

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY
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Master's Degree in Packaging Technology

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**A GLOBAL TRANSPORT PACKAGING GUIDELINE
FOR SELECTED BUSINESS AREAS**

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ABSTRACT

Lappeenranta University of Technology
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A global transport packaging guideline for selected business areas

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62 pages, 22 figures, 6 tables and 13 appendixes

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Professor Juha Varis

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In this Master's Thesis a global transport packaging guideline for selected business areas was compiled for the Fiskars the company, which provides branded consumer goods for home, garden and outdoor use. The business areas included were Home and Garden business areas.

The aim of the guideline was to be a comprehensive guide for the suppliers, product development, operations and external vendors of the company. The guideline consists of written instructions, tables and illustrations that provide useful information for players working with transport packages from sourcing through to shipments.

As the role of corporate responsibility and sustainability has grown, a part of responsible manufacturing strategy includes using materials that are re-usable, recyclable or recoverable as energy or through composting. Hence packaging waste management implementations of different regions were also inspected.

The resulting guide covers a range of topics concerning packaging and its transport. The topics include legal requirements, restricted materials and substances, preferred materials, markings, labeling of boxes, logistics and distribution center requirements, physical testing and an inspection checklist.

TIIVISTELMÄ

Lappeenrannan teknillinen yliopisto
Teknillinen tiedekunta
Pakkaustekniikan koulutusohjelma

Kirsi Seppänen

Globaali kuljetuspakkausohjeistus valituille liiketoiminta-alueille

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62 sivua, 22 kuvaa, 6 taulukkoa ja 13 liitettä

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Professori Juha Varis

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Työssä luotiin globaali kuljetuspakkausohjeistus Fiskars-konsernin valituille liiketoiminta-alueille. Fiskars tarjoaa kuluttajatuotemerkkejä kotiin, puutarhaan ja ulkoiluun, joista kodin ja puutarhan liiketoiminta-alueet sisällytettiin kuljetuspakkausohjeistukseen.

Kuljetuspakkausohjeistuksen tavoitteena on toimia kokonaisvaltainen ohjeena konsernin materiaalitoimittajille, liiketoiminnalle, tuotekehitykselle ja ulkoisille myyjille. Kuljetuspakkausohjeistus koostuu kirjallisista ohjeista, taulukoista ja kuvitetuista ohjeista, joiden tarkoitus on tarjota hyödyllistä tietoa toimijoille pakkaamisen eri elinkaaren vaiheissa.

Yritysvastuun ja kestävyuden roolin kasvettua, osa vastuullista tuotantostrategiaa on käyttää materiaaleja, jotka ovat uusiokäytettäviä, kierrätettäviä tai talteenotettavia. Tästä johtuen pakkausjätteen käsittelyä eri maantieteellisillä alueilla tutkittiin myös.

Tuloksena saatu kuljetuspakkausohjeistus kattaa aiheet, jotka koskettavat pakkauksia ja niiden kuljetuksia. Aiheita ovat muun muassa lailliset vaatimukset, rajoitetut materiaalit ja aineet, suositellut materiaalit, merkinnät, merkkaukset, logistiikan ja jakelukeskuksen vaatimukset, fyysinen testaus ja tarkastuslista.

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Where there's a will there's a way!

Lappeenranta, May 5th 2013

Kirsi Seppänen

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ABBREVIATIONS

BA	Business area
BST	Burst strength test
CEN	Comité Européen de Normalisation
CENELEC	European Committee For Electrotechnical Standardization
DC	Distribution center
ECT	Edge crush test
EMEA	Europe, The Middle East and Africa
ERP	Enterprise Resource Planning
EU	European Union
FCT	Flat crush test
FCM	Food Contact Material
FSO	Fiskars Sourcing Office
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ISTA	International Safe Transit Association
MPA	Megapascal
NPD	New Product Development
PO	Purchase Order
PRG	Product Requirement Guideline
PSI	Pre Shipment Inspection
US	United States
VMI	Vendor Managed Inventory

1 INTRODUCTION

In recent years, the significance of quality and sustainable management has grown substantially. Environmentally friendly consumer behavior has increased and the number of enterprises certified to an environmental management standard, ISO 14001, has been rising steadily. In addition, governments have set up sustainable procurement policies, according to trends reported by the United Nations. (United Nations, 2010).

Alongside my Master's studies I have been working as a project manager in a service organization dedicated to corporate responsibility. My personal field of expertise has been responsible graphic technology. As packaging technology and graphic technology have a close link, the environmental aspects and improved management of packaging were close to my interests when the project work was offered to me by the Fiskars Corporation.

Since there was no ensemble packaging guideline available within the Fiskars group, the company decided to introduce a general group-wide packaging guideline in 2012. The purpose of the guideline was to be a user-friendly, clear and comprehensive guide for suppliers, product development, operations and external vendors, especially those located in Shanghai and Bangkok. The packaging guideline is applicable to all Fiskars products sold and distributed in the EMEA region.

The goal of this Master's Thesis is to present the Fiskars group and the created Fiskars general packaging guideline for Home BA and Garden BA to the reader. The parts examined in the guideline are legal requirements, restricted materials and substances, preferred materials, markings, labeling of boxes, logistic and DC requirements, physical testing and inspection checklist. After an examination of the guideline, conclusions and discussion follow.

1.1 Fiskars group

Fiskars is a Finnish company providing branded consumer goods, with home, garden and outdoor use being their main business areas. The company was founded in 1649, making it the oldest one in Finland. The company employs approximately 4100 people in over 20 countries. (Fiskars 2012a)

The company has three key international brands; Fiskars, Iittala and Gerber. Fiskars is the biggest brand of the company and it is globally recognized as the world's leading brand in scissors. Buster, Arabia and Hackman are positioned as regional brands of the company and they are considered to have a strong position in their home markets. The company also owns over ten local brands, such as Rörstrand, which are meant to serve as door openers to new markets. (Fiskars 2011a, p. 3; 9).



Figure 1. Fiskars orange scissors with steel blades and impact resistant plastic handles made of Polybutylene terephthalate (PBT), Polypropylene (PP) or Acrylonitrile butadiene styrene (ABS). (Fiskars 2013).

The company also runs Fiskars Other functions, which cover the company's real estate business, shared services and corporate headquarter functions. Fiskars is also the largest single shareholder of the Wärtsilä Corporation. (Fiskars 2011a, p. 28–29).

Fiskars was ranked fifth in a study listing Finland's most valued brands in 2012. Brands of the Fiskars group – Iittala, Hackman and Arabia – were also included in the top ten list. Over 1000 Finnish and international brands were included in the

study wherein Finnish consumers gave their votes on how they perceive the brands. (Taloustutkimus 2013)

1.1.1 Fiskars Business Areas

Fiskars has three main business areas: Fiskars Home, Fiskars Garden and Fiskars Outdoors, listed here in order of net sales. The total net sales in 2012 were 747,8 million euros with a one percent growth compared to 2011. (Fiskars 2012b). The vast majority in year 2011 – 76,6 percent – of net sales in 2011 was from outside Finland. (Fiskars 2011a, p. 88)

The Home business area offers a broad selection of consumer products for kitchens, tables and homes. Fiskars home had a net sale of 306,3 million euros in 2011 and comprised 41 percent of consolidated net sales.

Fiskars Garden is a leading brand in garden hand tools with 294,3 million euro net sales in year 2011, accounting for 40 percent of consolidated net sales.

Fiskars Outdoors had 137,8 million net sales with a 19 percent share of consolidated net sales. The segment offers boats, outdoor equipment tools and accessories (Fiskars 2011a, p. 24). The Fiskars Outdoors segment and its products are excluded from this Master's Thesis.

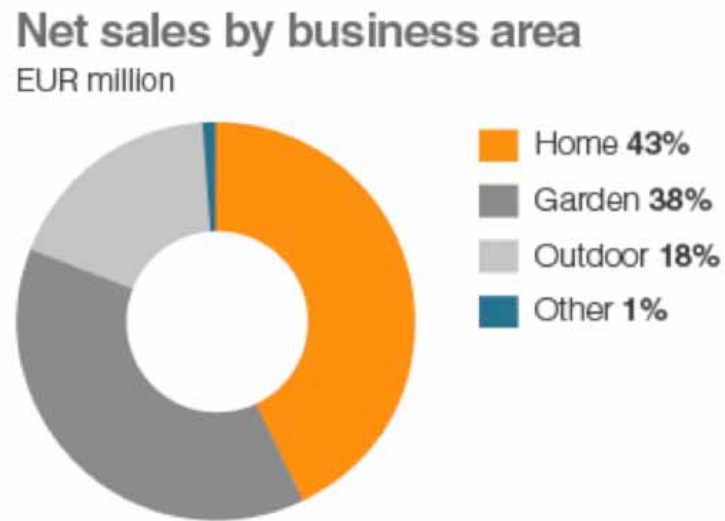


Figure 2. Fiskars' main business areas in order of net sales in the year 2012. (Fiskars 2012b)

1.1.2 Fiskars and sustainability

Fiskars has a sustainability directive, which states that their mission is to offer functional, durable and well-designed products as well as run and grow their business in a sustainable manner, taking care of people and the environment.

As part of the responsible manufacturing strategy, their principle is to use materials that are re-usable, recyclable or recoverable as energy or through composting. Fiskars has set goals to reduce their CO₂ emissions, improve material efficiency and free their products from harmful substances. (Fiskars 2011a, p. 32; 34).

As the objective of the company is to do profitable business in an ethical and responsible mode, Fiskars obeys a Code of Conduct. The Code of Conduct, to which the company is committed to in all levels of its operation, obliges the company to fully comply with laws and regulations and human rights. The code also concerns business conduct, environment, human resources practices, customer and supplier relations, intellectual property rights and other intangible assets as well as the code's implementation and compliance. (Code of Conduct)

1.1.3 Fiskars sourcing

The function of sourcing is to purchase the required materials, products and services the company needs. Sourcing has to face the demands set with regards to time, quantity and quality aspects with a given price. Purchasing has to be implemented as economically as possible and a needed service level has to be guaranteed. (Ritvanen et al. 2011, p. 32)

Fiskars has sourcing offices in Bangkok, Shanghai and Helsinki (Principal uncertainties). In Fiskars' case, sourcing can be considered global. Global sourcing can be defined as a strategic solution, in which a proactive approach towards improving competitiveness is emphasized. Part of improving competitiveness is to choose and evaluate suppliers and deliverers thoroughly. As products and services are increasingly bought from abroad, advantage in costs can be achieved. On the other hand, as the sphere of operations covers the whole globe, managing the supply chain can be challenging since products have to be delivered to a given address in a given amount of time. In addition, sourcing personnel have to be skillful enough to meet the needs of planning, logistics, customs, taxing, currency and cultural differences. (Ritvanen et al. 2011, p. 173)

Fiskars has described the opening of their Bangkok sourcing office in 2011 with the following statement: "A global sourcing function close to main supply markets will facilitate Fiskars new product development and quality assurance processes, and further strengthen Fiskars collaboration with its suppliers, thus adding value to business and enhancing Fiskars international competitiveness. Locating the global sourcing office near the supplier network will also ensure continuous improvement in promoting corporate responsibility and sustainability within the supply network, including the implementation and follow up of Fiskars Supplier Code of Conduct and development of operating models in co-operation with suppliers." (Fiskars 2011b)

1.2 Tertiary package elements

A tertiary package, i.e. a unit load, is a clump of filled shipping containers, which are sold as a unit to retailers or distributors by the manufacturer of the products. Unit loads are packages as such, and they are assembled and formed into units by the manufacturer. The higher level of packaging after tertiary package is “contain-erization”, or a transportation unit, where the unit is defined and handled as e.g. a truckload or railcar unit. (Leonard 1996, p. 211)

A common tertiary package or a unit load is a pallet loaded with shipping containers – for example corrugated board boxes – and they are fixed to a rigid form by auxiliary means, such as straps or plastic film. The constituent idea in palletizing is to load shipping containers on firm fixed sized platforms and move them with fork trucks in and out of e.g. trucks. (Leonard 1996, p. 212–213). A typical tertiary package consisting of secondary and primary packages is presented in figure 3.

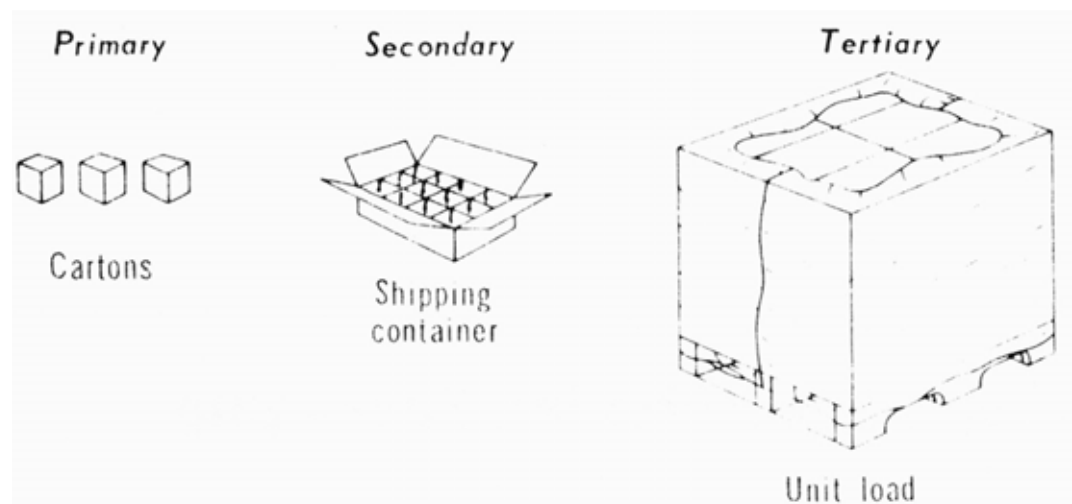


Figure 3. Unit load elements (Leonard 1996, p. 212)

According to Leonard (*ibid*) the primary and the tertiary packaging specifications are solely drawn up by the product manufacturer and packer, whereas the secondary package must obey the regulations of common carriers, such as contract truckers and seagoing shipping lines.

Pallet pattern – the arrangement of products on the pallet – is critical in case an orderly compact loading and distribution system is wanted. Pattern design may be restricted by the primary and secondary packages, the shipping method and size of conveyance, as well as warehouse space, according to Yam (2009, p. 901). The best available pallet pattern will also enable minimum overhang or underhang (Leonard 1996, p. 215). Overhang causes the unit loads to be too large as the unit exceeds the width of the pallet; thus loading them for transportation can be difficult and since there is too little room for maneuvering, the loads can wedge themselves in too tight during transportation, and thus cannot be removed undamaged. Alternatively underhang will allow the unit load to move too much during transportation, if auxiliary stabilizing is not executed properly, as the unit load does not cover the whole surface of the pallet. (Leonard 1996, p. 219)

The most common elements of tertiary packages are presented in the following chapters.

1.2.1 Pallets

In the 1930's pallets were originally used for handling goods in the distribution environment. Pallets, as they are recognized today, came into wider recognition during the Second World War as they were used for military purposes. The demand for pallets started to grow at the same time as forklift trucks gained currency in the US. (Yam 2009, p. 322; Leblanc 2011)

A pallet can be made of wood, corrugated and honeycomb paperboard, plastic, reinforced plastic or metal. Wood pallets are the most common (Leonard 1996, p. 213). Pallets are assigned to simplify the handling of goods, as they reduce work time and costs used in handling. Pallets are usually multi-trip or single-trip, i.e. returnable or expendable; returnable pallets are preferable in export operations, as pallets can be rotated in the pallet-pool systems between companies. (Ramsland & Selin 1993, p. 139).

In Europe, European Pallet Association (EPAL) governs manufacturers of EURO pallets in matters such as which types of nails and timber may be used in pallets. The stern standards are based on the Euro Pool pallet swap organizations. (2mv Logistics). The Euro Pool System is a provider of logistical services to retailers and they rent returnable trays and pallets to producers, traders, food processors and retailers. The rotation of trays and pallets is financed with a deposit system and the system guarantees stock availability of all trays in its service centers. (The system)

A wooden pallet has a bearing capacity of one tonne. Pallets are usually built using nails but there are pallets available in which no nails have been used, where fastening is achieved with dowels. Using dowels makes recycling the pallets less demanding as they can be chipped to compost. (Järvi-Kääriäinen et al. 2002, p. 191)

Pallet sizes are standardized and for example the grocery industry in Finland is using standardized pallets (Järvi-Kääriäinen et al. 2002, p. 96). The standards can be national or international and it is crucial to be aware of the accepted sizes of the pallets in the receiving country, as often the whole process from shelves' sizes to forklift trucks is based on handling standardized unit loads in order to reduce the extra work and costs. (Ramsland et al. 1993, p. 139). There are several standardized pallet sizes available and the International Organization for Standardization (ISO) "specifies the principal dimensions and tolerances for new single-deck and double-deck, reversible and non-reversible flat pallets, of all entry types and made of any material, related to their transportation and handling by pallet trucks, fork-lift trucks and other appropriate equipment." (ISO 2009)

The most commonly used pallet sizes in international trade, according to Ramsland et al. (1993, p. 193) are two types of Europallets, pallets used in U.S. and Canada and pallets used in Japan, Far East and Australia.

Europallets

EUR-pallets are the most used pallet dimensions in Europe. The most common sizes are Pallet EUR 1, with a size of 1200 x 800 millimeters and Pallet EUR 2 with a size of 1200 x 1000 millimeters. The other two pallet models are Pallet EUR 3 with a size of 1000 x 1200 millimeters and Pallet EUR 6, sized 800 x 600 millimeters. (Industrial information 2008). EUR-pallets 1 and 2 are used in the UK, the Netherlands, Belgium, Finland, Sweden, Denmark and Norway and parts of US and Canada (Ramsland et al. 1993, p. 139). EUR pallets are accessible to fork lift entry on all four sides. (Järvi-Kääriäinen et al. 2002, p. 96). An example of a EUR pallet is seen in figure 4.



Figure 4. A EUR-pallet, accessible to fork lift entry on all four sides. ISPM 15 treatment and EPAL markings are visible on the front. (EUR-Pallets)

Since the beginning of 2010, all new EUR / EPAL pallets have gone through an ISPM 15 treatment. The ISPM 15 treatment is marked on both central blocks of the longitudinal side of the pallet or on both central blocks on the 800 millimeter wider side. (ISPM 15). ISPM requires that a wooden packaging material is manufactured from debarked wood and heat treated so that the inner temperature of the wood materials is a minimum of 56-Celsius degrees minimum for 30 minutes or the wood material is fumigated with methyl bromide. Treatment of EUR pallets with methyl bromide is not allowed. (Evisa 2011) The ISPM 15 marking is presented in figure 5.

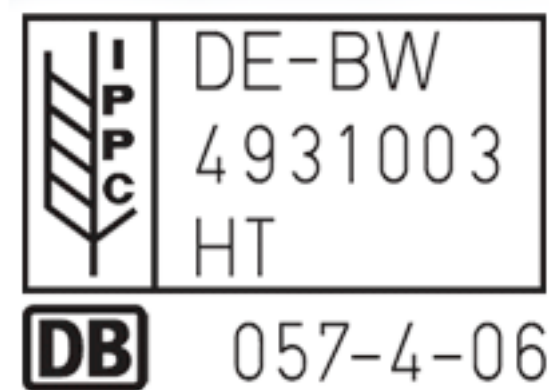


Figure 5. The ISPM 15 marking containing the IPPC certification symbol, country code (DE = Germany, BW = Botswana) and certification number 4931003. HT stands for heat treatment. Additional info can be added to the stamp (ISPM 15).

North American GMA and Japan, Far East and Australia pallets

The North American GMA pallet, also called the grocery pallet, represents 30 percent of the pallets produced in US each year. The pallet size is 1219 x 1016 millimeters (48 x 40 inches). The GMA pallet size was converted to a standard during 1960's and 1970's in US. Approximately 90–95 percent of pallets manufactured in US are made of wood, as has been done for over 70 years. (Clarke 2004, p. 1; 7). The GMA pallet is likewise accessible to fork lift entry on all four sides. (Leonard 1996, p. 213). It is widely used in the US and Canada where it is usually referred to in inches as a “48 x 40 pallet”. With the local equipment tailored to meet the needs of the GMA pallet, it is also conceivable to handle pallets sized 1000 x 1200 millimeters also. The pallet size usually used in Japan and Far East is 1140 x 1140 millimeters (Ramsland et al. 1993, p. 139). The unique pallet size used in Australia and New Zealand is 1165 x 1165 millimeters (Pacepallets 2011).

1.2.2 Containerboard

The containerboard industry is one of the biggest sectors in the paperboard industry. Over 100 million tons of containerboards were consumed in the year 2008, with one fourth of the amount in Europe. (Kuusipalo 2008, p. 219). In 1996 the

consumption was nearly 80 million tonnes, thus the consumption has been on the rise (Paulapuro 2000).

Containerboards, which consist of linerboard and a corrugating medium, are used to produce corrugated board. Linerboards are made of bleached or unbleached softwood and recycled pulps. Linerboard can be also manufactured from virgin fiber. Linerboard made from recycled fiber is called testliner or, if made of virgin fiber, kraftliner. The liner usually weights 125–350 g/m². (Kuusipalo 2008, p. 219)

A corrugating medium typically consists of semi-chemical pulp, but it can be mixed with recycled pulps. Semi-chemical fluting can be considered the middle wave layer of corrugated board and if the corrugating medium is solely made of semi-chemical pulp, it is usually called fluting. Compression strength and stiffness are required features for a corrugating medium. (Kuusipalo 2008, p. 220)

There are different flutings available in corrugated boards. The fluting differs based on its height, the number of flutes per meter or by the pitch or length of the flute. The standard flutes are named A, C, B and E, where A and C flutes are coarse flutes and B and E are fine and extra fine flutes. The most common is the C flute, as it is rigid and has good stacking strength properties. There are also non-standard flutes available, called mini, micro and extra coarse flutes. (Kuusipalo 2008, p. 221–223)

Corrugated board can be separated into different categories based on its structure: single-faced corrugated, single-wall corrugated, double-wall corrugated and triple wall-corrugated. The single-faced corrugated has one liner and one layer of corrugated medium glued to each other and single-wall corrugated has two liners and one corrugated medium glued together. Double-wall corrugated has three liners and two layers of corrugated mediums attached together so that one liner is between two corrugated layers. Triple-wall corrugated consists of four liners and three corrugated mediums. The bigger the rate of combination, the stronger and more robust packaging can be achieved. (Kuusipalo 2008, p. 220–221)

1.2.3 Films

Shrink films and stretch films are used to stabilize the unit loads. There are several methods for applying films in unit loads, such as flow-through shrink-wrap, spiral-wound stretch wrap, preformed shrink-film bag and stretch band and slip-sheet. Stretch films are usually made of PE-LD or softened PVC (Järvi-Kääriäinen et al. 2002, p. 96).

Flow-through shrink-wrap

In a flow-through shrink-wrap a unit load is passed between two vertically attached rolls of shrink film and as the load passes the film rolls, it pushes the film ahead and along the sides of the load. Since the unit load has passed the rolls, a pair of heat-sealing bars will pull in the film. The unit is then exposed to heat for a few minutes and the film will be shaped around the unit tightly. (Leonard 1996, p. 221)

Spiral-wound stretch wrap

In a spiral-wound stretch wrap one roll of vertically attached film will handle the palletized load. The unit load is placed on a turntable beside the roll; the end part of the film is placed into the unit and then as the turntable is started the unit load begins to pull the film onto itself from the film roll. The film roll moves up and down while the turntable is turned on to create a spiral wrap from the top to the bottom of the unit load.

The spiral-wound stretch wrap system is claimed to be relatively preferable compared to flow-through shrink-wrap as the film application requisites are cheaper and no heat shrinking is needed as well as the space needed for the operation is smaller as well. (Leonard 1996, p. 221)

Preformed shrink-film bag

A preformed shrink-film bag is a well-suited method for products insensitive to heat, cold or weather conditions, i.e. products which can be stored outdoors. A preformed bag made of shrink film is placed on the unit load, and with heating equipment, the bags will shrink around the unit load. (Leonard 1996, p. 223)

Stretch band and slip-sheet

Stretch band and slip-sheet differs from the previous methods distinctively with its material and inability to be handled with fork trucks. In a stretch band and slip-sheet method the shrink film is rolled so that only enough film is used to get around the unit load.

The wooden pallet is replaced with a heavy sheet of kraft board; slip-sheets are made from three plies of kraft. Polyethylene-lined board and hard-sized board can be used for wet / damp conditions. (Yam 2009, p. 176) The slip-sheet has a lip a couple of inches wide sticking out from two sides next to each other. The slip-sheets are moved with modified push-pull or pull-pack trucks. (Leonard 1996, p. 223)

Slip-sheets are easy to use and require minimal warehouse space, and they are low cost as well: less than ten percent of a new wooden pallet. (Yam 2009, p. 176; Leonard 1996, p. 223)

The four described methods for film-stabilized unit loads are presented in figure 6.

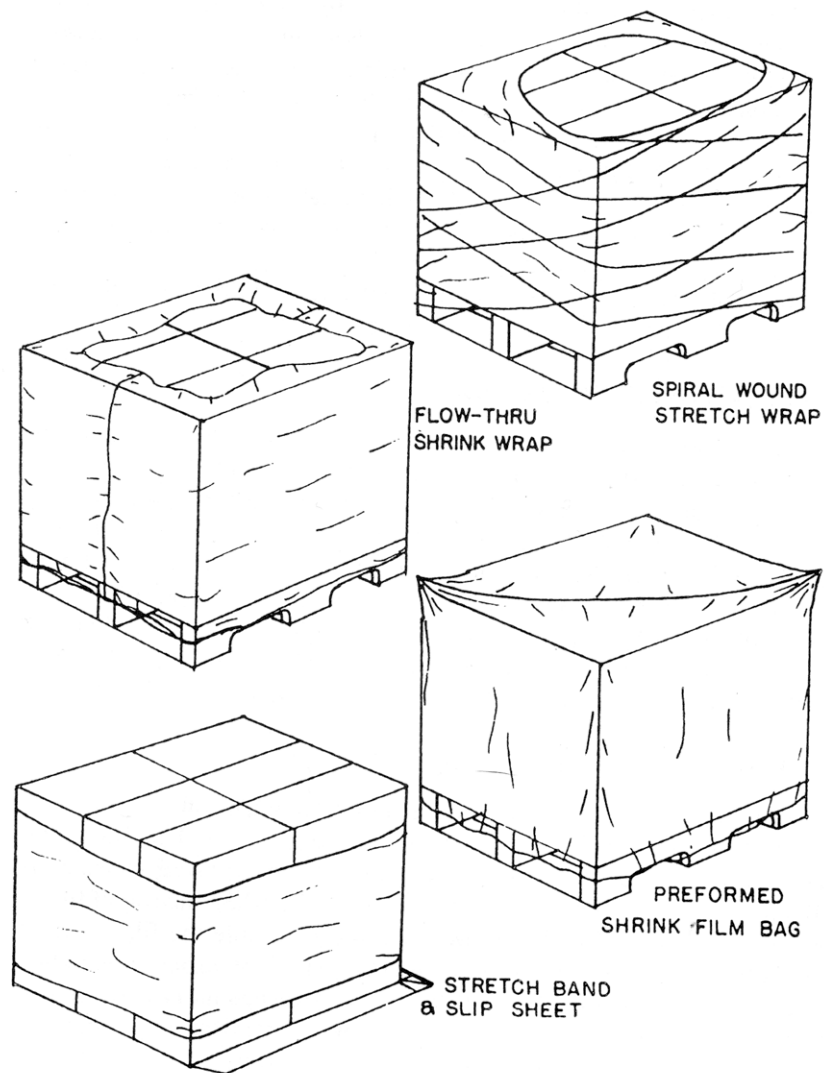


Figure 6. Film-stabilized unit loads. (Leonard 1996, p. 222).

1.2.4 Straps

Strapping is used for closing and securing the unit load. The straps can be metallic or made of polypropylene, polyamide, polyester, PET and copolymers. Strapping with steel straps is used for strapping heavy unit loads. Steel straps have a tensile strength average from 550 MPa to 980 MPa, with cold rolled medium carbon steel strapping having the highest average tensile strength. The crucial values of different plastic strapping materials are tensile strength, break strength, working range, elongation percentage at break, elongation recovery percentage and retained tension percentage. Plastic strapping materials usually lose their tension when used

in straps, especially when polypropylene is used. (Ramsland et al. 1993, p. 126–127)

1.2.5 Labels

The purpose of labels and markings is to give information about the contents of the unit load and logistical information. Labels can be categorized based on their manufacturing, as there are glue-applied labels, self-adhesive labels and heat sealable labels available. (Ramsland et al. 1993, p. 92)

Self-adhesive labels are often used for labeling secondary packages and unit loads. The labels can be applied to the package manually or by machine and various equipment: even high-speed automated machines are available. Crucial factors to consider when choosing self-adhesive labels are the package surface where the label will be attached to and the grain direction of the paper label, as well as the size of the label, since a label too small will not necessarily stick properly due to a relatively small surface area. The labels commonly consist of papers, plastics – usually polyester and PET – and different adhesives and release papers, which are silicone coated as this prevents the adhesive from sticking to the release paper. Storage conditions, such as humidity, time and temperature with its changes have important role when the shelf life of labels is concerned. (Ramsland & Selin 1993, p. 92–93)

An example of a self-adhesive pallet label used by the Fiskars Hämeenlinna distribution center can be seen in figure 7. The pallet label is printed for a unit load from the then current ERP system.



Figure 7. A pallet label example. (Vesterinen 2012)

1.2.6 Case: The Fiskars Hämeenlinna distribution center

Fiskars established a Nordic distribution center in Hämeenlinna, Finland in the year 2011. The distribution center handles Fiskars Home products and runs a small wrapping department. The distribution center has three main areas: receiving area, the storage area, and the shipping area and it operates with a FIFO principle (First In First Out). An ERP system from Pluto Technologies was used as the warehouse management system, but an SAP ERP system is due to be taken into operation during 2013. (Soininen 2012)

The distribution center layout is based on a U flow design, where the goods are received and dispatched at the same side of a warehouse building (Ritvanen et al. 2011, p. 85). With a U flow design, products can be placed within a short distance since there are several main corridors and the space available in the distribution center can be successfully utilized as goods are loaded in layers. According to Ritvanen et al. (2011, p. 86) loading in layers can cause difficulties in monitoring

and controlling the stream of goods and the bearing capacity of the pillars has to be carefully considered. The turnover time in the Hämeenlinna DC is from two months to two years (Heinilä 2012)

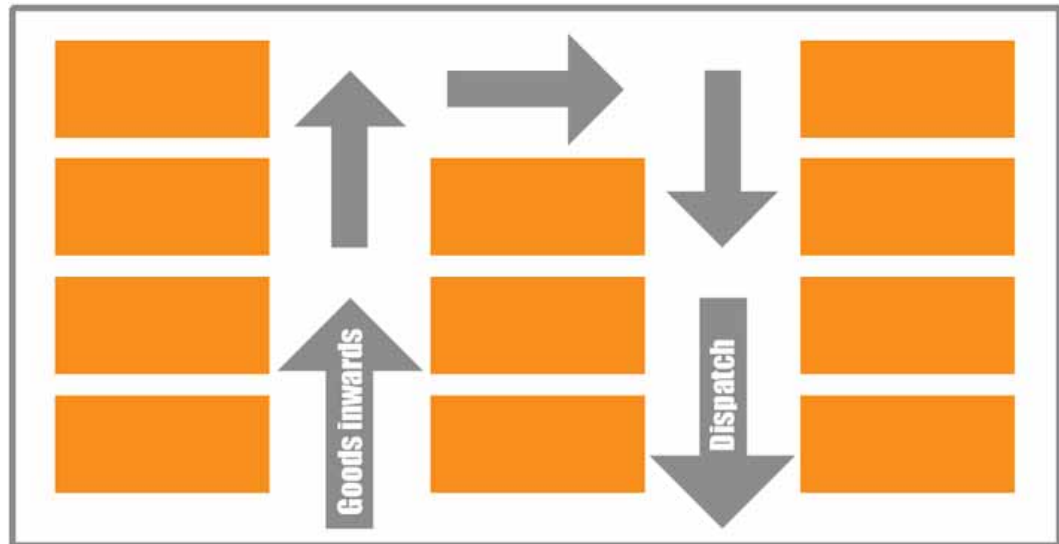


Figure 8. A demonstrative floor plan of a U flow design in a warehouse. (Based on Ritvanen et al. 2011, p. 86)

The quality control is set to occur in the receiving area. Fiskars obeys the Acceptable Quality Limit (AQL), where the AQL is defined to be four percent; products are considered acceptable if the worst tolerable packages are found to be equal to or below four percent of the order quantity (Anjoran 2011). The AQL definitions are decided in the quality department, with the purchasing department deciding the properties measured. At the time of the interview in May 2012, standard measures for the received packages or loaded pallets were not demanded, nor were pallet tilting tests taken (Soininen 2012). According to Heinilä (2012), quality inspections take time, which is not reserved in the ‘time budget’, and more time for developing the distribution center operations is required.

An AQL inspection standard sheet for glass used in the Hämeenlinna distribution center is presented in figure 9. Delivery control sheets for ceramics and glass as well as a cutlery quality control sheet and a cookware quality control sheet are presented in appendixes 9–12. Another inspection standard used for ceramics can be seen in appendix 13.

INSPECTION STANDARD (AQL. LEVEL = 4%)										
BATCH SIZE	SAMPLING	Reduced			Normal			Tightened		
		Samp.	Ac.	Re.	Samp.	Ac.	Re.	Samp.	Ac.	Re.
51-90	1 ^{st.}	3	0	2	8	0	2	13	0	2
	2 ^{nd.}	3	0	2	8	1	2	13	1	2
91-150	1 ^{st.}	5	0	3	13	0	3	13	0	2
	2 ^{nd.}	5	0	4	13	3	4	13	1	2
151-280	1 ^{st.}	8	0	4	20	1	4	20	0	3
	2 ^{nd.}	8	1	5	20	4	5	20	3	4
281-500	1 ^{st.}	13	0	4	32	2	5	32	1	4
	2 ^{nd.}	13	3	6	32	6	7	32	4	5
501-1,200	1 ^{st.}	20	1	5	50	3	7	50	2	5
	2 ^{nd.}	20	4	7	50	8	9	50	6	7
1,201-3,200	1 ^{st.}	32	2	7	80	5	9	80	3	7
	2 ^{nd.}	32	6	9	80	12	13	80	11	12
3,201-10,000	1 ^{st.}	50	3	8	125	7	11	125	6	10
	2 ^{nd.}	50	8	12	125	18	19	125	15	16
10,001 -	1 ^{st.}	80	5	10	200	11	16	200	9	14
	2 ^{nd.}	80	12	16	200	26	27	200	23	24

	Code	NAME	(Finnish)
G1	101	Bubbles, blisters	Rakko
	102	Surface bubbles	Pintarakko
G2	201	Greyiness	Harmaus
G3	301	Broken, cracks	Rikki, prökkä
	302	Scratches	Naarmu
G4	401	Tension	Jännite
G5	501	Wrong colour, wrong shade	Väärä väri
	502	Stones	Kivi
	503	Lines (coldlines, hotlines, blowing lines), cor	Raita (kuuma-, kylmä-, puhallus), ramppi
	504	Shear marks	Saksenjälki
	505	Marks (oil-, burn-, firing mark)	Jälki (öljy, liekitys)
G6	601	Dirt	Lika
	602	Transport, packaging faults	Kuljetus, pakkaus
G7	701	Shape not according to drawing	Väärä muoto, vino
	702	Tolerance out-of-specification	Yli toleranssien
	703	Oval shapes	Ovaali
	704	Pattern not according to drawing	Väärä kuvio, puuttuva kuvio
	705	Seam lines visible, sharp lines	Sauma, terävä reuna
	706	Rocking	Keikkuminen
	707	Rim faults, rim cutting faults	Suurvirhe
	708	Mould marks	Muotinjalke
709	Laser marking, sandblasted logo	Laser logo, hiekkapuhalluslogo	

G1:Bubble G2:Grayness G3:Broken G4: Tension G5: Glass mass G6: Other product fault G7: Fault in shape

Figure 9. An AQL inspection standard sheet for glass. (Heinilä 2012)

The storage area consists of six-tiered shelves where stacked pallets are placed. They are collected with forklifts to and from the storage area. The six-tiered shelving system used in Hämeenlinna can be seen in figure 10. A turntable for spiral-wound stretch wrap is placed close to the shipping area.



Figure 10. The storage area of the Fiskars Hämeenlinna distribution center.

The goods in the storage area are positioned based on their weights; the heaviest items are not only placed on the bottom layer but also on the corridors nearest to the shipping area. The maximum height for the stacked pallet is 1200 millimeters and a 100-millimeter space below the pallets has to be left for the forks of the forklift truck. The width of one shelf is measured to fit four EUR-pallets. Figure 11 shows the area closest to shipping.



Figure 11. The view to the other end of U flow layout, shipping area, at the Fiskars Hämeenlinna distribution center.

1.3 Packaging waste management

Packages have an impact on the environment throughout their lifecycle. The impact can be observed as early as the manufacturing state of the package and after different states of use the package may end up recycled or as waste. (Ritvanen et al. 2011, p. 74) The sustainable position of paper and paperboard is that it should not be a polluter in manufacturing, use or disposal, and neither should it be a drain on irreplaceable resources. The benefit of paper and paperboard packaging as a protector is considered to outweigh the consumption of resources in manufacturing and use. According to Kirwan (2005, p. 53) it is extremely important that paper and paperboard-based packaging will meet the demands set for packaging in a way which minimalizes the environmental impact of manufacturing, use and disposal. The demands set take into account forestry, manufacturing of ingredients, printing, conversion, packaging, distribution, consumer use and ultimate disposal.

Kuusipalo (2008, p. 330) states that environmental effects are the factors, which should be already taken into account in designing packaging materials and packages. Furthermore, it should be invariably kept in mind that the production of contents, for example food, causes more harm to the environment and uses more energy than the packaging production.

A used package is not a considerable amount of total waste created, but it is remarkably visible. Packaging waste is created in many locations during its lifecycle: it results from households as well as from work places, distribution and commerce and this creates the challenge: small amounts of waste are created in several locations. (Kirwan 2005, p. 72)

The main principle of waste management is waste minimization, which can be achieved in paper-based packages by design, reducing the weight of the packaging material or changing the material specification (ibid). Also Ritvanen et al. (2011, p. 75) express that to minimize the environmental impact, the amount of packaging material should be limited to requisite and restricted materials and ingredients should be used within the set limits.

As mentioned in the chapter 2.2, Fiskars states that as a part of a responsible manufacturing strategy, their principle is to use materials that are re-usable, recyclable or recoverable as energy or through composting. Kirwan (2005, p. 72–73; 77–78) presents recovery, recycling and landfill as waste management options. Recovery can be attained by waste assortment at homes, central collecting points, sorting facilities and plants since paper and paperboard are recyclable, combustible and biodegradable. Recycling is presented as composting or reprocessing, in which material is processed from one purpose to another and landfill is considered to be the least environmentally friendly option due to waste of land, contamination and methane release.

The environmental issues of packaging waste have a high visibility due to governments, commercial factors, and consumers and consumer groups, according to Kirwan (2005, p. 160). Governments especially in North America and Western Europe have banned certain packaging types and have set recycling rates. Commercial factors are arising from companies dealing with expectations from customers and governments and their own responsibility politics. Consumers and consumer groups are environmentally conscious buyers interested in environmental credentials.

1.3.1 Packaging recovery and recycling in EMEA region

Packaging Recovery Organisation Europe, PRO EUROPE as short, is the parent organization for European packaging and packaging waste recovery and recycling schemes. The organization uses the Green Dot trademark as a financing symbol, which indicates Producer Responsibility. The Green Dot sign in packages stands for the fact that a financial share has been paid to a qualified national recovery organization, which is set up in accordance with the principles defined in The European Packaging and Packaging waste directive (94/62/EC) on packaging and packaging waste and the respective national laws.

There are 31 member organizations active in 31 countries and 28 packaging recovery organizations in 28 countries using the Green Dot as their symbol. In addi-

tion approximately 170 000 companies have licensees to Green Dot and about 460 billion packaging items are labeled yearly with the Green Dot sign. PRO EUROPE is also in a co-operation with similar systems in UK's VALPAK and Canada's Stewardedge. VALPAK and Stewardedge are taking care of the Green Dot in UK and the NAFTA (North American Free Trade Agreement) region to ensure that all licensees of the Green Dot may use labeled packaging without problems throughout the world. (Overview). The Green Dot symbol can be seen in figure 12.



Figure 12. A Green Dot symbol. (Duales System Deutschland 2013)

In Finland, The Environmental Register of Packaging, PYR, is a non-profit company working in co-operation with producer organizations (General information). The country is using 2,2 million tons of packages annually. Over 95 percent of the packages are recycled or recovered and only five percent ends up in the landfill. Despite the sparse population in Finland, the rate of recycling packaging waste in 2010 was 55 percent, with the rate recovery of packaging waste being 85 percent. The recovery rate includes the energy use. The minimum limits set by the European Union for recycling of packaging waste were 55 percent and 60 percent for the recovery. (PYR 2012)

In Finland, producer responsibility “obliges producers to organize the reuse, recovery or suitable treatment or disposal of their products and the wastes derived from them, and to cover the related cost”. The responsibility covers for example printing paper and the use of paper for manufacturing other paper products and packaging. The term producer refers to manufacturers and importers of the products. With regards to packaging, the packagers and the importers of packaged products are within the definition of manufacturer. The aim of the producer re-

sponsibility is to encourage the manufacturers and importers to contemplate the life cycle of their products. (Ympäristö 2013). As for the United States, there is no producer responsibility legislation for packaging (Waste and Recycling in the United States).

Packaging and Packaging waste directive

The European Packaging and Packaging waste directive (94/62/EC) covers all packaging placed on the European market and all packaging waste, no matter if it is used or released at, for example, industrial, commercial, household or any other level, regardless of the material used. The directive regulates measures which are aimed at limiting the production of packaging waste. The directive also promotes recycling, re-use and other forms of recovering waste. The directive also states that final disposal should be considered as a last option. (European Union 2011). The directive provides guidelines on the return, collection and recovery systems, marking systems and identification systems (Kuusipalo 2008, p. 331).

2 METHODS

The purpose of the guideline was to standardize the used transportation packaging materials, their sizes, material markings, labels, logistics and testing methods throughout the Fiskars Home and Garden BAs in order to ease and fasten the package handling. These procedures were also expected to improve risk management throughout the supply chain. The packaging guideline concerns non-food contact packages and packaging materials.

The main target groups for the general packaging guideline were Fiskars' suppliers and buyers, especially those located in Shanghai and Bangkok. The company's supply chain includes their own manufacturing, sourcing, logistics and distribution.

The form of the packaging guideline was designed to be an easy-to-use and read guide with clear and logical step-by-step instructions. As the guide was meant to be a consistent tool in everyday use, a compact and easy-to-update form was required. The compiled guideline was designed to be updated twice a year or more often, if needed.

2.1 Implementation of the packaging guideline project

The packaging guideline project was built around a project group consisting of experts from different fields of the Fiskars group. The expertise of the group covered the fields of legislation, logistics, package design, product design, sourcing, quality and a student project coordinator to take care of the document version handling and putting together the material into one guideline document. Additionally, the coordinator needed to create training and launching materials for the guideline.

The partial and scattered information for the guideline was received from experts from their own fields, in order to be edited, assembled and completed into a logi-

cal printed and electrical form. In addition, tables, illustrations and images had to be created in case needed. The missing and required information for the guideline was found from external sources, such as databases, publications and websites. One way to gain knowledge on a given issue was benchmarking the practices of transport packaging.

The project group convened three times between spring and fall 2012 to analyze and review the subjects and content included in the guideline. If a subject or content was added or needed to be further defined, the schedule for those actions was set. The role of the project coordinator was to supply and edit the additional information needed. Within the given schedule the needed information was added to the present guideline version and the guideline was distributed to group members for feedback.

Interviews were conducted at the Hämeenlinna Fiskars distribution center in May 2012 and project group meetings were held at Fiskars headquarters in Helsinki between March – June 2012.

3 RESULTS

The reason for creating the general packaging guideline was to provide a user-friendly, clear and comprehensive guide to Fiskars' products development, operations and external vendors. The assembled guideline was designed to be applicable to all Fiskars products. External vendors of Fiskars products, components, raw materials and packaging materials are assumed to ensure that their suppliers of materials are aware of the demands set in the guideline and that they comply with them.

The guideline was outlined into eight sections. The sections were

- Legal requirements
- Restricted materials and substances
- Preferred materials and material markings
- Other markings
- Labeling of retail and master boxes
- Logistics information and DC requirements
- Physical testing guidelines
- Inspection checklist.

The guideline was designed to be published as an online version on the Fiskars Intranet website, where the latest updated version can be found. The eight sections will be presented in the following chapters.

3.1 Legal requirements

The first part, the legal requirements concerning packaging, was composed of the directives and national legal requirements for packaging materials. The legal requirements needed to be taken into account were the EU directive on Packaging and packaging waste, the EU decision of Identification of the packaging material, ISPM 15, REACH regulation, U.S. California Proposition 65, Chemicals used in

manufacturing, Regulation on wood origin, Green Dot/Grüne Punkt and Special requirements for Packaging and Clause on shipments to US or Australia and New Zealand.

The core content of each mentioned directive and regulation was presented as a guiding principle for the users of the packaging guideline in order to clarify the main laws that the Fiskars packaging requirements are based on. In cases of conflicting demand between guidelines and legal requirements, the strictest one was set to apply.

For example, special requirements for Packaging and Clause on shipments to US or Australia and New Zealand were defined to include the requirements on naming and marking of the country of origin, precautionary actions, ISPM 15 treatment, description of the goods and their origin, quantity markings, warranty / guaranty markings and FSC certification.

3.2 Restricted materials and substances

In the second section, certain materials were set to be restricted and hence should not intentionally be present in any of Fiskars packaging materials, e.g. in cardboard, blister, pallet, filling material, printed labels, glue, tape, etc. For example, the limitation that the combined content of Lead (Pb), Cadmium (Cd), Mercury (Hg) and Hexavalent Chromium (Cr(VI)), must not exceed 100 ppm (parts per million) is based on a European Union directive.

Limit values for Heavy Metals in packaging materials were set according to US and Fiskars' internal requirements. A requirement was set that the documentation for compliance must be based on an accredited testing method of the components in packaging materials. A claim was also added that Fiskars, authorities and other bodies have the right to test Fiskars products and if restricted materials and substances were detected, the supplier would be liable to compensate for testing costs and other harm caused. The list of restricted materials placed in the guideline is shown in table 1.

Table 1: Materials not to be intentionally present in the packaging materials.

Hazardous material	CAS #	Packaging type	Fiskars policy	Legislative reference	Testing method
Heavy metals Cadmium Lead Mercury Hexavalent chromium, Cr (VI)	7440-43-9 7439-92-1 7439-97-6 18540-29-9	Paper, paperboard, cardboard, plastic components and coated paper	Intentional introduction of any amount of lead, mercury, cadmium or hexavalent chromium in any packaging is prohibited. Unintentional presence of these materials is limited to 100 ppm (mg/kg) total concentration of cadmium, lead, mercury, and hexavalent chromium in any packaging.	USA: Toxics in packaging act ¹ , Currently enforced Finland: VNp nro 962/1997 ² . EU: Directive 94/62/EC and its amendments ³ .	ASTM test methods, the U.S. EPA Office of Solid Waste and Emergency Response publication, Test Methods for Evaluating Solid Waste (SW 846), or any similar method accurate at level 100 ppm.
Polyvinyl chloride (PVC)	9002-86-2	All packaging	Not allowed due to Hazardous Decomposition Products (HCl) and risks in manufacturing.	Customer requirement ^{4 5}	
CFCs (chlorofluoro carbons) and HCFCs (hydro-chlorofluorocarbons)	N/A	Plastic foam	Not allowed due to ozone depleting properties. CFCs and HCFCs are not allowed to use. Not allowed to be used in any plastic foam.		
Flame retardants penta-BDE, octa-BDE or deca-BDE; other halogenated flame retardants	32534-81-9 32536-52-0 1163-19-5 etc...	Plastics	Not allowed	EU: Directive 2003/11/EC ⁶	

¹ http://www.toxicsinpackaging.org/model_legislation.html

² <http://www.finlex.fi/en/laki/kaannokset/1997/19970962>

³ http://ec.europa.eu/environment/waste/packaging_index.htm

⁴ <http://www.ica.no/FrontServlet>

⁵ <http://www.rimibaltic.com/>

⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0011:EN:HTML>

Hazardous material	CAS #	Packaging type	Fiskars policy	Legislative reference	Testing method
Triclosan (antimicrobial agent)	3380-34-5	Active silica bags	Not allowed. Please ensure that moisture-removing substances do not contain triclosan.	Customer requirement ⁷	
Butylhydroxytoluene (BHT)	97123-41-6	All polybags	TO BE CONFIRMED		ASTM D4275 - 09
Vinyl acetate	85306-26-9	Adhesives and tapes	TO BE CONFIRMED		ASTM D2190 - 07
Wooden packing materials without fumigation	N/A		<p>Suppliers outside EU are not allowed to import goods to EU or Norway on any wooden packaging material (i.e. pallets, boxes, frames, supporting and base wood etc.) if the pallets are not made of debarked wood and fumigated/heat-treated and marked as stated in ISPM 15 standard.</p> <p>This concerns also shipments sent from US to EU and from Portugal to other EU countries.</p> <p>This does not concern shipments to/from EU to Switzerland.</p> <p>These requirements do not ap-</p>	<p>Evira⁸</p> <p>IPPC⁹</p> <p>EC¹⁰</p> <p>Currently enforced.</p>	

⁷ <http://www.ica.no/FrontServlet>

⁸ http://www.evira.fi/portal/en/plants/import_and_export/wooden_packaging_material/import_from_non-eu_countries/

⁹ https://www.ippc.int/file_uploaded/1323945454_ISPM_15_2009_En_2011-11-29_Refor.pdf

¹⁰ 2005/15/EC http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=32005L0015&model=guichett

Hazardous material	CAS #	Packaging type	Fiskars policy	Legislative reference	Testing method
			ply to wood of 6 mm thickness or less, wood packaging material made entirely from processed wood produced using glue, heat and pressure, such as plywood, oriented strand board and veneer or wood packaging material used in intra-Community trade.		
Other SVHC (Substances of Very High Concern)	Several		Contamination limit value: 0,1 % of weight	Echa Europe ¹¹ <ul style="list-style-type: none"> • Authorization list (Annex XIV of REACH) • Candidate list • Registry of intensions • Priority of substances • Restrictions (Annex XVII of REACH) 	

Other plastics and combination materials often used in products, should be avoided in packaging

ABS (Acrylbutadienestyrene), PMMA (Polymethyl methacrylate), PE (Polyethylene), PTFE (Polytetrafluoroethylene), PC (Polycarbonate)

Note! If a package is part of a product, the material can be used.

¹¹ <http://echa.europa.eu/web/guest/candidate-list-table>

3.3 Preferred materials and material markings

The third section covers the guidelines of preferred materials and markings. The object of the section was to clarify the Fiskars support on sustainable design and their general rule to use single materials or materials that are easy to separate and recycle with help of using recycling markings in their materials.

The section also describes how the detailed material specification is defined during the NPD process and how it is based on design requirements and packaging needs. Special materials were allowed to be used if required by packaging solutions, but it was stated that the NPD packaging design process is needed to verify special materials. Materials mentioned outside the table must be further approved for use in the NPD process, with further testing and verifying done during NPD.

Preferred materials were outlined to

- Natural fibers
 - Corrugated board, carton / paperboard, paper and paper pulp, recycled paper
- Other natural wood-based products
 - Acetate
- Polymers
 - PET, PE-HD, PE-LD, PP, PS, Other, Bio plastics
 - EPE, EPP, EPS, and EPU allowed in foams
- Metals
 - Aluminum, steel
- Wood
 - Oak, ash, beech, birch, rubber wood, maple.

Markings of the preferred materials, which were included in the guideline, are based on the universal recycling symbol, as shown in figure 13.



Figure 13. From left to right: recycling symbols to corrugated board, PET and bioplastics. (Recycling codes 2013)

It was deemed that wood used in pallets had to be made of debarked wood and fumigated / heat-treated and marked as stated in ISPM 15 standard if pallets are either exported from EU or imported to EU area, including import from Portugal to EU area.

In addition, a table for corrugated board and its strength and visual quality requirements is included in this chapter. Table 2 indicates the requirements for corrugated board technical specifications.

Table 2. Requirements for corrugated board technical specifications.

Corrugated board	Thickness ISO 3034/mm	Bending stiffness, ISO 5628 /Nm	ECT* ISO 3037 / kN/M	BST* ISO 2759 / kPa	FCT* ISO 3035 / kPa	Brightness ISO 2470-1/ % min
N/G flute	App. 0.8		Critical 1.8 Target 2.0	500 Target 600	450 Target xx	80
F flute	App. 1.1		Critical 2.0 Target 4.0			80
E flute	App. 1.7	Min. 0.65 Target 0.9	Critical 4.0 Target 6.0	Min 600 Target 1000	Min 450 Target 500	80
B flute	App. 3	Min. 2.5 Target 3.0	Critical 4.0 Target 7.0	Min 600 Target 1000	Min 280 Target 380	80 or brown
C flute	App. 4	Min. 5.0 Target 6.0	Critical 5.0 Target 9.0	Min 700 Target 1000	-	80 or brown
BC flute, double wall	App. 7	Min. 16.0 Target 20	Min 7.5	Min 1000	-	80 or brown

3.4 Other markings

Other markings concerning Fiskars packages were material markings required in consumer packages and in transportation packages and other common handling marks in retail or transportation packages for fragile products. In addition, other common material markings used in packages, such as waste markings, product markings, warnings, as well as patents were included in the fourth section of the guideline.




Material marking of consumer packages

The material markings of the consumer packages were considered necessary on identifying all single and multilayer plastic packaging materials used for consumer and service packages. The plain number inside the triangle (01–09) as partly shown in figure 13 indicates the type of the plastic used. These standards were not set to concern tapes or strapping. It was decided that if the volume of the consumer package is less than 0.125 m³ or weight less than 25 grams, no marking is required. Each part of the consumer package that consists of plastic materials must have one symbol and the minimum size of a black printed marking was set between 10 and 17 millimeters.

Material marking in transportation packages

Handling symbols were included in the required other markings to guide on how the transportation packages should be treated during the whole logistics chain. The symbols as well as handling information for package handling instructions are internationally standardized. It was decided that symbols shall be printed directly to the master cartons, but in case not printed, they should be added with labels or tapes. These symbols should be used when transporting fragile products, i.e. glass and ceramics. Table 3 shows the required symbols by Fiskars when transporting fragile products.

Table 3. Required symbols used when transporting fragile products.

Designation	Symbol	Explanation
Fragile, handle with care		The symbol should be applied to master cartons including easily broken products. Master cartons marked with this symbol should be handled carefully and should never be tipped or rolled over. ISO 7000 No. 0621
This way up		The package must always be transported, handled and stored so that the arrows always point upwards. Rolling, swinging, severe tipping or tumbling or other such handling must be avoided. ISO 7000 No. 0623.
Keep dry		Master cartons should be protected from excessive humidity and must accordingly be stored under a cover. If particularly large or bulky packages cannot be stored in DCs or sheds, they must be carefully covered with tarpaulins. ISO 7000 No. 0626.

As for placing the label with the above mentioned symbol, the following instruction was defined: if the master carton label is placed on the short side of the box, handling symbols can be printed on the long side of the box. Marking on both sides is required. The place for the symbols was set to be the top left corner on the long side of the box. For very small boxes, symbols should be printed on the long side as big as possible so that they are clearly visible. If printing the symbols should be an obstacle, tape with symbols was decided to be acceptable. The minimum symbol and most common symbol for marking with tapes is a fragile mark. Instruction on placing the handling symbol is shown in figure 14.

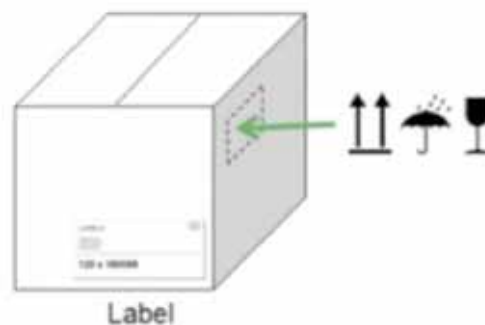


Figure 14. Instructions on placing the master carton label and handling symbols.

Other common markings used in packages

Other common material markings used in packages, such as waste markings, product markings, warnings and also patents were included in this section of the guideline. Fiskars recommends using the following marks in case required:

- Der Grüne punkt, (the Green Dot Mark) to show that Fiskars has paid the recycling fee
- WEEE mark as EU waste electric and electronic equipment directive sets requirements for marking of electronics appliances
- CE mark stating that the product was assessed before being placed on the market and meets EU safety, health and environmental protection requirements
- Food Contact Material to indicate materials and articles intended to come into contact with food
- Warning of suffocation on plastic bags. The warning states it is forbidden to use plastic film less than 38 microns thick and orders to use perforated bags wherever possible. Also it should be made sure that a statement “WARNING – risk of suffocation. Keep away from young children” is printed on the bag
- "Patent Pending" notification on the packaging. Fiskars states that it may only include the "Patent Pending" notification on the packaging if an application for a patent has actually been filed

3.5 Labeling of retail and master boxes

The fifth section of the guideline was limited to involve Fiskars products, which include the package and Fiskars Home retail box and master carton markings with illustrative examples and templates. The following instruction was comprised.

In case the product includes the packaging, the following information should be available:

- All single items: a clear barcode EAN13 marking on the packaging

- Batch-/PO number on product packaging for traceability purposes if there is no traceability marking on the product itself
- If VMI product batch number is replaced by supplier number and manufacturing date, the same batch-/PO number or supplier number and manufacturing date should show on the retail and master carton labels

3.5.1 Retail box

The retail box packaging should be supplied with a label that contains the following information:

- Company/Brand logo (e.g. Fiskars)
- Company address details
- Batch-/PO number and / or manufacturing date (as per the products). Date format: DDMMYYYY
- Supplier number
- Defined amount of products (Qty)
- Consumer item EAN13 number
- Consumer item product number
- Retail box EAN13/EAN14 number
- Product name / Description
- Barcode GS1-128, with application according to GS1 standard:
 - Product identification = EAN13 / EAN14
 - Batch number = 6 figures, normally PO number for traceability
 - Manufacturing date YY MM DD (used when no PO number is available)
 - Barcode scan ability: grade A–C
 - Barcode size: 49,4 millimeters x 16 millimeters (minimum)

The retail box label sample when the retail box is coded as EAN14 is seen in figure 15.

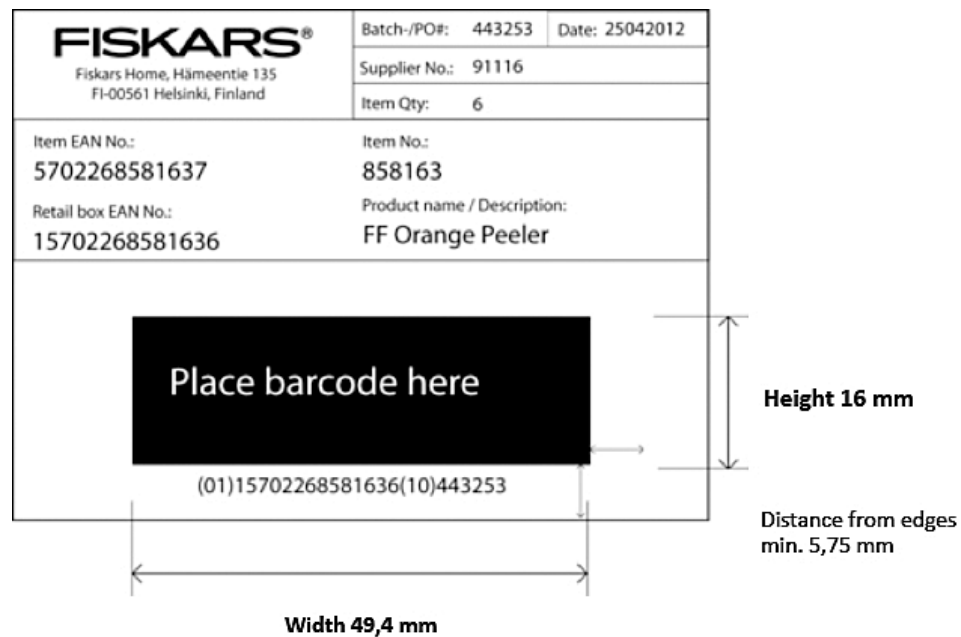


Figure 15. Fiskars Home retail box label sample when retail box EAN number is 14 characters long. Measure for barcode and its margins are additionally shown in the picture.

3.5.2 Master carton

The master carton should contain two labels, placed in the two top left corners so that they stay visible when loaded into pallets. The master carton-packaging label should contain the following information:

- Company/Brand logo (e.g. Fiskars)
- Company address details
- Batch-/PO number and / or manufacturing date (as per the products). Date format: DDMMYYYY
- Supplier number
- Defined amount of consumer items (Qty)
- Consumer item EAN13 number
- Consumer item product number
- Master carton EAN13/EAN14 number
- Product name/description

- Weight information; weight should not exceed 15 kg while the maximum weight is 25 kg
- Weight symbols accordingly 0–15 kg or 16–25 kg.
- Barcode GS1-128, with application according to GS1 standard:
 - Product identification = EAN13 / EAN14 (Master box EAN)
 - Batch number = 6 figures, normally PO number (traceability)
 - Barcode ITF-14 can be used for Garden products
 - Barcode scannability: grade A–C
 - Barcode size: min. 83 millimeters x 32 millimeters (width max 165 millimeters)

A figure showing the placing of master carton labels was also included in the guideline as shown in the figure 16.

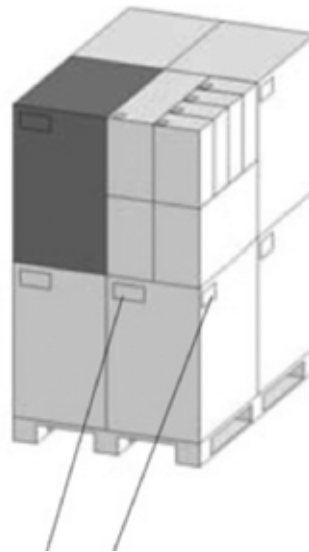


Figure 16. A clarifying figure of the master carton containing two labels, placed in the two top left corners.

A master carton label sample when master carton is coded as EAN 14 is presented in the figure 17. A retail box label sample when coded as EAN13, as well as a master carton label sample coded as EAN13 and a B-quality carton label template with a retail box label template and a master carton label template are presented in appendixes 1–5.


FISKARS® Fiskars Home Hämeentie 135, FI-00561 Helsinki, Finland		Batch-/PO#: 443253	Date: 25042012
		Supplier No.: 91116	
Item Qty: 48			
Item EAN No.: 5702268581637		Item No.: 858163	
Master carton EAN no.: 257002268581633		Product name / Description: FF Orange Peeler	
Weight: 3,5 kg		<div style="background-color: black; color: white; padding: 5px; text-align: center;">Place barcode here</div>	Height min. 32 mm Distance from edges min. 5,75 mm
		Width 83 mm (max 165 mm)	

Figure 17. The Fiskars Home master carton label coded as EAN 14 with measure and margins aids.

A separate model for B-quality master carton label was also defined as seen in figure 18. The Iittala logo can be replaced by a relevant brand logo.

iittala® Fiskars Home Hämeentie 135, FI-00561 Helsinki, Finland		Batch-/PO#: 11	Date: 25042012
		Supplier No.: 11	
Item Qty: 12			
Item EAN No.: 6411920003493		Item No.: 000349 B	
Product name / Description: Festivo candleholder 80mm			
Weight: 2,1 kg		<div style="background-color: black; color: white; padding: 5px; text-align: center;">Place barcode here</div>	Height min. 32 mm Distance from edges min. 5,75 mm
		Width 83 mm (max 165 mm)	

Figure 18. A master carton label for B-quality products.

3.6 Logistic information and DC requirements

The sixth section, logistic information and DC requirements were included in the guideline since easy handling of packages and speeding up DC operations was desired. The section includes information on packing lists, accepted pallet sizes, general requirements and treatments, loading, testing and marking of the unit load as well as loading the unit into a container.

In general, it was deemed that each shipment should include a packing list, which is required to include information regarding

- Vendor
- Weight / volume / number of packages and description
- PO number. If more than one PO is included in an inbound then the PO number per lane
- Item
- Description
- Quantity including quantity description (pieces etc.).

The information on the list should be marked in descending order based on EAN code or product number.

3.6.1 EUR and Sea Container Pallets

Fiskars states that palletized products sustain transport better and maintain better quality. It was stated in the guideline that the Material Area Manager decides if the product should be palletized or not, with permission for the use of any alternate pallets besides EURO pallets or Sea Container pallets being granted by the receiving DC manager, since it can lead to a safety risk in DC handling.

Detailed instructions on using EUR pallets were defined as follows:

- Used in land transportation in Europe
- Dimensions 1200 x 800 x 144 millimeters
- Unit load maximum height 1150 millimeters
- Thickness of the board minimum 18 millimeters

Detailed instructions on using Sea Container pallets to EMEA were defined as follows:

- Used in overseas transportations to Europe
- Dimensions 1150 x 780 x 144 millimeters or 1150 x 800 x 144 millimeters
- Unit load maximum height 1150 millimeters
- Thickness of board minimum 18 millimeters



In both cases Fiskars recommends the load to be distributed evenly.

In case products are to be shipped to US or Australia and New Zealand, following pallet dimensions should be used if palletizing is required:

- Pallet size in US is 48 x 40 inch = 1219 x 1016 mm
- Pallet size in Australia and New Zealand is 45,87 x 45,87 inch = 1165 x 1165 mm

It was also stated that wooden pallets should be in neat and clean condition, i.e. mold or sharp nails sticking up from the pallet are not allowed. The pallet needs to be a four-way pallet with support bars on the long side of the pallet and they shall be designed in such a manner that they can withstand the weight of another pallet. Permission to design pallets that are not stackable is granted by the Fiskars Group Logistics director. Such pallets must be marked with a 'Do not stack' marking. An example of stacking markings is seen in table 4.

Table 4. The stacking symbols concerning weight and stacking prohibition.

Designation	Global symbol	Explanation
Stacking weight limitation		<p>The maximum stacking load stated as X kg max. Since such marking is sensible only on packages with little loading capacity, cargo bearing this symbol should be stowed in the uppermost layer. ISO 7000 No. 0630</p> <p>If the weight is stated 0,00 kg, it means only transport on "upper layer" or "top layer" or "do not stack".</p>
Do not stack		<p>Stacking of the packages is not permitted and no loads should be placed on the package. ISO 7000 No. 2402.</p> <p>Please see chapter 6.3 instruction for non stackable pallets.</p>

Approximately 80 % of the pallet surface should be wood. Pallets do not need to be planed wood, but the boxes, packages and products must remain intact and in neat condition during transport. Pallets have to be treated and marked as stated in the ISPM 15 standard.

3.6.2 Loading the pallets

The requirements on loading the pallet were stated as follows: pallet material must be supportive enough for the pallet to not break during handling or transport. To give the unit load stability, a corrugated paper between some layers should be used. For protection purposes, a corrugated board should be placed on the top and bottom of the load and should be wrapped with transparent plastic film. In addition, underhang is to be avoided.

If it is necessary during loading, a thick corrugated cardboard as corner supports and / or plastic straps can be used. When using corner supports, they must be placed before plastic film wrapping. Everything shall be packed and stored in a designated area before Pre Shipment Inspection and the unit should not be

wrapped in plastic for easy access during PSI. After passing PSI the unit load is wrapped.

Regulations on handling two pallets together were chosen in such a manner that unit load height would not exceed 1150 millimeters. Attaching two pallets together with the same strap or film is forbidden and bending the pallet during lifting and storing is not allowed. Loads which are tilted, collapsed or tilted and stacked, will not be accepted since they cause risk of damaging the goods and a safety risk for the Fiskars DC staff. In order to prevent tilting, collapsing or tilting a stacked pallet, a corner support and a corrugated board between some layers was advised for use.

Handling of mixed units was considered to be very time consuming in Fiskars DC and therefore it was deemed that the number of mixed unit loads must be minimized. If the shipment includes close to a half a pallet of one item, the customer must load a separate pallet and not combine items with another item.

An illustrative figure of a tilted, collapsed and a tilted and stacked unit load included in the guideline can be seen in figure 19.

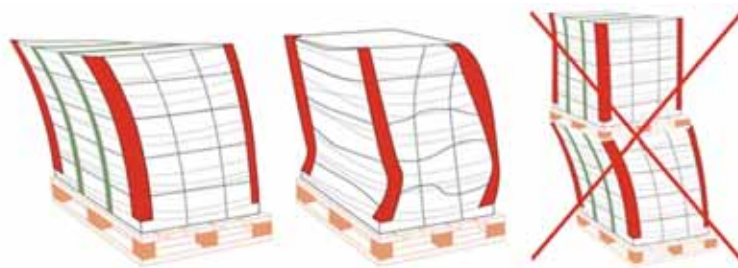


Figure 19. From left to right: Examples of a tilted unit load, collapsed unit load and a tilted and stacked unit load.

3.6.3 Testing the unit loads

Two testing methods were implemented for the guideline: a 10° test for unit loads without fixation and a 27° test for fixed unit loads. In a 10° test a loaded pallet has to stand a 10° tilting with a forklift from all four sides without any changes in the

unfixed load. This means a unit load has to stay complete without straps, corner support, wrapping or cardboard and products should not fall off.

A formula for calculating the minimum height (H) of the tilted angle to reach is the length of the unit load times 0,176. For example when unit length is 1200 mm

$$H = 1200 * 0,176 = 212 \text{ mm} \quad (1)$$

In a 27° test a loaded pallet has to stand a 27° tilting without any changes on the fixed load or products falling off. A unit is tilted to a 27° angle with a forklift from all four sides. The minimum height (H) of the tilted angle to reach is the length of the unit load times 0,5. For example when unit length is 1200 mm

$$H = 1200 * 0,5 = 600 \text{ mm} \quad (2)$$

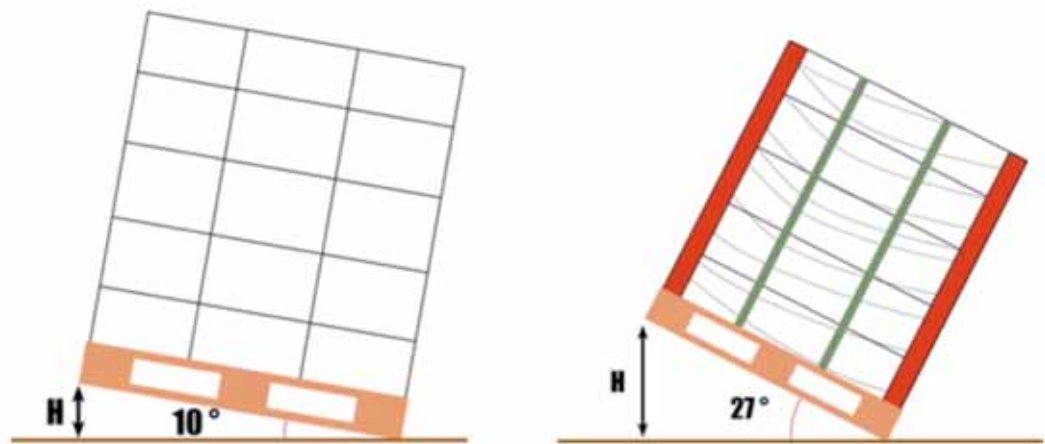


Figure 20. Two testing methods for loaded pallets, a 10° test on the left and a 27° test.

For testing the bearing capacity of the unit loads, the operator is asked to place three units on top of each other and see how the bottom one reacts. If the bottom load collapses or the boxes get damaged when the third unit is loaded on top of the other two, an operator is asked to re-stack the boxes or give the unit load more support by adding more corrugated cardboard.

3.6.4 Marking of the unit loads

Besides instructions on marking the retail and master cartons, marking instructions for the unit loads were also included. The type of marking depends on whether the pallet is loaded with mixed items or only one type of item. All loads must be provided with a label specifying the content and the label should be put on both short sides of the unit load. Marking on mixed unit loads was decided to contain the following information:

- Paper size A4 (297 mm x 210 millimeters)
- Pallet number (for example 24)
- Product numbers
- Number of pieces
- Ex factory date
- EAN number (article number in bold and bigger size)
- Quantity of each item (selling unit quantity)
- A or B quality.

A and B quality batches were instructed not to be mixed on the same pallet.

In the case that a pallet is to contain only one type of item, the marking should have to contain the following information:

- Paper size A4 (297 millimeters x 210 millimeters)
- Pallet number (for example 10)
- Ex factory date
- EAN number (article number in bold and larger size)
- Quantity of item (in bold and bigger size, selling unit quantity)
- A or B quality.

3.6.5 Loading into a container

Loading the unit load into a container involves instructions on placing the pallet in relation to other pallets and the risks of units collapsing and moving during transport. It was noted that using a wooden plank nailed to the end of the container minimizes the risk of the cargo moving and is highly recommended when the

container is not fully loaded. By making a cross of wood and placing it in the middle of the container the cargo is further secured from moving. In addition, it was stated that to minimize collapses the unit load on top should weigh less than the bottom unit. An illustrative image created and placed in the guideline is seen in figure 21.

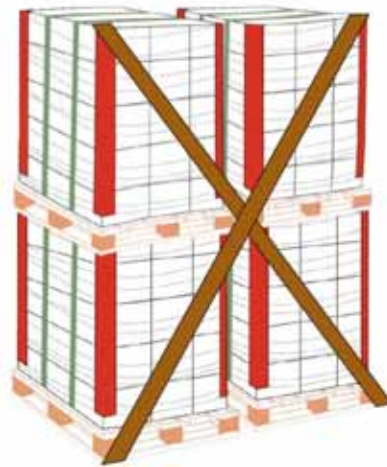


Figure 21. A cross of wood placed in the middle of a container to secure the unit loads from moving.

3.7 Physical testing guidelines

The seventh chapter, a guideline for testing, was created in order to define simple testing methods for transportation packages for Fiskars Home and Garden area products at a low cost. Covered areas included transportation from the manufacturing site to the Hämeenlinna distribution center. Further transportation and shipments were not included.

3.7.1 Continuous checking and performance evaluation

Testing guidelines were divided into continuous checking and performance evaluation. Continuous checking included the following test methods:

- Visual inspection
- Main dimensions inspection
- Labeling

- Bar code inspection.

The testing methods, standards, description, priority, responsibility and acceptance criteria of continuous checking are presented in appendix 6.

Performance evaluation included test methods as follows

- Atmospheric condition
- Drop tests
- Compression test for the package
- Transport vibration
- Transport vibration and repetitive shocks

The testing methods, standards, description, priority, responsibility and acceptance criteria of performance evaluation are presented in appendix 7.

Testing standards were added to the guidelines since testing results had to be compared to the set standards. Standards were defined as the company's standard product requirements (SPR), ISO/IEC standards, ISTA standards, product specific PSI standards, quality cards and packaging specifications.

3.7.2 Drop tests – retail and master boxes

The drop test was set to include ten free-fall drops for non-fragile and packed products. The dropped package should withstand the drops with each labeled corner, edge or flat starting from corner A in alphabetical order facing ground. If products are broken or move significantly in the transportation package, the test will be considered a failure. The package needs to be dropped in the test in the following, alphabetical order:

- A: The most fragile corner, carton manufacturer's joint
- B: Shorter edge radiating from corner A
- C: Medium edge radiating from corner A
- D: Longest edge radiating from corner A
- E: Flat on side of the smallest faces

- F: Flat on opposite small face
- G: Flat on one of the medium faces
- H: Flat on opposite medium face
- I: Flat on one of the largest faces
- J: Flat on opposite largest face.

The drop test phases and spots concerning the package in alphabetical order are seen in figure 22.

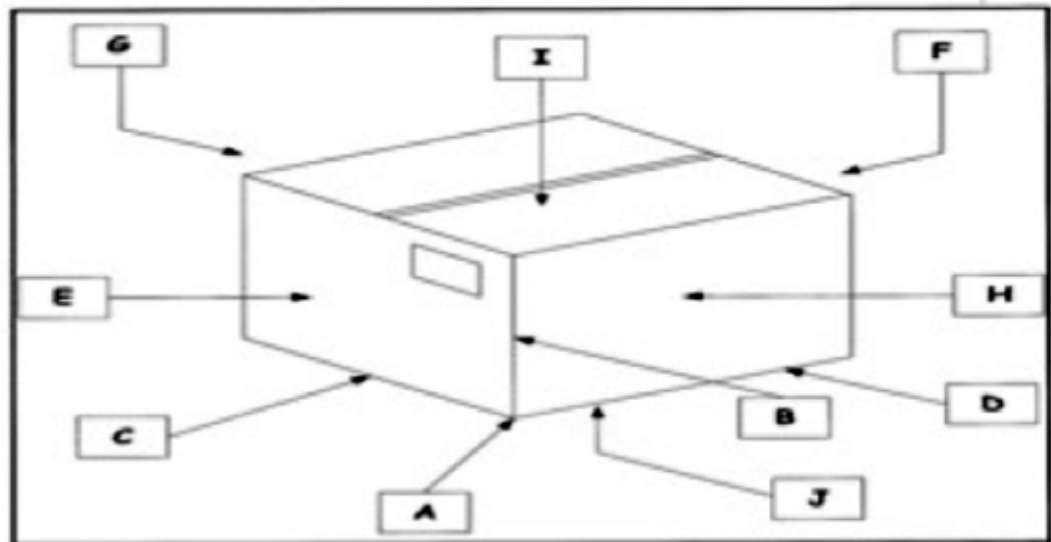


Figure 22. The drop test phases in alphabetical order.

The dropping height is dependent on the weight of the package. The required heights and weights for the retail and master boxes for the dropping tests are seen in table 5.

Table 5. Required weights and heights for the retail and master boxes in imperial and metric measures.

Imperial weight and height measures		Metric measures	
Package weight	Drop height	Package weight	Drop height
1-20 lb	30 inches	1-9 kg	76 cm
21-40 lb	24 inches	10-18 kg	61 cm
41-60 lb	18 inches	19-27 kg	46 cm
61-100 lb	12 inches	28-45 kg	30 cm
101-150 lb	8 inches	46-68 kg	20 cm

3.7.3 Condition and static compression test

As the packed product is desired to endure long transportation distances in different climate zones, the packed product will be conditioned to the climate conditions during transportation. Tropical climate conditions are: temperature $38^{\circ}\text{C} \pm 2^{\circ}\text{C}$, relative humidity $85\% \pm 5\%$ with the required time for testing being 72 hours minimum.

The static compression test is set to be performed after the conditioning test. In order to determine the static compression load with a formula, the following equation was created

$$L = W * \frac{(H-D)}{D} * F \quad (3)$$

In which W = weight of the transportation package in kilograms, (retail box or master box depending on package structure), H = 2400 millimeters (constant), D = Height of the transportation package in millimeters as outer dimensions and F=3 (constant).

In the test, a sample unit is subjected to the test load immediately after one hour of conditioning. Then a visual inspection of the sample unit is performed and an inspection of the contents of the sample unit is carried out. Whether the package will be accepted or rejected after the tests depends on if any products are damaged, if the sales carton or the inner part is crushed, and if the sales carton is visually damaged so that appearance is not acceptable for resale. Minor faults can still be accepted. The sample unit will be passed if all the sales packages packed in it are passed and if it still affords reasonable protection to the content and sufficient rigidity to assure stacking.

3.7.4 Random vibration test

With the random vibration test instructions, the effects of an overnight transportation by truck or airplane to a packaged product can be determined. In the test, a packaged product is subjected to random vibration inputs in vertical linear motion first in base-down orientation for 30 minutes, then in top-down orientation for 10 minutes and continuing side-to-side and front-to-back orientations for 10 minutes each. The same vibration spectrum is used for all tests.

A package fails the test if it at least one of the following criteria is met: any of the products is damaged, any of the products are loose in the package, internal fitting is damaged, internal fitting has created a lot of visually disturbing dust, or the sales carton is visually damaged in such a manner that the package's appearance is not acceptable for resale. Minor faults can be accepted, though. The sample unit will have passed if all the consumer packages packed in the unit are passed and if it has no great visible damage.

3.8 Inspection checklist

As the final chapter in the guideline, a compact table was created for inspection checklist purposes. An inspection procedure is introduced in the left column and acceptance criteria for the procedure in the right column as seen in table 6.

Table 6. An inspection checklist

Inspection	Acceptance criteria
Visual inspection	Package appearance and size has to match the specification. Clean, neat, dry, not stained, not broken or smashed, etc. Closed properly to protect product from dust, dirt or humidity.
Main dimensions inspection	Package size has to match the specification
Labeling	Labels need to comply to Fiskars requirements
Bar code inspection	Class A-C
Atmospheric condition	Package must still provide protection after the test
Drop test	Pass: No damage to the item and package still affords protection Fail: Package opens, the item is damaged
Compression test for the package	Package shall not collapse and the dimensions of the tested package shall not be considerably changed
Random vibration test	Sample unit will be passed if all the consumer packages packed in the unit are passed and if it has no great visible damage.

4 ANALYSIS AND DISCUSSION

The achieved results in this project were mainly based on packaging and transport industry standards, as the standards were considered to ease and speed up the packaging supply chain and minimize risks at Fiskars. The guideline was based on Fiskars' principles on responsible material handling during the full life cycle of a package.

The goal for the content of the guideline was to be thoroughly supportive of the company's principles on responsible manufacturing strategy and sustainability. When considering the project results relative to sustainability, outlining the material and substance requirements and recommendations for suppliers, product development, operations and external vendors was crucially important. The results support Fiskars' sustainability direction of running and expanding business in a sustainable manner, taking care of people and the environment. The results also make the sustainability policies more visible and concrete and they fulfill the legal demands set by local and global authorities.

When analyzing the results relative to logistics and distribution, significant improvements were aspired upon in palletizing, labeling and loading, as problems with above mentioned matters were recognized in the Hämeenlinna distribution center during interviews. An enquiry on experiences regarding the guideline or possible improvements gained after the publishing of the guideline was sent to distribution center, but no responses were received. The testing of the unit loads was introduced as a completely new work phase, which can be considered to be yet another key component in quality assurance.

The created packaging guideline was desired to be as compact as possible, so limitation and reasonable editing was needed. There were many issues which could have concerned primary packages, but would not have served the end-user in, for example, the distribution center in the best possible way. In addition, the Guidance for Printing Inks Used for Food Contact Materials was excluded even-

tually, since the transport or primary package is not designed to be in direct contact with food.

The number of pages was limited to approximately 40 pages. The amount of pages was considerably greater at first, as issues were presented more thoroughly, but not in a user-friendly way. Issues left out were e.g. basic functions of a package, requirements for carton technical specifications, CEN / CENELEC standards, information on recycling marks used in Japan, China and Korea and instructions on loading variable amount of units into different sized trucks in the most efficient way. Legislative texts were summarized and references to sources were provided.

In addition, the type of English used in the guideline was framed so that as little room for confusion was left as possible, i.e. the language used was simplified on some occasions. The limited amount of pages was justified as the guideline was meant to be used alongside every day processes at workplaces and not as a separate hidden document for upper management.

After completing the guideline project, it was launched with training materials. Whether a group-wide follow-up will be implemented on how the guideline is followed or received, will remain to be seen. No clause of consequences is included in the guideline in case the packaging guideline is not dutifully obeyed. Hence the actions in case of conflicts could be stated or mentioned as a reference in future updates of the guideline. In the future, more studies concerning improvements, benefits and disadvantages of the guideline or costs related to implementations of the guideline instructions could be carried out.

The challenge in compiling the packaging guideline is in the question: how to serve the end-user in a best possible way as the guideline was to be introduced as a general group-wide packaging guideline and the target group covered players from several different cultural and educational backgrounds? Based on the feedback received from the guideline project group, the guideline has gained positive feedback and it is considered to be useful in the future.

5 CONCLUSIONS

The objective of this Master's Thesis was to assemble a global transport packaging guideline for Home and Garden business areas of the Fiskars company. The function of the guideline was to ease and fasten the package supply chain management and improve risk management, as Fiskars did not have any previous packaging guideline available in order to help standardizing the materials, substances and procedures. The presented guideline concentrated on following factors concerning packages and transportation: legal requirements, restricted materials and substances, preferred materials, markings, labeling of boxes, logistic and DC requirements, physical testing and inspection checklist.

The guideline was compiled in the year 2012 and it offers written instructions, tables and illustrations for working with transport packages from sourcing to shipments. The aim of the created packaging guideline was to be a user-friendly, clear and comprehensive guide for suppliers, product development, operations and external vendors of the company. One purpose of the guideline was also to support and concretize the company's principles of sustainability and responsible manufacturing strategy in the field of the packaging supply chain.

The packaging guideline project was built around a project group consisting of experts from different fields of Fiskars and a student project coordinator. The role of the student coordinator was to take care of the document version handling, information sourcing and putting together the material into one guideline document. As for further studies, the guideline could be applied partly in case a guideline of primary packages or a visual packaging guideline was to be compiled.

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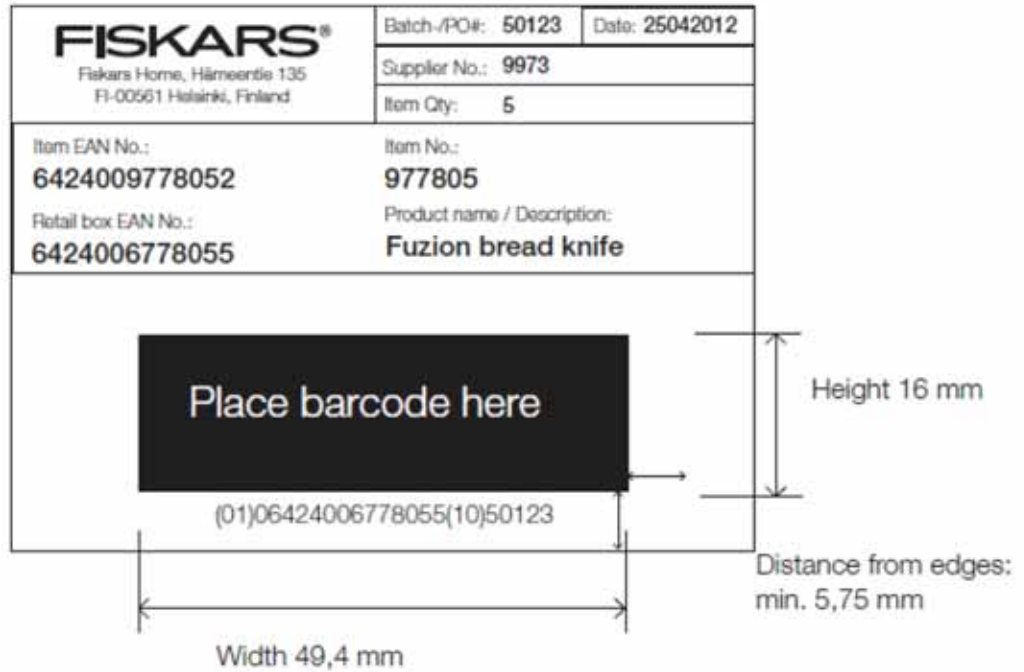
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Appendix 1: Retail box label sample – retail box coded as EAN13



Appendix 2: Master carton label sample – master carton coded as EAN13



Appendix 3: B-quality carton label template

 Fiskars Home Hämeentie 135, FI-00561 Helsinki, Finland	Batch-/PO#:	Date:
	Supplier No.:	
	Item Qty:	
Item EAN No.:	Item No.:	B
Product name / Description:		
Weight:	kg	

Appendix 4: Retail box label template

 Fiskars Home, Hämeentie 135 FI-00561 Helsinki, Finland	Batch-/PO#:	Date:
	Supplier No.:	
	Item Qty:	
Item EAN No.:	Item No.:	
Retail box EAN No.:	Product name / Description:	

Appendix 5: Master carton label template

FISKARS® Fiskars Home Hämeentie 135, FI-00561 Helsinki, Finland	Batch-/POF:	Date:
	Supplier No.:	
	Item Qty:	
Retail box EAN No.:	Item No.:	
Master carton EAN no.:	Product name / Description:	
Weight: kg		

Appendix 6: Continuous checking test type

Method	Standards	Description	Priority ¹	Responsibility ²	Acceptance criteria	Other
Visual inspection	<p>Garden: Fiskars Standard Product Requirements (SPR)</p> <p>Home: Product specific PSI-standard, quality card, packaging specification</p>	Initial inspection for the inner and outer parts of the transportation packages.	Mandatory	SO, DC	Package appearance and size has to match the specification. (Internal check list), clear, pure, non-stained etc.	
Main dimensions inspection	Package specific drawing + practical fitting test	Package measurements and weight to be checked	Mandatory	SO, DC	Package size has to match the specification (internal check list)	
Labeling	Fiskars Package Guideline, special instructions for fragile products in package drawing	All labels are checked visually	Mandatory	SO, DC	Labels need to comply Fiskars generic requirements	
Bar code inspection	ISO / IEC 15416	To ensure that a code is properly produced and will read throughout the supply chain, its quality must be graded by a barcode verifier /inspection instrument.	Mandatory	SO, DC	Class A-C	

Appendix 7: Performance evaluation checking test type

Method	Standards	Description	Priority ¹	Responsibility ²	Acceptance criteria	Other
Atmospheric condition	<p>Garden: Fiskars Standard Product Requirements (SPR)</p> <p>Home: Packaging guideline</p>	<p>1. Temperature + 23 C°</p> <p>2. Relative humidity 50 %</p> <p>3. Test duration 24h</p>	Mandatory	NPD	Package must still provide protection after the test	
Drop tests	<p>Garden: Fiskars Standard Product Requirements (SPR)</p> <p>Home: Packaging guideline</p> <p>Check ISTA standard</p>	<p>The test consists of a series of ten free-fall drops. The dropping height depends on packages weight. Required height for can be seen from the table 8. The package must be dropped once on each labeled corner, edge or flat starting from corner labeled as A.</p> <p>The test if failed if products are broken or dramatically moved inside the transportation package.</p> <p>See section 7.3</p>	Mandatory	NPD	<p>Pass: No damage to the item and package still affords protection</p> <p>Fail: Package opens, the item is damaged</p>	Separate instructions for fragile items
Compression test for package	ISO 2234	<p>1. Static load for the packages 30kg (= three stacked packages)</p> <p>2. Apply load and release</p> <p>3. Visual inspection after</p>	Mandatory	NPD	Package shall not collapse and the dimensions of the tested package shall not be considerably changed	

Method	Standards	Description	Priority ¹	Responsibility ²	Acceptance criteria	Other
		<p>testing</p> <p>Appropriate load for each package must be calculated</p> <p>See section 7.3</p>				
Random vibration test	Packaging Guideline	<p>Packaged product will be given random vibration inputs (vertical linear motion) first in the base-down (normal shipping) orientation for 30 minutes, then in the top-down orientation for 10 minutes and continuing in the side-to-side and front-to-back orientations for 10 minutes each.</p> <p>The same vibration spectrum is used for all tests.</p>	Mandatory	NPD	Sample unit will be passed if all the consumer packages packed in the unit are passed and if it has no greater visible damage.	

Appendix 8: Transport vibration test

Method	Standards	Description	Priority ¹	Responsibility ²	Acceptance criteria	Other
Transport vibration	ISO 13355	<ol style="list-style-type: none"> 1. Frequency range 3 ... 200 Hz 2. ASD-level 0,05 m²/s³ (0,0005 g²/Hz), 3 Hz 3. ASD-level 1,2 m²/s³ (0,012 g²/Hz), 6 ... 18 Hz 4. ASD-level 0,1 m²/s³ (0,001 g²/Hz), 40 Hz 5. ASD-level 0,05 m²/s³ (0,0005 g²/Hz), 200 Hz 6. Total spectral acceleration 0,59 grms 7. Test duration 60 minutes in each of the three test directions 8. Package clamped to the test table surface 9. Visual inspection after testing 	If requested	NPD	Package and context of the package must remain undamaged	Can be replaced with test delivery from supplier.
Transport vibration, repetitive shocks	ISO 13355	<ol style="list-style-type: none"> 1. Frequency range 3 ... 200 Hz 2. ASD-level 0,05 m²/s³ (0,0005 g²/Hz), 3 Hz 3. ASD-level 1,2 m²/s³ (0,012 g²/Hz), 6 ... 18 Hz 4. ASD-level 0,1 m²/s³ (0,001 g²/Hz), 40 Hz 5. ASD-level 0,05 m²/s³ (0,0005 g²/Hz), 200 Hz 6. Total spectral acceleration 0,59 grms 7. Test duration 30 minutes in vertical axis 8. Package unclamped to the test table 9. Visual inspection after testing 	If requested	NPD	Package and context of the package must remain undamaged	Can be replaced with test delivery from supplier.

1) Mandatory / optional / not applicable / if requested 2) NPD / FSO / DC / DC Supplies

Appendix 9: Delivery control sheet – ceramics



DELIVERY CONTROL CERAMICS

Supplier	<input type="text"/>	EX factory date	<input type="text"/>
Article	<input type="text"/>	Article number	<input type="text"/>
Order number	<input type="text"/>	Delivered quantity	<input type="text"/>
Accepted level of quality	<input type="text"/>	Invoice number	<input type="text"/>
Method	<input type="checkbox"/> Reduced <input type="checkbox"/> Normal <input type="checkbox"/> Inse	Container number	<input type="text"/>

Tot nr of carton	<input type="text"/>	CONTROL Sample size No of rejects Decision AC RE
Cartons packed	<input type="text"/> % packed	
If % packed is less than 95% consult Quality Manager		
First spot test	<input type="text"/>	<input type="text"/>
Second spot test	<input type="text"/>	<input type="text"/>

Follow up spot test after 100% inspection performed by supplier will be completed and reported separately by

Fiskars inspector 100 % Control

Supplier inspector

Reject items was replaced by overrun

RESULT A-GRADE B-GRADE REJECTS

General comments	Non conforming items found in spot test			
	Code	1:st spot test	2:nd spot test	Total

Picture(s) main defect (item or others)	Date	<input type="text"/>	APPROVED	<input type="text"/>	
	Signature	<input type="text"/>	REJECTED	<input type="text"/>	
	Dimention measurements		Diameter(s)		
	sample	Weight	Height	1	2
	1				
	2				
	3				
	4				
	5				
	Avg				
Min					
Target					
Max					

Labeling and general checkpoints

Correct:

- Barcode / label / spelling - item
- Barcode / label / spelling - innerbox
- Barcode / label / spelling - master
- Barcode / label / spelling - pallet
- Backstamp size / color
- Item sticker and placement
- Gift box

Y	N	N/A

If Avg value is out of specification consult Quality Manager

Stackability test reference sample	Pass	Fail	N/A

Color measurement for color glazes

	L	a	b	
Sample				Delta
Target				0,0

If delta value is out of specification consult Quality Manager

Appendix 10: Delivery control sheet – glass

FISKARS® DELIVERY CONTROL GLASS

Supplier EX factory date
 Article Article number
 Order number Delivered quantity
 Accepted level of quality Invoice number
 Method Reduced Normal Sense Container number

Tot nr of carton % packed
 Cartons packed
 If % packed is less than 95% consult Quality Manager

CONTROL	Sample size	No of rejects	Decision	
			AC	RE
First spot test				
Second spot test				

Follow up spot test after 100% inspection performed by supplier will be completed and reported separately by Fiskars inspector 100 % Control
 Supplier inspector

Reject items was replaced by overrun **RESULT** A-GRADE B-GRADE REJECTS

Non conforming items found in spot test

General comments	Code	1:st spot test	2:nd spot test	Total

Picture(s) main defect (item or others)

Date APPROVED
 Signature REJECTED

Dimention measurements			Diameter(s)	
sample	Weight	Height	1	2
1				
2				
3				
4				
5				
Avg				
Min				
Target				
Max				

Labeling and general check points

Correct:

Barcode / label / spelling - item Y N N/A

Barcode / label / spelling - innerbox

Barcode / label / spelling - master

Barcode / label / spelling - pallet

Item sticker and placement

Gift box

If Avg value is out of specification consult Quality Manager

Stackability test reference sample Pass Fail N/A

Appendix 11: Cutlery quality control sheet



This inspection is made in addition to suppliers normal production inspection. Following inspection can only be made by authorized person.

Supplier: _____ Product: _____
 Order number: _____ Product code: _____
 Batch size: _____ Controller: _____

A. CUTLERY

Code	Defect name	Defect quantity
1. SHAPE AND DIMENSIONS		
A1.1	main dimensions	
A1.2	shape	
A1.3	symmetry	
A1.4	shape pressing of handle	
A1.5	line of fork prongs	
2. SURFACE QUALITY		
A2.1	rust	
A2.2	orange peel effect	
A2.3	polish/satin finishing quality	
A2.4	scratches	
A2.5	crack	
A2.6	dents	
A2.7	pin holes	
A2.8	welding pin holes	
A2.9	sharpness of cutting edge	
A2.10	grinding og cutting edge	
3. LASER AND ETCHING		
A3.1	quality	
A3.2	position	
4. OTHER DEFECTS		
A4.1	construction of joint	
A4.2	appearance of joint	
A4.3	serration quality	
A4.4	hardness of knife blade	
A4.5	sharpness of cutting edge	
A4.6	other functionality	
A4.7	quality of plastic part	
A4.8	quality of wood part	
TOTAL		0

Order size	Sample size	Max. Defect quantity
2 - 50	5	0
51 - 150	13	1
151 - 280	20	3
281 - 500	32	4
501 - 1200	50	6
1201 - 3200	80	8
3201 - 10000	125	12
10001 - 35000	200	18
35001 -	315	26

1.st inspection

Ac	Re

If there are more than max. defect quantity, the whole batch needs to be inspected (100 % inspection).

Mark how many pieces from 100 % inspection are accepted and how many rejected.

Only accepted pieces can be shipped.

100 % inspection

Accepted (pcs) _____
 Rejected (pcs) _____

Other comments:

Date: _____

Signature: _____

Appendix 12: Cookware quality control sheet



This inspection is made in addition to suppliers normal production inspection. Following inspection can only be made by authorized person.

Supplier: _____ Product: _____
 Order number: _____ Product code: _____
 Batch size: _____ Controller: _____

B. COOKWARE

Code	Defect name	Defect quantity
1. SHAPE AND DIMENSIONS		
B1.1	main dimensions of body	
B1.2	main dimensions of lid	
B1.3	main dimensions of handles	
B1.4	dimensions of assembly	
B1.5	rim and bottom evenness	
B1.6	concavity of bottom	
B1.7	rim's rolling	
2. SURFACE QUALITY		
B2.1	rust	
B2.2	even surface	
B2.3	enamel's colour and evenness	
B2.4	quality of oiltreatment	
B2.5	quality of sandblasting	
B2.6	polishing/satin finishing	
B2.7	scratches	
B2.8	cracks	
B2.9	dents	
B2.10	pin holes	
B2.11	thorns	
B2.12	cleanliness	
3. STAMP, LITER SCALE		
B3.1	quality	
B3.2	position	
4. QUALITY OF JOINTS		
B4.1	screw fitness	
B4.2	handle fitness	
B4.3	lid's fitness to body	
B4.4	welding mark	
B4.5	attachement	
B4.6	constructions of joint	
TOTAL		0

Order size	Sample size	Max. Defect quantity
2 - 50	5	0
51 - 150	13	1
151 - 280	20	3
281 - 500	32	4
501 - 1200	50	6
1201 - 3200	80	8
3201 - 10000	125	12
10001 - 35000	200	18
35001 -	315	26

1.st inspection

Ac	Re

If there are more than max. defect quantity, the whole batch needs to be inspected (100 % inspection).

Mark how many pieces from 100 % inspection are accepted and how many rejected.

Only accepted pieces can be shipped.

100 % inspection

Accepted (pcs)	
Rejected (pcs)	

Other comments:

Date: _____
 Signature: _____

Appendix 13: Inspection standard sheet for ceramics

INSPECTION STANDARD (AQL. LEVEL = 4%)										
BATCH SIZE	SAMPLING	Reduced			Normal			Tightened		
		Samp.	Ac.	Re.	Samp.	Ac.	Re.	Samp.	Ac.	Re.
51-90	1 st.	3	0	2	8	0	2	13	0	2
	2 nd.	3	0	2	8	1	2	13	1	2
91-150	1 st.	5	0	3	13	0	3	13	0	2
	2 nd.	5	0	4	13	3	4	13	1	2
151-280	1 st.	8	0	4	20	1	4	20	0	3
	2 nd.	8	1	5	20	4	5	20	3	4
281-500	1 st.	13	0	4	32	2	5	32	1	4
	2 nd.	13	3	6	32	6	7	32	4	5
501-1,200	1 st.	20	1	5	50	3	7	50	2	5
	2 nd.	20	4	7	50	8	9	50	6	7
1,201-3,200	1 st.	32	2	7	80	5	9	80	3	7
	2 nd.	32	6	9	80	12	13	80	11	12
3,201-10,000	1 st.	50	3	8	125	7	11	125	6	10
	2 nd.	50	8	12	125	18	19	125	15	16
10,001 -	1 st.	80	5	10	200	11	16	200	9	14
	2 nd.	80	12	16	200	26	27	200	23	24

	Code	NAME	(Finnish)	(Swedish)
P1	101	Poor foot ring	Huono jalkarengas	Ojämn fotring
	102	Sponging defects	Pyyhintävirhe	Putsfel
	103	Bottom up	Ylös alaisin	Upphöjd botten
	104	Bottom down	Pohja pudonnut	Nedsjunken botten
	105	Rough edge	Terävä reuna	Skrovlig kant
	106	Warp	Vino us	Skevhet
	107	Lid does not fit	Epäsopiva kansi	Lock-passning
	108	Bad embossment	Kohokuviointi virheellinen	Dålig relief
	109	Dimension faults	Mittavirhe	Dimensionsfel
	110	Too heavy	Painava	För tung
	111	Too light	Kevyt	För lätt
	112	Misplaced/warped handle	Korvan paikka väärä/vino	Felplacerad/skev hänkel
	113	Casting/shaping marks	Valu/muovausjälki	Gjut/formedings märken
P2	201	Thin glaze	Ohut lasite	Tunn glasyr
	202	Thick glaze	Paksu lasite	Tjock glasyr
	203	No glaze	Hankautuma	Torrfläckar
	204	Glaze run	Lasite valuma	Glasyrvalk
	205	Glaze dimple	lasitekuoppa	Glasyrrop
	206	Glaze drop	lasitetippa	Glasyrdroppe
	207	Pinhole	Neulanreikä	Nålstygn
	208	Cluster of pinholes	Neulanreikä rykelmä	Grupp av nålstygn
	209	Pinholed glaze	Reikäinen lasite	Nålstygn, hela ytan
	210	Orange peel	Lasite hilsellee	Porer
	211	Too glossy	Liian kiiltävä	För blank
	212	Too matt	Liian matta	Dålig glans
	213	Bits	Massaraiske	Knotter
	214	Repair work	Uudelleen käsitelty	Reparationer
215	Color variations	Sävyvaihtelu	Flammig glasyryta (färgad)	
216	Wrong whiteness tone	Väärä valkoisuus sävy	Gulbränt	
217	Crystals/foggy surface	Kiteinen/samea pinta	Kristaller/disig yta	
P3	301	Black spot	Musta piste	Svarta prickar
	302	Contamination	Mure	Befall
	303	Contaminated clay	Massalikainen	Ören massa
P4	401	Decoration is missing	Koriste puuttuu	Dekor saknas
	402	Broken decal	Kuva rikki	Trasig dekal
	403	Misplaced	Koriste väärässä paikassa	Felplacerad dekal
	404	Decal blisters	Koristeessa rakkoja	Konking i dekal
	405	Blurry decal	Epäselvä kuva	Suddiga färger
	406	Miscoloured	Väärän värinen	Misfärgad
	407	Wide/thin/broken/smeared rim	Leveä/ohut/rikki epätasainen	Bred/smal/trasigt/kladdigt dekorrand
	408	Light	Vaalea	För ljus dekor
	409	Dark	Tumma	För mörk dekor
	410	Miscolored handle	Värivirhe elinkehä	Misfärgad hänkel
	411	Color stains	Väriä	Färgfläckar
412	Backstamp	Leimavirhe	Bottenstämpel	
413	Gold/platina faults	Kulta/platinvirhe	Guld/platina fel	
P5	501	Cracks	Halkeamia	Sprickor
P6	601	Scratched surface	Naarmuuntunut	Repor
	602	Transportation	Vahingoittunut kuljetukseen	Transportkada

P1: SHAPE P2: SURFACE P3: SPECKS P4: DECORATION/COLOR P5: CRACKS P6: SCRATCHES AND HANDLING