International Standard 6822

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Potatoes, root vegetables and round-headed cabbages — Guide to storage in silos using forced ventilation

Pommes de terre, légumes à racines et choux pommés — Guide pour l'entreposage en silos équipés d'une ventilation forcée

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6822 was developed by Technical Committee ISO/TC 34, *Agricultural food products*, and was circulated to the member bodies in June 1982.

It has been approved by the member bodies of the following countries :

Australia	Iraq	Romania
Austria	Israel	South Africa, Rep. of
Czechoslovakia	Kenya	Spain
Egypt, Arab Rep. of	Korea, Rep. of	Sri Lanka
Ethiopia	Malaysia	Tanzania
Hungary	Netherlands	Turkey
India	Philippines	USSR
Iran	Portugal	Yugoslavia

The member bodies of the following countries expressed disapproval of the document on technical grounds :

New Zealand
USA

Potatoes, root vegetables and round-headed cabbages — Guide to storage in silos using forced ventilation

0 Introduction

The method described in this International Standard relies on the most recent procedures for the storage of potatoes, root vegetables and round-headed cabbages in silos, having as its objective a reduction of losses of the products and a reduction of the manual labour required for the technological processes.

1 Scope and field of application

This International Standard specifies a method of storing potatoes, root vegetables and round-headed cabbages in silos using forced ventilation.

The method is applicable to potatoes and vegetables (root vegetables, round-headed cabbages) intended for different purposes : for human consumption, for seeds and for fodder. It provides for the use of a system of ventilation using outside air for regulation of the storage conditions of the products.

The method is particularly efficient in regions having moderate climates, where the average temperature during harvest is from 0 to +2 °C, or lower during the night.

2 Conditions of harvesting and putting into store

The method provides for the possibility of storing all varieties of potatoes and vegetables which are suitable for storage and which are cultivated in the producing country in compliance with standardized conditions of growing, harvesting, transport and putting into store.

The quality of the products shall comply with the requirements of the quality standards in force in the producing country. The following products may be stored :

— late varieties of vegetables suitable for long conservation;

— well-formed, ripe, undamaged, healthy and unfrozen vegetables grown without abundant watering or abundant nitrogenous fertilizer.

Putting into store can be carried out in bulk as well as in packages standardized for the given variety of vegetables.

3 Preparation of the site and construction of silos

3.1 Choose a flat site, with minimum slope and an underground water bed of depth at least 1,5 to 2 m, close to accessible transport routes and an electricity supply.

Depending on the level of underground water, the silo can be placed on the surface of the site or partially underground.

3.2 The storage sites supplied by permanent transport routes and with a fixed covering consisting of a frame to be filled up, may be used for 5 to 10 seasons or more, or they may be provisional for a single season.

3.3 A pit of depth 0,3 m shall be prepared at the base of the silo, the ventilation of which is effected by distribution channels. The pit shall be covered by a wooden trellis on which the products can be stored.

3.4 The dimensions of silos vary from one region to another, their widths being from 3 to 5 m, their heights from 1,3 to 2 m, and their lengths from 15 to 30 m. In regions where storage of products according to this method has been widely practised, the width of the silo may be as much as 20 to 25 m and its length up to 100 m.

3.5 For covering the silos, building materials and available heat-insulating materials (wood, sawdust, peat, straw, earth) may also be used, as well as plastics foams and compressed heat-insulating tiles.

3.6 It is necessary to provide, along the length of the silos, hatches for loading and unloading the products, as well as for the control of storage conditions. Besides loading and unloading on the longitudinal sides of silos, these operations may also be carried out at either one or both ends without disturbing the covering or insulation material.

3.7 To make more efficient use of fans and for better regulation of ventilation, silos shall be grouped two by two. It is necessary to provide access to transport of width 6 m between the silos.

4 System of forced ventilation

4.1 The silos shall be equipped with a system of ventilation composed of inlet and outlet channels.

4.2 For ventilation, provide equipment consisting of fixed fans, or mobile installations with electric controls or other types of controls.

4.3 The output of the fans shall ensure a delivery of 50 to 100 m^3 of air per tonne of product per hour, according to local climatic conditions. In certain regions having a cold climate, the output of the fans may be reduced to 20 m^3 of air per tonne per hour.

4.4 Air shall be fed by underground distribution channels (for fixed sites) or by transportable surface tubes (for provisional sites). The cross-sectional area of the channels shall ensure an air flow rate of 3 to 6 m/s with a pressure of 15 mmH_2O (see figure 1). When the products are damp or caked with moist earth, the speed of the air current shall be increased to 5 to 10 m/s and the pressure to 20 to 50 mmH_2O.

4.5 Underground channels shall be constructed of bricks, concrete, or wood. Channels in coherent soil do not need to be covered. Transportable surface channels shall be made of wood, tinplate, or polymeric materials (plastics). The channels shall be moisture proof.

4.6 In the secondary distribution channels, valves shall be provided for regulation of the air flow or for checking the channels. The main distribution channel shall be large enough to permit a person to operate the air access valves in the secondary distribution channels.

4.7 The air from the distribution channels shall arrive underneath the trellis on which the products are stored.

4.8 The air passing through the stacks of products shall escape through the outlet tubes situated at the top of the silos.

5 Loading and unloading the products

5.1 Silos served by a single fan shall be loaded as soon as possible, so that ventilation can start when the silo is completely filled. In a silo which has been partially filled ventilation is not efficient, as air escapes from the uncovered part of the channel.

5.2 Loading and unloading the products may be performed by the use of conveyor belts moved into the hatches. It is also possible to use other means of handling.

5.3 In these silos, the products shall be stored loose. When storage in cases with palettes or in other containers with or without a palette is employed, the ventilation is not efficient as the air takes the path of least resistance and escapes between the packages.

5.4 Preparation (sorting, cleaning) of the products for use may be carried out either in the open if the external temperature is sufficiently high or inside silos equipped with artificial light.

6 Technique of ventilation

6.1 For damp products continuous (day and night) drying may be used; the air current shall not be too cold in order not to damage the products.

6.2 Afterwards, airing of the products, in order to cool them, shall be carried out in that period of the day when the temperature of the outside air is below the temperature of the stored products.

6.3 Subsequent ventilation shall be performed in order to ensure that the temperature of the mass of product is kept at not less than −1 °C for round-headed cabbage, 0 °C for root vegetables, and 2 °C for potatoes. The ventilation of the products shall last as long as necessary to maintain the temperature mentioned above.

6.4 Control of the fans and of the valves of the distribution channels may be automatic or manual (see figure 2).

7 Checking of the storage conditions and the products

7.1 Checking the storage conditions of products in silos is based on daily measurement of the temperatures at different points inside the silos, checking of the ventilation and the condition of the products.

7.2 The storage temperature shall be measured by means of electric resistance thermometers, thermocouples, etc., or any appropriate apparatus.

7.3 The uniformity of ventilation shall be checked by measuring the rate of flow of the air in the distribution channels and in the outlet tubes, by means of anemometers.

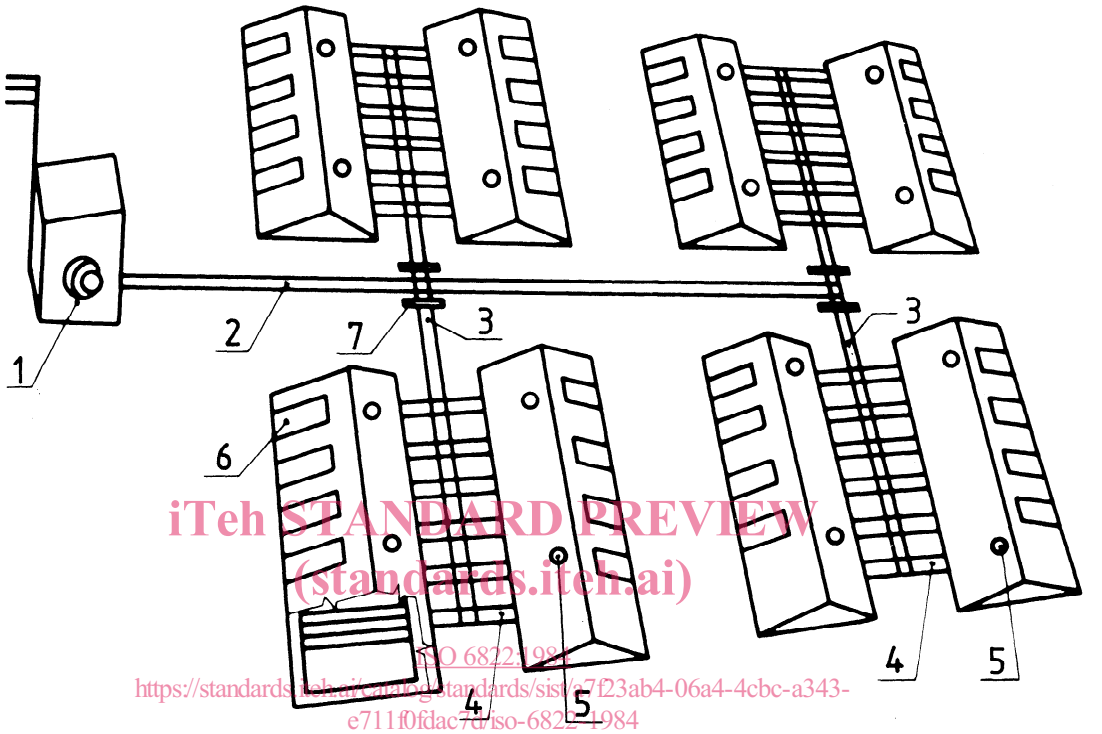
7.4 The condition of the products shall be checked periodically, once a month, by analysis of a bulk sample composed of simple samples taken in compliance with the recommendations in force in the producing country.

8 Preparation of silos for storage

8.1 Before the storage season, the silos and the surrounding site shall be cleaned of all waste. The interiors of fixed silos shall be dried before storage, and, for this reason, the hatches shall be left open when the silos are not in use. Those sections of the trellis which can be dismantled shall be taken outside.

8.2 The silos and the trellis shall be disinfected by permitted means.

8.3 It is necessary to check and, if the need arises, to repair the covering of the silos, the air distribution channels, the electric network, and automatic installations.



1 Fan

2 Main distribution channel

3 Secondary distribution channels

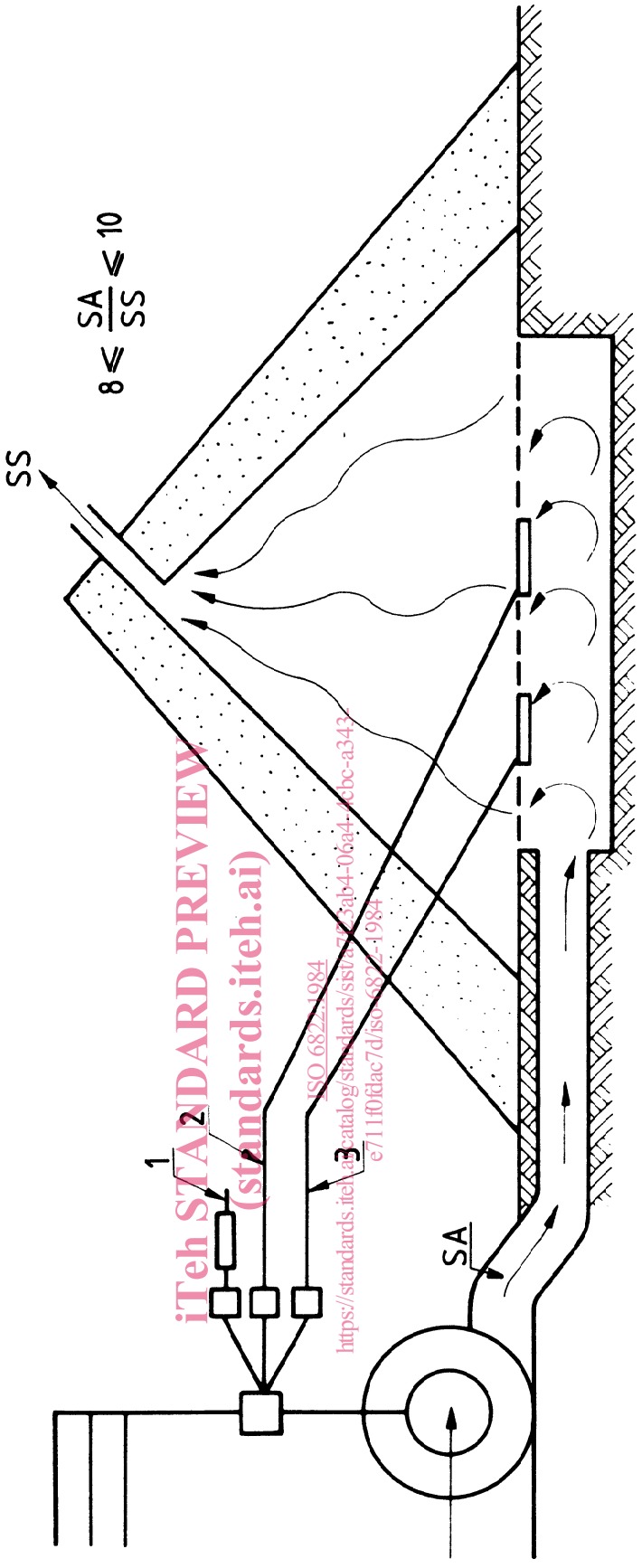
4 Inlet tubes

5 Outlet tubes

6 Hatch for loading

7 Regulating valves

Figure 1 — Layout of a site for fixed silos



1, 2, 3 } Regulation thermo-alarm

SA Section of the inlet tubes

SS Section of the outlet tubes

Figure 2 — Pulsed air cooling system for a site for fixed silos

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