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Hand hole design principles and test methods for handheld packages

DTS stage

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Foreword

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This document was prepared by Technical Committee ISO/TC 122, *Packaging*, Subcommittee SC ~~2~~ 3 *Performance requirements and tests for means of packaging, packages and unit loads (as required by ISO/TC 122)*.

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

Introduction

The aging of distribution and logistics workers, the increase in female workers, and the rapid growth of e-commerce have all led to an increase in the frequency of package handling tasks and an increase in the intensity of workers' work processes. The product categories thatThe product categories that logistics workers handle manually are diverse, including various electrical and electronic products, household goods, food and beverage products, etc. One of the major ergonomic safety issues that arise is musculoskeletal disorders and spinal injuries caused by repetitive vertical movements, movements, and momentary loads.

According to Reference [11the 'Findings of the survey of musculoskeletal disorders among market workers' by the Institute for Occupational and Environmental Health in Koreas (2019),] most market staff are women in their 40s40's and 50s50's. They pick up and put down boxes on an average of 149 times a day, and 85.3 % of them suffer from musculoskeletal injuries such as pain in the shoulders, backs, and knees. The study concluded that even just by adding hand holes to boxes would reduce the load by 10 %.

Although hand holes in boxesHand hole is just one element that makes logistics and distribution activities more convenient and less dangerous to handlers, and cannot completely eliminate all risks of accidents that may occur during the logistics process. However, hand holes of a box may, they can enhance safety and efficiency in the entireby making logistics and distribution processactivities, including loading, unloading, warehousing, sorting, and transportation, and helpsmore convenient and less dangerous to handlers, thus helping to prevent workers from musculoskeletal disorders. Transport packaging designed appropriately for the size and/or weight of the product, the durability of the package material, etc., reduces the risk of workers using excessive lifting forces. Poor design maycan lead to product damage or worker injury.

This document provides hand hole design criteria and test methods for handheld packages to provide a safer working environment for workers who must lift or move boxes. This Some criteria and test methods in this document is written with reference to the test and evaluation method ofare based on ASTM D6804, andwith some modifications to the design requirements and test method are suggested with some modifications formethods to ensure the usability of this standarddocument.

Hand hole design principles and test methods for handheld packages

1 Scope

This document describes the ergonomic design criteria and test evaluation ~~method~~methods for the hand ~~hole~~holes of ~~a box for~~ handheld packages ~~with the maximum weight of up to 23 kg; a box~~ that ~~is~~are handled by human operators during the distribution and logistics process. This document is applicable to handheld packages with a maximum weight of up to 23 kg.

This document does not cover all issues of safety, health, and the environment related to the handling of packages.

2 Normative references

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

ISO 186, *Paper and board — Sampling to determine average quality*

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 527-1~~:2019~~, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 21067-1~~:2016~~, *Packaging — Vocabulary — Part 1: General terms*

3 Terms and definitions

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

~~**3.1**~~
~~**handheld package**~~
~~courier freight and distribution packaging up to 23kg for one adult to handle~~

~~Note 1 to entry: The maximum allowed weight that one person can handle at one time may vary depending on individual strength, box weight, size, operation frequency, moving distance, and country to country.~~

~~**3.2**~~
~~**hand hole**~~
~~pre-cut holes on the package for handling convenience during logistics and distribution activities~~

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
handheld package
courier freight and distribution packaging, weighing up to 23 kg, intended to be handled by one adult

Note 1 to entry: The maximum allowed weight that one person can handle at one time can vary depending on individual strength, box weight, size, operation frequency, moving distance, and country-specific regulations.

3.2
hand hole
pre-cut hole on the package, intended to be used as a handle during logistics and distribution activities

4 Design criteria

~~**4.11.1General**~~

4.1 General

When establishing the design criteria for hand holes, manufacturers and sellers of handheld boxes can take into account various elements including ~~the contents of~~those covered in this ~~standard such~~document as well as material, structural and technical feasibility, logistical suitability, application effects, and other safety functions and costs.

4.2 Hand hole

~~**4.2 Handle**~~

~~4.2.2~~4.2.1 General

An adequate ~~handle~~hand hole should be used for packages, allowing ~~1~~one or ~~2~~two people to safely handle the product. Such a ~~handle~~hand hole is intended for lifting the package upwards in a vertical direction. It is not designed to be pulled, pushed, or lifted with one hand. The hand holes described in this document are intended to be used with two hands in a common handling environment.

~~Not all~~Hand holes ~~on the package are~~ can be used as handles~~.~~, but not all hand holes are designed for this function. Some of them ~~may~~can be designed for other purposes, such as ventilation, or inspection and adjustment of the contents. Some ~~handles may~~hand holes can be designed to facilitate moving or rotating heavy packages rather than lifting them. Even if a hole is made onto the packaging for ventilation or inspection of contents, if ~~they are~~it is used for ~~handle~~handling of the packaging, it shall meet the design criteria of 4.2.2~~4.3.2.~~.

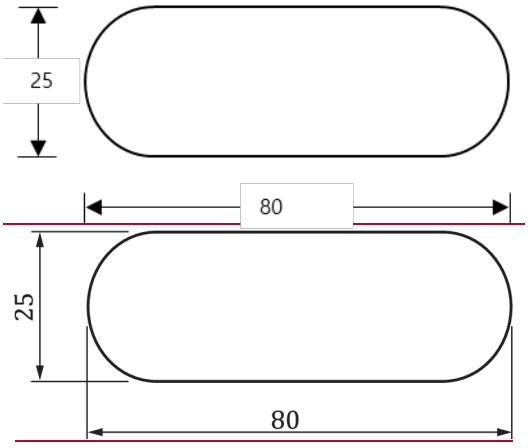
~~4.2.3~~4.2.2 Hand hole design

~~4.2.3.1~~4.2.2.1 Structure and size

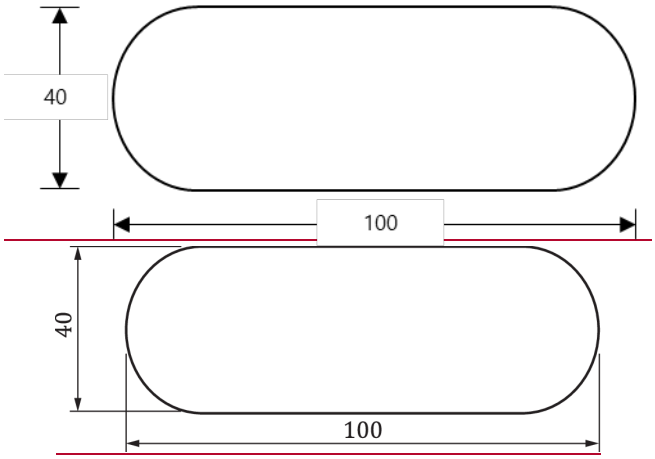
A hand hole should allow the box to be gripped by hands. The perforated part should not be sharp so as to avoid injuries. The hole should have a high shear durability and a streamlined shape for the dispersion of pressure.

Figure 1~~Figure 1~~ shows the structure and size of a standard hand hole suitable for most adults. The shape and size depend on a number of factors such as the characteristics and the weight of the product and may be subject to negotiation between the supplier and the user.

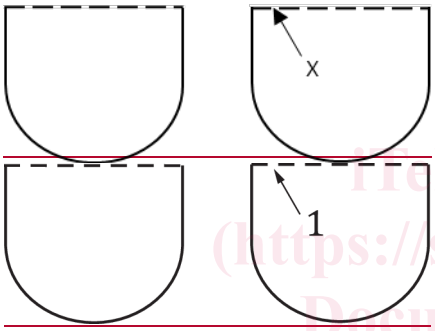
Dimensions in millimetres



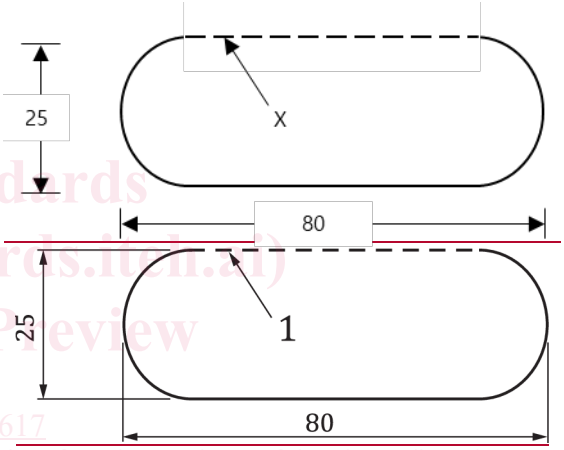
a) Ordinary oval ~~handle~~hand hole



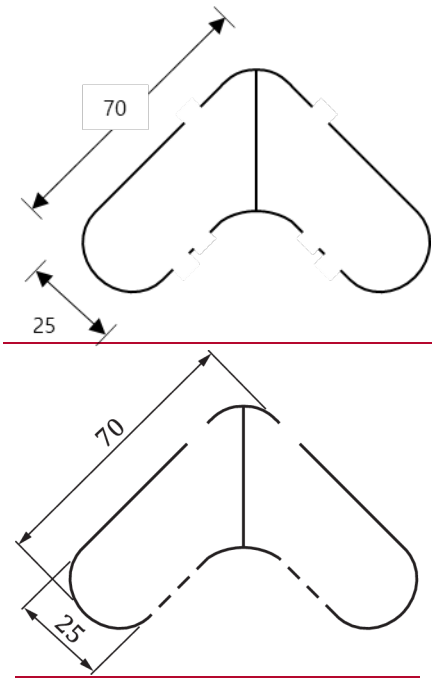
b) Long oval ~~handle~~hand hole suitable for gloved hands



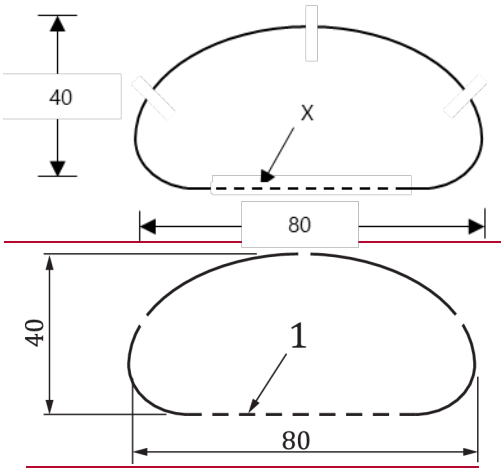
c) Hand hole to insert two fingers into or to use a pulley with



d) Half-folded hand hole, mainly used for heavy objects thanks to its foldable top



e) Triangular top-arched hand hole for increased tear strength



f) Deformed upper arch hand hole

Key

~~X~~1 folding side

Figure 1 — Examples of structure and size of hand holes

~~4.2.3.2~~4.2.2.2 Reinforcement

If necessary, the arrangement of the product and cushioning material can be changed or reinforced during the packaging design stage to strengthen the corrugated cardboard at the top of the ~~handle~~hand hole and to prevent its damage, thus complementing the perforated hole. Reinforcement can be achieved~~:~~

— through a composite mould where a material that reinforces is placed around the hand hole~~;~~, or

— by attaching some handle tape.

NOTE Composite moulds ~~may~~can have negative effects on recyclability of packaging materials.

Figure 2~~Figure 2~~ shows ~~an example~~examples of ~~the~~ application of ~~the~~ reinforcing material.