



**Warehouse and warehousing for bagged
storage of cereals and pulses —
Requirements**

PUBLIC REVIEW DRAFT

DKS 2657:2022

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Kenya Institute of Food Science and Technology
Agriculture and Food Authority
Warehousing Receipt Council
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Warehouse and warehousing for bagged storage of cereals and pulses — Requirements

KENYA BUREAU OF STANDARDS (KEBS)

Head Office: P.O. Box 54974, Nairobi-00200, Tel.: (+254 020) 605490, 602350, Fax: (+254 020) 604031
E-Mail: info@kebs.org, Web: <http://www.kebs.org>

Coast Region

P.O. Box 99376, Mombasa-80100
Tel.: (+254 041) 229563, 230939/40
Fax: (+254 041) 229448

Lake Region

P.O. Box 2949, Kisumu-40100
Tel.: (+254 057) 23549, 22396
Fax: (+254 057) 21814

Rift Valley Region

P.O. Box 2138, Nakuru-20100
Tel.: (+254 051) 210553, 210555

DKS 2657:2022

Foreword

This Kenya Standard was prepared and revised by the Cereals and Pulses Technical Committee under the guidance of the Standards Projects Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

Warehouses are intended for the storage and physical protection of grains from the weather, prevention of the entry of pests and security. They also include materials and equipment required for inspection, drying, screening, sorting, grading, packaging and handling of bagged grain and storage pest control.

The structure should be properly built to provide good storage conditions, easy access and safe working conditions, and should not provide harbourage for pests.

In general, the condition of grain changes slowly while in storage; the extent of any change depends on ambient conditions at harvest. Changes in moisture content and temperature are limited to the periphery of a bulk or to the outer bags of a stack, unless the storage period is prolonged or the grain is ventilated.

Heavy infestations of insects, however, may cause a rise in temperature in the grain mass, possibly due to the development of fungi. Ideally, the warehouse should permit some control of temperature and humidity, to keep the grain cool, dry and at a uniform temperature as much as possible.

The objective of this standard is to provide guidance to industry regarding appropriate storage of cereals and pulses in order to reduce on the level of post-harvest losses incurred in these commodities.

This standard as well will be invaluable in promoting the Structured Trading Systems (STS) in the region to promote both regional and International trade in cereals and pulses. The standard will play a major role in the implementation of the Warehouse Receipt System (WRS) and the Commodity Exchange in the region

This second edition replaces the first edition of KS 2657:2016

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

ISO 6322-1:1981, Storage of cereals and pulse — General consideration in keeping cereals.

ISO 6322-2:2000, Storage of cereals and pulse — Practical recommendations.

Acknowledgement is hereby made for the assistance derived from these sources.

Warehouse and warehousing for bagged storage of cereals and pulses — Requirements

1 Scope

This Draft Kenya Standard covers the location, structural, facility, safety and management requirements for a warehouse for storing bagged cereals and pulses.

This standard applies to public warehouses, private commercial warehouses, bonded storage, cooperative warehouses and distribution centers .

2 Normative references

The following referenced documents are indispensable for the application 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 6322-3, *Storage of cereals and pulses — Control of attack by vertebrate and invertebrate animals*

3 Terms and definitions

For the purpose of this standard, the following terms and definitions shall apply.

3.1

warehouse

building for storage of grains meant for trade, exchange and food security programmes

3.2

Pallet/ spacers/ dunnages

wooden, plastic or any other suitable frames used on concrete floors for stacking bags to prevent direct contact between the grains and the floor

3.3

competent authority

any person or organization that has the legally delegated or invested authority, capacity, or power to perform a designated function

3.4

warehousing

performance of administrative and physical functions associated with storage of grains. These functions include cleaning and maintenance of a warehouse, inspection, drying, screening, sorting and grading of grains, stacking, pests prevention and control, records keeping and any other activity necessary to store grains safely.

3.5

defective grains

grains which are pest damaged, discolored, stained, rotten and diseased, immature and shriveled grains and broken grain

3.6

foreign matter

all organic and inorganic material

3.7

organic matter

any animal or plant matter (seed coats, straws, weeds) other than rice, damaged rice, other grains, inorganic extraneous matter and harmful/toxic seeds

3.8.

inorganic matter

stones, glass, pieces of soil and other mineral matter

3.9

non- food uses

Uses such as fuel and industrial

3.10

dusting

Application of dry, finely powdered pesticides which may be mixed with an inert carrier and applied with some type of blower

4. Requirements

4.1 Location

Consideration shall be given to potential sources of contamination from the local environment and the surrounding areas

4.1.1 The location of a warehouse shall be authorized by the competent authority (ies).

4.1.2 The site shall be located at relatively high elevation to avoid water logging and safe from natural flooding calamities. The topography of the location shall be in such a way that it is elevated and should be well drained to avoid water logging and natural flooding calamities

4.1.3 The warehouse shall be accessible by road and /or rail

4.1.4 The warehouse shall have access to clean water, communication facilities and power supply.

4.1.5 The warehouse shall not be near any facility where the danger of fire is constantly present

4.1.6 Warehouses near public facilities shall take necessary measures to mitigate the effects of their operations to the surroundings.

4.1.7 There should be ample space to facilitate movement and parking of transport.

4.2 Structural requirements

4.2.1 General

4.2.1.1 The construction and building materials shall conform to the National Building Regulations and relevant standards.

4.2.1.1.2 The warehouse shall be designed constructed and maintained in a manner appropriate to the nature of the operations to be carried out, hazards associated with those operations and the potential sources of contamination from the environs

4.2.1.1.3 The material shall be durable, nontoxic , wind and water tight.

4.2.2 Orientation

4.2.2.1 The orientation of the warehouse shall be such that radiant heat gain from the sun is minimal.

4.2.3 Foundation

The foundations shall be of adequate strength to take the weight of the building and of the grain filling, and should be termite proofed.

4.2.4 Floor

4.2.4.1 The floor shall be adequately strong and capable of withstanding heavy loads and vibrations.

4.2.4.2 The floor shall be elevated or constructed higher than the existing ground.

4.2.4.3 The wall floor junction should be rounded to facilitate cleaning

4.2.4.4 The floor shall be smooth, easy to clean and resistant to the cleaning system applied

4.2.4.5 The floor should be designed to avoid standing water

4.2.4.6 The floor shall be free from cracks and crevices where moisture from the ground may affect the stored grains or can harbour pests.

4.2.5 Walls

4.2.5.1 The internal surfaces of the walls shall be smooth, free from projections to eliminate dust-laden surfaces, and facilitate cleaning of the store

4.2.5.2 The junction between walls and roof shall be well sealed in order avoid birds and rodents to access the store rooms.

5.4.3 A water/damp-proof barrier shall be incorporated into the base of the walls. Water proofing compound may be incorporated during the plastering and finishing of the walls.

4.2.5.4 The walls shall be free from cracks and crevices where moisture from the walls may affect the stored grains or can harbour pests

4.2.5.5 The internal surfaces of the walls should be painted using a bright colour for easy spotting of pests

4.2.6 Roofs

4.2.6.1 Roof design shall be in a way that facilitates pest control and other stock management procedures.

4.2.6.2 The roof shall be designed so as not to provide harbourage for insects and mites. An internal ceiling is not advised, as it may provide harbourage for predators.

4.2.6.3 Internal pillars within the warehouse supporting roof frames should be avoided as much as practicable as it affects warehouse operations

4.2.6.4 Roof shall be provided with the necessary lateral and vertical wind brace to resist forces due to strong winds and earthquakes.

4.2.6.5 The roof covering materials shall be reflective and keep the warehouse dry.

4.2.6.6 The inclination of the roofs shall be sufficient to drain rainwater quickly, taking into account that the water may be forced up by the wind.

4.2.6.7 Roofs shall be watertight and gulleys kept clear of debris and leaves.

4.2.6.8 The roof shall be a good thermal insulator, not affected by condensation, and give protection against attack by pests and moulds.

4.2.6.9 Roofs with cyclones and ventilation fans shall ensure that the condensed water is drained properly

4.2.6.10 The roofing materials shall be designed to ensure proper temperature controls in the warehouse

4.2.6.11 Rainwater drainpipes shall not be less than 90 mm in diameter.

4.2.6.12 All drain pipes from roof gutters shall be external, well fitted, firmly fixed and protected from damage and shall have mesh baffles fitted inside their open ends.

4.2.7 Doors

4.2.7.1 The number of doors shall be determined by the frequency of access to the stored product.

4.2.7.2 The door shall fit tightly to ensure pest control and fumigation.

4.2.7.3 The door shall be made of food grade steel or any other material with similar properties. If it is made of timber, the lower part of both the door and the frame should be covered by a steel strip or any other material with similar properties, protecting them against attack by rodents.

4.2.7.4 The door shall be provided with a secure locking system.

4.2.7.5 The size of the entrance shall depend on loading and unloading operations and shall be not less than 2.5-m wide and 2.5-m high.

4.2.8 Ventilation

4.2.8 .1 Vents shall be provided near the floor level in the wall and at the top of the walls near the grid line or any other method of aeration that is suitable . A suitable meshed ventilation duct should be placed in each gable so that warm air accumulating under the roof can escape and to control the birds

4.2.8 .2 Ventilation openings shall be fitted on the outside with anti-bird grills and on the inside with pests screens, which will deter pests.

4.2.8 .3 In addition to natural ventilation exhaust, fans may be introduced for forced ventilation.

4.2.8 .4 Windows should be kept to a minimum or avoided. They should be left open as little as possible. Windows shall be protected by mesh grilles to keep birds out when the windows are open.

4.2.9 Illuminations

4.2.9 .1 Illuminations inside the warehouse shall be sufficient with lights not being too bright or too dim

4.2.9 .2 Artificial lighting is preferable for the interior of the warehouse, where natural lighting is used., it shall be aligned along the corridors and not directly above the grain stacks.

4.2.10 Fence

4.2.10.1 The site of the warehouse shall be secured against the unauthorized entry of persons and animals.

4.2.10.2 Gates shall be adequate for their purpose and wide enough to allow easy vehicle access.

4.3 Facility requirements

There shall be annex rooms, separate from the grain storage areas and shall include the facilities for reception, offices, laboratory, equipment and chemical store, washrooms, changing room and showers.

4.3.1 Office space and related facilities

The office space shall be:

- a) easily accessible for staff and other visitors;
- b) clearly signposted;
- c) well aerated;
- d) safe and unobstructed; and
- e) clean, naturally well-lit and suitably furnished.

4.3.2 Washrooms

4.3.2.1 washrooms for male and female shall be separately provided in the premises of the warehouse.

4.3.2.2 The floor of the washrooms shall be non-absorbent, washable and non-slip materials.

4.3.2.3 The wall shall be constructed from non-absorbent, washable materials and shall be light coloured, up to a minimum height of 2 m and they shall be smooth and without crevices and shall be easy to clean and disinfect.

4.3.2.4 The washrooms shall be furnished with hand washing facilities.

4.3.2.5 The number of washrooms shall be adequate for the number of employees. The number of washrooms may be determined using Table 1.

Table 1 — Number of washrooms in Warehouse and warehousing for bagged storage of cereals and pulses

SL No	Number of employees	Number of washrooms
i)	1 – 15	1
ii)	16 – 35	2
iii)	36 – 55	3
iv)	56 – 80	4
v)	81 – 110	5
vi)	111 – 150	6

NOTE Over 150 employees, one additional fixture for each additional 40 employees.

4.3.3 Changing rooms and showers

4.3.3.1 The warehouse shall provide suitable changing room and showers for workers.

4.3.3.2 Changing rooms shall be furnished with labelled lockers.

4.3.3.3 All cleaning materials shall be provided.

4.3.4 Equipment store

4.3.4.1 Equipment such as for fumigation, sampling, cleaning may be provided in the warehouse. Such equipment shall be appropriately stored and separate from the grain storage and chemical storage areas.

4.3.4.2 The floor shall be non-absorbent and washable.

4.3.5 Chemical store

4.3.5.1 Chemicals such as pesticide, rodenticides, fumigants may be stored at the warehouse. Such chemicals shall be stored in a separate room under lock and key.

4.3.5.2 The chemical store shall be well ventilated and the fumes released should not be harmful to the environment

4.3.5.2 Chemicals shall be clearly labelled for easy identification.

4.3.5.3 The floor and the wall shall be easy to clean.

4.3.5.4 Chemical store shall be clearly identified as such.

4.3.6 Laboratory

4.3.6.1 The warehouse shall be provided with laboratory for internal control.

4.3.6.2 The laboratory should have an adjacent office for the lab workers

4.3.6.3; The laboratory shall have facilities to undertake basic tests such as moisture content, organoleptic test, physical tests, aflatoxin screening and grading.

4.3.6.4 The laboratory shall have sufficient area for test to be conducted and equipment. These equipment may include moisture meters, sieves, aflatoxin screening kits, weighing balance.

4.3.6.5 The laboratory equipment shall be calibrated,

4.3.6.6 The laboratory shall be well aerated

4.3.6.7 The floor and the wall shall be easy to clean.

4.3.6.8 The testing area shall be sufficiently lit.

4.4 Safety requirements

4.4.1 The Warehouse and the warehouse site shall have Warning signs or boards displayed in hazardous/dangerous places

4.4.2 Firefighting equipment in working condition (fire extinguishers, fire hydrants) shall be provided and be installed in a conspicuous and accessible location.

4.4.3 There shall be provisions for well-equipped first aid facilities.

4.4.4 Safety signs, fire exits, eyewash stations, shall be indicated

4.4.5 Smoking zones (where smoking is allowed) shall be clearly indicated

4.5 Management requirements

4.5.1 Cleaning and maintenance

4.5.1.1 The buildings, equipment, utensils and all other physical facilities of the establishment, including drains, shall be maintained in good and orderly condition.

5.4.1.2 The store shall be cleaned and treated prior to any storage operation.

4.5.1.3 The store and environment of the warehouse shall be kept clean and shall be disinfected /disinfested regularly to prevent insect and mites infestation.

4.5.1.6 Changing facilities and washrooms shall be kept clean.

4.5.2 Waste disposal

4.5.2.1.Waste from sorting and screening shall be disposed in such a way that does not harbour rodents and other pests.

4.5.2.2.Waste from the warehouse shall be collected and disposed in environmentally friendly manner.

4.5.3 Inspection, drying, screening, sorting and grading unfit materials

Such operations shall be carried out in a clean and sanitary manner. Only clean, sound product shall be stored.

4.5.3.1 Inspection

4.5.3.1.1 The general appearance of the products shall be observed during the process of unloading; if the grains are moist, insect infested, insect damaged, or contain an unusual amount of dirt, debris or other foreign material.

4.5.3.1.2 If the observations from sensory analysis do not allow taking the decision, a sample from the suspected lots shall be taken and accurate tests conducted before any acceptance of the lot.

4.5.3.2 Drying

4.5.3.2.1 If grains brought to the warehouse do not comply with maximum moisture content stated in relevant East African Standards, the grains shall be dried and moisture content reduced to the specified level.

4.5.3.2.2 If heated air is used for moisture reduction, temperature and drying time shall be synchronized so that they do not result in adverse effect on the nutritional composition and quality of the grain in its intended use.

4.5.3.2.3 If drying is done under the sun, drying should be held on a clean environment on clean drying sheets, preferably black. The grain should be spread in a thin layer and raked at intervals, to remove the moisture.

4.5.3.2.4 Whatever the drying system, care shall be taken to avoid attack by pests .

4.5.3.3 Screening, sorting and grading

Ungraded grains shall be screened and sorted before being graded according to relevant East African Standards as soon as they reach the warehouse.

4.5.3.3.1 Grains shall be screened and/or aspirated to remove all defective grains and foreign matter

4.5.3.3.2 Screening shall be done in such a way that the operation does not pollute the environment

4.5.3.3.3 Sorting shall be done before any grain treatment to ensure the removal of all defective grains .

4.5.3.3.4 Defective grains, shall be bagged separately and tagged as unsuitable for human consumption!

4.5.3.3.5 Containers of defective grains shall be removed as soon as practicable from the warehousing area.

4.5.3.3.6 materials which carry the danger of contamination by mycotoxins shall be diverted to non-food uses.

4.5.4 Loading and unloading

4.5.4.1 Loading and unloading may be done mechanically or manually.

4.5.4.2 If manual loading and unloading is used, the floor should be 1-m above the ground to permit easy loading or unloading into trucks at the sides of the warehouse.

4.5.4.3 Loading and unloading shall not take place in open area when it is raining. A canopy should be constructed over every entry door to allow continuous loading and unloading even when it rains.

4.5.5 Provision of pallets

4.5.5.1 The spacers (pallets) /, dunnages shall be used to avoid the sacks being in direct contact with the ground

4.5.5.2 Spacers /pallets should be of standard manageable size, and therefore easy to lift. They shall be treated with pesticides and stacked neatly when not in use.

4.5.6 Stacking

While deciding the whereabouts of bag stacks the following shall be considered:

- a) Bags of grains in each lot shall be stacked in basic patterns of cluster formation so that bags can be easily counted, and quality maintained;
- b) Stacking around pillars shall be avoided, as this makes inspection and fumigation difficult, and it can damage the building;
- c) The bag stack shall be built at least 1 m away from the walls of a store. This allows easy inspection, prevents moisture ingress from contact with the wall and facilitates fumigation treatments since a gastight sheet can be placed over all sides of the stack;
- d) Gangways leading to the doors shall be at least 1-m wide to allow for proper inspection and spraying. An inspection walkway shall always be left between stacks;

- e) The bag stack shall not be built too high and not closer than 1.5 m to the store roof beams so that staff can work on top of stacks;
- f) When using jute or sisal bags, the bag stack can be built to around 18 - 20 layers. any higher then there is a risk to stability and it is difficult for storage workers. (When using polypropylene or plastic bags the stack heights must be lower as they are less stable than jute or sisal)
The stacks should not cover the ventilations in the warehouse;
- g) The size of the stacks shall conform with fumigating sheets in situations where warehouses cannot be made airtight; and
- h) Different commodities, of new and old consignments should be placed in different stacks i.e. separated in batches based also on the time of their reception in store, as far as the available space will allow.

4.5.7 Pests prevention and control

4.5.7.1 Pests can be prevented and controlled by

- a) keeping grains in a modified atmosphere
- b) spraying the floors and walls with pesticides;
- c) dusting of grains by pesticides; and
- d) fumigation.
- e) Maintain the walls and the floors free from cracks and crevices
- f) The warehouse shall be kept clean and tidy both inside and outside for easy management and to keep away pests

4.5.7.2 Where control is by fumigation, the following provisions shall apply:

- a) fumigants shall only be used by properly trained and authorized persons, who know the dangers and the necessary safeguards.
- b) there shall be no human habitations within 100 m of the planned fumigation; if there are, the arrangements shall be made for people to be relocated during the treatment.
- c) fumigated stacks shall be kept closed and post warning signs displayed until the gas concentration is at the safe level for human beings
- d) the stacks shall be well covered during fumigation and where direct fumigation is done there shall be no store imperfections, e.g. cracks in the floor, unfilled floor joints, roof leaks etc., which might jeopardize the success of the fumigation.
- e) at the end of the fumigation, warehouse shall be aerated carefully according to the standard procedure to minimize dangers.

4.5.7.3 The control of attacks by vertebrate and invertebrate animals shall be done in accordance with ISO 6322-3.

4.5.8 Structural management and maintenance

4.5.8.1. Floor cracks and crevices should be repaired as soon as possible to prevent pests and moisture in the warehouse

4.6 Record keeping

Warehouse shall keep records of:

- a) origin, history of and volume of each lot of cereals and/or pulses kept;
- b) laboratory tests carried out;
- c) names of chemicals used for pests control;
- d) fumigation detailing the fumigant used, the date and method of fumigation, person or company carrying out the fumigation;
- e) names of employees and training undertaken;
- f) authorization by Environmental agency;
- g) servicing and calibration of all equipment;
- h) cleaning; and
- i) pest control detailing the pesticide used, the date and method of spray/dusting, person or company carrying out the pest control.

ANNEX 1
INFORMATIVE ANNEX
CATEGORIES OF WAREHOUSES

1. Private Warehouses:

These are owned and managed by the channel suppliers (manufacturers/traders) and resellers and are used exclusively for their own distribution activities.

Examples:

- (a) Warehouses constructed by farmers/producers near their fields/places of work.
- (b) Warehouses owned and managed by wholesalers and retailers close to their selling centers.
- (c) Warehouses constructed by manufacturers near their production units.
- (d) Warehouses taken on rent by retail stores.
- (e) Retailers may have several regional warehouses to cater the needs of their stores.
- (f) Warehouses owned/leased by a wholesaler where it stores and distributes. Maintaining private warehouses involves fixed as well as variable costs. Examples of fixed costs are basically the investments made in terms of insurance, capital, interests and taxes. The variable costs on the other hand, include maintenance costs and operating costs.

Note: when these private warehouses are used for commercial purposes, this standard shall apply

2. Public Warehouses:

These warehouses are owned by government and semi government bodies and are made available to private firms to store goods on payment of rent. The public warehouses are usually set up to help small traders who are not in position to have their own warehouses due to financial constraints.

Therefore, in order to promote trade and industry, central or state governments come forward to cater such storage needs of traders/retailers. Anyone can avail these facilities to solve its short-term distribution needs. Retailers sometimes due to increased sales even find their private warehouses insufficient if their facilities have reached capacity or if they are making a special, huge purchase of products for some reasons.

3. Bonded Storage:

These warehouses are owned, managed and controlled by government as well as private agencies. Bonded warehouses are storage facility used to store imported goods for which import duty is still to be paid. The bonded warehouses run by private agencies have to obtain license from the government.

In actual, this enables the government bodies to hold control on private firms to pay their taxes on time. Without paying duties, importers cannot take over or open the goods. Globally, it has been seen that these warehouses are found near the ports and are usually owned by dock authorities. Bonded warehouses are subject to two types of taxes: (a) Excise duty and (b) Custom duty.

4. Co-operative Warehouses:

These warehouses are owned, managed and controlled by co-operative societies. These societies provide storage facilities on the most economical rates to their members only. The basic purpose to run such warehouses is not to earn profit but to help their members.

5. Distribution Centres:

This type of storage facility usually has large space, which enables fast movement of large quantities of stores for short period. While, on the other hand, conventional warehouses hold goods for long time, say 2 months or 1 year.

These warehouses basically by nature, serve as points in the distribution system at which goods are procured from different suppliers and quickly transferred to various customers. These centers provide computerized control, which make movement of goods quick, fast and reliable.

In order to minimize delivery time, these storage facilities are found close to transportation centers. In some cases, distribution centers handle the goods for less than a day period such as in case of fast foods or perishable products. Most of the goods enter in the early morning (dawn time) and is transferred/distributed by the evening time.

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Annex II
Informative annex
competent Authorities for approving building of warehouses

1. Building permit

It is issued by the City planning department of the county. Can also be issued by National Construction Authority

2. Environmental permit

Given by National Environmental Management Authority

3. Occupancy Certificate

Given by the municipal Authority upon completion of inspection of the building

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