

SS 668 : Part 3 : 2020
(ICS 67.080)

SINGAPORE STANDARD

**Cold chain management of chilled and frozen
foods**

– Part 3 : Code of practice for vegetables and fruits

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The Technical Committee sets up the Working Group on Cold Chain Management of Chilled and Frozen Foods – Code of Practice for Vegetables and Fruits to prepare this standard. The Working Group consists of the following experts who contribute in their *individual capacity*:

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The organisations in which the experts of the Working Group are involved are:

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Enterprise Singapore
GS1 Singapore Limited
Jurong Cold Store Pte Ltd
MyKenzen Nutrition Services Pte Ltd
Malaysia Dairy Industries Pte Ltd
NTUC Fairprice Co-operative Ltd
Occasions Catering Pte Ltd
OJJ Foods Pte Ltd
PSA Corporation Ltd
Reckitt Benckiser Group
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SATS Airport Services Pte Ltd
Singapore Food Agency
Singapore Polytechnic
SMH Food Group of Companies
SOCOTEC Certification Singapore Pte Ltd
Swisslog Singapore Pte Ltd
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Foreword

This Singapore Standard was prepared by the Working Group on Cold Chain Management of Chilled and Frozen Foods – Code of Practice for Vegetables and Fruits set up by the Technical Committee on Food Processing, Distribution and Services under the purview of FSC.

The review of the following standards resulted in the development of the SS 668 series of standards on cold chain management of chilled and frozen foods:

- SS 585 : 2013 Cold chain management of vegetables;
- SS 552 : 2016 Code of practice for cold chain management of chilled pork;
- SS 621 : 2016 Code of practice for cold chain management of milk and dairy products;
- TR 49 : 2016 Cold chain management of frozen fish and seafood.

The SS 668 series comprises the following parts under the general title of “Cold chain management of chilled and frozen foods”:

- Part 1 : General requirements
- Part 2 : Code of practice for meat
- Part 3 : Code of practice for vegetables and fruits
- Part 4 : Code of practice for fish
- Part 5 : Code of practice for chilled table eggs

NOTE – Parts 2 to 5 are intended to be used in conjunction with Part 1.

The maintenance of the cold chain is integral to uphold the safety of consumers and the protection of public health while preserving the nutritional and sensory qualities of perishable vegetables and fruits. The cold chain extends their shelf life by slowing down microbial spoilage and/or biological contamination. It also reduces unnecessary food wastage along the chain.

The introduction of new and modern technologies in food production at the farm, processing and packaging have revolutionised the whole concept of chilled and frozen food preparation, storage and transportation. These processes have a significant impact on consumers' perception and expectations of food safety and quality. Proper management of every link of the cold chain constitutes an integral part in the production, storage and transportation of wholesome and safe chilled and frozen foods to the consumers.

SS 668 : Part 3 was developed to meet the increasing demand by consumers for value-for-money agri-produce, in terms of safety, freshness, quality and availability over a sustained manner.

This Code covers the major links of cold chain management of vegetables, and fruits starting from farm, packing house, transportation, distribution and wholesale centre to retail.

Annex A of SS 668 : Part 3 is reproduced with the kind permission of Postharvest Technology Center from Dr. Marita Cantwell. 2001. Properties and Recommended Conditions for the Long Term Storage of Fresh Fruits and Vegetables <http://postharvest.ucdavis.edu/files/230191.pdf> (Accessed March 24, 2020).

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "Mature Standards". Mature Standards will not be subject to further review, unless there are requests to review such standards.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore and the Singapore Standards Council shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR. Although care has been taken to draft this standard, users are also advised to ensure that they apply the information after due diligence.*
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Cold chain management of chilled and frozen foods – Part 3 : Code of practice for vegetables and fruits

0 Introduction

The maintenance of a cold chain for vegetables and fruits is important for maintaining the freshness, shelf life, quality (including nutritional value and sensory characteristics) and safety of perishable vegetables and fruits for human consumption. The cold chain helps to extend the shelf life of vegetables and fruits by slowing down the deterioration process caused by exposure to higher temperatures, accumulation of ethylene gas and microbial spoilage. The maintenance of the cold chain for vegetables and fruits is more complex than for other products as harvested vegetables and fruits are still living and respiring. Therefore, both temperature and relative humidity affect the freshness and quality of vegetables and fruits (as explained in Annex A). It is important to measure and record the surface temperature of vegetables and fruits at each link of the cold chain. This provisions in this code are not exhaustive. The code is useful as a reference for the general principles of cold chain management of vegetables and a fruit, as the cold chain is an important element of the quality assurance system of vegetables and fruits.

Modern technologies for vegetable and fruit production at the farm, pre-harvest considerations, post-harvest handling techniques, packaging, storage, distribution and transportation modes constitute integral parts of the vegetable and fruit cold chain management processes. All of these processes have a significant impact on the quality as well as shelf life of vegetables and fruits. Only proper management at every stage of this cold chain would enable the supply of fresh, quality, wholesome and safe vegetables and fruits for human consumption.

Many significant advantages can be derived by the business partners and consumers in various stages through the adoption and implementation of this code. This code will help clarify uncertainty and misconceptions concerning the handling, quality, wholesomeness and safety of vegetables and fruits. Proper management of the cold chain will ensure that nutritional and sensory qualities of vegetables and fruits are preserved while wastage arising from microbial spoilage, physiological breakdown and physical injuries to vegetables and fruits throughout the supply chain is greatly reduced, thus resulting in fresher and higher quality vegetables and fruits which can command a higher value in the market. Through proper management of the cold chain, there will be an increase in productivity to all parties along the value chain.

1 Scope

This code specifies cold chain requirements for an organisation carrying out post-harvest preparation and related activities. It aims to assist the organisation to adopt the appropriate guidelines to demonstrate its ability to consistently meet cold chain requirements. This code will not define the manufacturing requirements for processes or repeat the general technical requirements of a cold chain system listed in SS 668 : Part 1.

This code provides specific cold chain requirements for vegetables and fruits covering pre-harvest and harvesting practices at the farm, post-harvest preparation and minimal handling such as cutting, etc., before packing, cold storage, transportation and distribution to ensure their safety, quality and wholesomeness, and safeguard public health.

This code is applicable to whole, intact, minimally cut vegetables and fruits which are not further processed. It covers whole leafy, headed and fruited vegetables, roots, herbs and fruits.

The objectives of this code are to:

- establish a quality assurance system and provide benchmarks for the management of temperature and relative humidity profiles in the stages of cold chain for fresh vegetables and fruits;
- establish and implement best practices in cold chain management of fresh vegetables and fruits for adoption by the industry, especially for import/export and local production.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

SS 668 : Part 1 Cold chain management of chilled and frozen foods – Part 1: General requirements