

**Portable rigid plastic Hermetic grain silo  
—Specification**

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Kenya Industrial Research and Development Institute  
National Environment Management authority  
East African Packaging Industries  
National cereals and produce board  
Kenya Agricultural and Livestock Research Organization  
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# **Portable rigid plastic Hermetic grain silo — Specification**

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# KS 2874:2019

## Foreword

This Kenya Standard was prepared by the multi- Technical Committee on Packaging (053), hard fibre (066) and Cereals and Pulses (001) under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards

Development of this standard was necessitated by the need to use hermetic storage technologies for storage of dry food commodities, their derived products and seeds in order to reduce post-harvest losses and increase the shelf life without the need to use pesticides.

Portable rigid plastic hermetic silo is sold to food value chains in Kenya with users benefiting from lower post-harvest losses, maintain qualities of stored commodities leading to increased food security, income, nutrition and health.

In the manufacturing sector, the silos are used to preserve products that require protection from moisture, water vapour and controlled oxygen permeability.

As the market for Portable rigid plastic hermetic silo expands, there is a risk of substandard products being imported or manufactured locally and hence undermine proper storage of dried food commodities and their derived product.

The Portable rigid plastic Hermetic grain silos, are made from food grade, virgin polyolefin resins to ensure safety of the consumers and safeguard the interest of the stakeholders. These silos have to meet the minimum requirements expected for the purpose.

This standard shall be useful to farmers, manufacturers, dried food commodity traders, importers, exporters, standards enforcement agencies and other stakeholders in checking quality of Portable rigid plastic Hermetic grain silo.

Parameters covered in the standard include water vapour and Oxygen transmission rate of the walls, dimension, material composition, construction of the silos among others.

During the preparation of this standard, reference was made to the following document:

**KS EAS 354 Plastic containers for up to 5 litres capacity — Specification....**

Acknowledgement is hereby made for the assistance derived from this source.

## **Portable rigid plastic Hermetic grain silos —Specification**

### **1 Scope**

This Kenya Standard specifies the requirements and methods of test for Portable rigid plastic Hermetic silos used for storage of dry food commodities, derived products and seeds where controlled conditions of moisture and oxygen is a required.

### **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 1663:2007(E) Rigid cellular plastics — Determination of water vapour transmission properties*

*ISO 4591 Plastics -- Film and sheeting -- Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*

*ISO 2556 Plastics -- Determination of the gas transmission rate of films and thin sheets under atmospheric pressure -- Manometric method*

*ISO 1926:2009 Rigid cellular plastics -- Determination of tensile properties*

*ISO 8256:2004 Plastics — Determination of tensile-impact strength*

*ISO 10193:2000 General use light gauge metal containers -- Nominal filling volumes of round cylindrical and tapered containers of up to 40 000 m*

*KS ISO 1183-1 Plastics -- Methods for determining the density of non-cellular plastics -- Part 1: Immersion method, liquid pycnometer method and titration method*

*KS 2319:2011 Determination of overall migration of constituents of plastic materials and articles intended to come in contact with food stuffs – Methods of analysis*

### **3 Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

#### **3.1**

##### **water vapour transmission rate**

Quantity of water vapour transmitted through unit area of a test specimen in unit time under specified conditions of temperature, humidity and thickness

#### **3.2**

##### **Oxygen transmission rate (OTR)**

Quantity of oxygen transmitted through unit area of a test specimen in unit time under specified conditions of temperature, humidity and thickness

#### **3.3**

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### **batch**

The silos of the same design and type produced from the same grade of polymer by the same converting unit in a given period of time.

### **3.4**

#### **closure**

A device that effectively closes and seals an opening in a silo.

### **3.5**

#### **brimful capacity**

The volume of grains held by the silo when filled to the point of overflowing at  $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ , while standing on a level surface.

### **3.6**

#### **nominal capacity**

The volume of grain the silo is intended to hold at  $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ .

### **3.7**

#### **container mass**

The mass in grams of a fully finished empty silo excluding the top closure

### **3.8**

#### **dry food commodity**

cereals and pulses whose moisture content is within acceptable limits as specified in the Standards

### **3.9**

#### **derived products**

processed products from cereals and pulses

## **4 Requirements**

### **4.1 General requirements**

#### **4.1.1 Materials**

**4.1.1.1** Portable rigid plastic Hermetic silos shall be made from food grade virgin material.

**4.1.1.1** The silo shall retain its colour through the life-span.

**4.1.1.2** Any additives such as plasticizers, antistatic agents, pigments, and inhibitors, shall be compatible with the polymer and shall not deleteriously affect the grains and other products.

**4.1.1.3** Resins and articles intended to come into contact with dry food commodities and their derivatives shall be manufactured in compliance with Good Manufacturing Practice so that under their normal or foreseeable conditions of use, they do not transfer constituents to foodstuffs in quantities that are harmful to humans.

### **4.2 Construction**

The body and the bottom of the silo shall be integral, i.e. moulded into one piece. The closure shall be firmly secured on to the barrel of the silo to ensure hermeticity.

### **4.3 Finish**

**4.3.1** Both the inside and outside of grain silo shall be free from pits and flashing, and pigmentation shall be evenly distributed.

**4.3.2** The body of the silos shall be smooth and shall have no sharp edges and any other imperfections.

## **5 Specific requirements**

When tested in accordance with the methods specified in Table 1, Portable rigid plastic Hermetic silo shall comply with the requirements specified therein.

**Table 1 — Specific requirements for Portable rigid plastic Hermetic grain silo**

<b>S/No.</b>	<b>Characteristic</b>	<b>Requirements</b>	<b>Test method</b>
<b>i.</b>	Water vapour transmission rate (WVTR), (g/m <sup>2</sup> /day),max.	10	KS ISO 1663:2007
<b>ii.</b>	OTR, (cc/m <sup>2</sup> /day),max	250	KS ISO 2556
<b>iii.</b>	Thickness of the walls, mm, min	4	KS ISO 1663:2007
<b>iv.</b>	Tensile strength at break, mPa min.	22	KS ISO 1926:2009
<b>v.</b>	Air tightness	it shall not leak.	Annex A
<b>vi.</b>	Drop test	Shall show no splitting, cracking, permanent distortion or other signs of failure.	Annex B
<b>vii.</b>	Impact Strength	Shall show no splitting, permanent distortion or other signs of failure.	KS ISO 8256
<b>viii.</b>	Density of the finished product (polymer material),g/mm <sup>3</sup> min	0.935	ISO 1183-1

### **5.3.3 Food grade requirements**

**5.3.3.1** When tested in accordance with KS ISO 177 the bag shall not transfer toxic substances injurious to human on the packed products.

## **6 Capacity**

When tested in accordance with KS ISO 10193 the nominal capacity shall be as specified on marking and shall have a tolerance of  $\pm 2\%$ .

## **7 Packaging and Labelling**

### **7.1 Packaging**

**7.1.1** Portable rigid plastic Hermetic Silos shall be suitably packed in a manner that prevents damage, contamination during normal handling, storage and transportation.

**7.1.2** The Silos shall be packaged in agreed quantity between the buyer and seller

### **7.2 Labelling**

The silos shall be legibly and indelibly marked with the following information.

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- i. Manufacturer's name and address /or registered trade mark.
- ii. Name, "Portable rigid plastic Hermetic grain silo"
- i. nominal capacity in in Kg as dried maize equivalent, e.g. 360
- iii. Tare weight of the Silo with lid in kg.
- iv. Batch number or code
- v. Instruction for correct use,
- vi. Instruction for storage and disposal
- vii. The declaration, 'Country of manufacture and origin.



**Annex A  
(normative)****Air-leakage test****A.1 Apparatus**

- a) A bath of water in which a specimen float;
- b) A suitable supply of compressed air;
- c) A flexible hose having a pressure gauge and a pipe fitting that form a pressure-tight seal with an opening made in a specimen.

Note1: It is often convenient to drill a small hole through the centre of a closure and secure the fitting in such a way that the normal sealing function of the closure is not impaired.

**A.2 Test specimens**

From the remainder of the sample take at random and not those used for other tests

**G.A Procedure**

Connect the flexible hose to one specimen, float the specimen on the water in the bath, and apply the internal air pressure given in 5.4 so rotate the specimen that all portions are submerged (in turn) and examine for air leaks. Repeat the test on the other specimens.

Note 2: Ensure that the operator is protected from possible rupture of the specimen.

**Annex B**  
(normative)

**Drop test**

**B.1 Principle**

The drop test is used to determine the ability of the silo to withstand rough and sudden drop from a height.

**B.2 Procedure**

Fill the silo with sand or any other weight to designated load. Elevate it to a height of  $3 \text{ m} \pm 0.05 \text{ m}$ , keeping it in a vertical position. Drop it from this position in such a manner as to fall freely and to strike the concrete floor. Repeat the test three times.

After each drop observe any physical damage to the silo.