
International Standard



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Fruits and vegetables — Physical conditions in cold stores — Definitions and measurement

Fruits et légumes — Conditions physiques des locaux de réfrigération — Définitions et mesurage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (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 set up 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 2169 was developed by Technical Committee ISO/TC 34, *Agricultural food products*.

This second edition was submitted directly to the ISO Council, in accordance with clause 5.10.1 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the first edition (i.e. ISO 2169-1974), which had been approved by the member bodies of the following countries :

Australia	India	Romania
Austria	Iran	South Africa, Rep. of
Belgium	Israel	Thailand
Czechoslovakia	Netherlands	Turkey
Egypt, Arab Rep. of	New Zealand	USSR
France	Poland	
Hungary	Portugal	

The member body of the following country had expressed disapproval of the document on technical grounds :

United Kingdom

Fruits and vegetables — Physical conditions in cold stores — Definitions and measurement

0 Introduction

The International Standards which have been prepared, or which are in the course of preparation, concerning conditions which allow fruits and vegetables to be kept well in cold storage, make reference to the optimum values of physical factors which are used in industrial practice : temperature, relative humidity, air-circulation ratio, rate of air change.

Storage practice has shown that the definitions of these physical factors need either to be made clear or to be repeated in order to avoid frequent confusion (for example, between the temperature applied to the produce and that of the atmosphere in the store, or between the air-circulation ratio and the rate of air change).

This International Standard draws attention to valid methods of measuring the physical factors concerned and renders it unnecessary to repeat systematically the definitions of these factors in each International Standard, which would have the effect of enlarging considerably each text intended for the users of International Standards on the storage of produce of plant origin.

Finally, it has appeared essential to inform users about the difficulties which arise in measuring certain physical factors.

The International Standards concerning the cold storage of fruits and vegetables, which have inspired this document, are intended for cold-storage users. To facilitate their task, it has sometimes been found necessary to adopt in this text definitions which, without being absolutely scientifically rigorous, provide values which are sufficiently accurate and easy to use.

1 Scope and field of application

This International Standard gives definitions of the physical factors usually employed in the industrial cold storage of fruits and vegetables (temperature, relative humidity, air-circulation ratio, rate of air change, etc.), and provides useful information concerning their measurement.

2 Temperature

2.1 Temperatures to be considered

2.1.1 Temperatures applied to the produce

For the cold storage of a produce of plant origin, several temperatures or ranges of temperature have to be considered :

a) **lethal temperature** : That temperature of refrigeration which causes physiological freezing of a produce with the death of the tissues.

b) **critical temperature** : In general, the temperature below which, for a given storage period and for certain kinds of fruits and vegetables, there result physical disorders, such as internal browning (with or without modification of the atmosphere), changes in the texture of the tissues (banana, cucumber, avocados, lemons, etc.).

In some particular cases, it is the temperature below which it is impossible to obtain normal ripening after storage.

c) **optimum long-term keeping temperature** : The temperature of the produce which enables satisfactory conservation and long-term storage to be achieved in a normal or controlled atmosphere until consumption.

The danger of damage at a given temperature depends upon the duration of its application.

In the case of short-term storage, it may be possible to keep certain produce at the critical temperature or at a temperature below this without causing physiological disorders.

For long-term keeping, the temperature of the produce should always be above the lethal temperature and, whenever necessary, above the critical temperature.

However, for certain fruits, such as Williams pears, the critical temperature concerning ripening may be above the optimum refrigeration temperature.