefco.org
	ECMA CODE of folding carton	www.ecma.org
	Vertical Drop test	ISO 2248
	Vertical random vibration test	ISO 13355:2016
	Environmental testing: Shock	IEC 60068-2-27:2008
Recycling	Material recycling codes	https://en.wikipedia.org
	QT-504-glue-separation	www.epbp.org
	RecyClass – Recycling-Tool for plastic packaging	www.recyclclass.eu
	Directive 94/62/EC on packaging and packaging waste	http://eur-lex.europa.eu/
	certified material selection	www.fsc.org
Printing and Barcodes	Automatic identification and data capture techniques – Barcode print quality test specification: Linear Symbols	EN ISO / IEC 15416
	Generation of artworks for packaging, quality and legibility of barcodes	PC 44-701-1-145
	Bar coding – Symbology specifications - Interleaved 2 of 5 - Code 39 - Code 128 - EAN/UPC	ISO/IEC 16390 ISO/ IEC 16388 ISO/IEC 15417 ISO/IEC 15420
Inventronics	Standards for Delivery of Goods to Global Supply Center	

7. Change history

Date	Version	Reason for change
January 2024	1.0	Initial creation