

SS 683-1:2022
(ICS 27.200; 67.260)

SINGAPORE STANDARD

**Specification for ammonia refrigeration system
in cold chain for food businesses**

– Part 1 : Design, installation and commissioning

SS 683-1:2022
(ICS 27.200; 67.260)

SINGAPORE STANDARD

**Specification for ammonia refrigeration system in
cold chain for food businesses**

– Part 1 : Design, installation and commissioning

Published by Enterprise Singapore

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilised in any form or by any means, electronic or mechanical, including photocopying and microfilming, without permission in writing from Enterprise Singapore. Request for permission can be sent to: standards@enterprisesg.gov.sg.

© Enterprise Singapore 2022

ISBN 978-981-5073-24-9

Contents

	Page
Foreword _____	3
0 Introduction _____	4
1 Scope _____	4
2 Normative references _____	4
3 Terms and definitions _____	5
4 Design _____	8
5 Installation of ammonia refrigeration system _____	19
6 Commissioning _____	21
 Annex	
A System pressure testing certificate _____	22
 Table	
1 Alarm response _____	18
 Bibliography _____	 23

Foreword

This Singapore Standard was prepared by the Working Group on Ammonia Refrigeration System set up by the Technical Committee on Workplace Health and Safety under the purview of the Quality and Safety Standards Committee.

The SS 683 series comprises the following parts under the general title of “Specification for ammonia refrigeration system in cold chain for food businesses”:

Part 1 – Design, installation and commissioning

Part 2 – Operation, inspection, servicing and maintenance

Part 3 – Emergency response plan and the recovery process

Although HFC are not ozone-depleting substances (ODS), they are greenhouse gases with high global warming potential and are commonly used as alternatives to chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC).

With the reduction in the global supply of ODS (i.e. CFC, HCFC) and HFC refrigerants, industries are turning to natural refrigerants such as ammonia as alternatives. Ammonia, with its zero global warming and ozone depleting potential, good thermodynamic efficiency and a manageable pressure rating, is considered to be a potential refrigerant to meet industrial refrigeration demands.

It is presupposed that in the course of their work, users will comply with all relevant regulatory and statutory requirements. Some examples of relevant regulations and acts are listed in the Bibliography. The Singapore Standards Council and Enterprise Singapore will not be responsible for identifying all of such legal obligations.

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.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

Specification for ammonia refrigeration system in cold chain for food businesses – Part 1: Design, installation and commissioning

0 Introduction

0.1 Ammonia, which is used as a refrigerant in the cold chain for food business, has toxic and flammable properties. It is a preferred refrigerant for low temperature processing and cold storage due to its many benefits such as being a natural refrigerant, and has both ozone depletion potential and global warming potential equal to zero. Ammonia is classified as B2L gas (higher toxicity/lower flammability) under ISO 817:2014.

0.2 Ammonia gas is colourless and lighter than air. It has a sharp, pungent odour that serves as a warning of its presence. In refrigeration systems, ammonia is liquefied under pressure. Liquid ammonia, when released into the atmosphere, rapidly absorbs moisture in the air and forms a dense, visible white cloud of ammonium hydroxide, which is a corrosive alkaline liquid. It will settle to ground level and increase the risk of exposure to workers and the public.

0.3 Ammonia takes time to build up concentration to a level that is lethal to cause severe injury and death. However, high ammonia concentration can occur instantly due to a leak that can be lethal as well.

0.4 The threshold concentration at which ammonia can be detected varies among individuals and long-term exposure to ammonia can weaken an individual's ability to detect the gas. A person exposed to ammonia above 5 ppm can experience symptoms such as nausea, headache, eye, nose, throat and chest irritation. According to the local workplace safety and health regulatory requirements, the short-term permissible exposure limit (PEL) over a 15 min period is 35 ppm, while the long-term PEL over an 8 h period is 25 ppm. The immediately dangerous to life or health (IDLH) value defined by the United States' National Institute for Occupational Safety and Health (NIOSH) is 300 ppm.

0.5 The route of harmful exposure to ammonia is unlikely through food due to the unpalatable qualities that ammonia can render to food. At threshold odour and taste concentrations, ammonia is unlikely to be of health concern, hence no health-based guidance values have been proposed by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) and World Health Organization (WHO). The safety of food, when ammonia leakage incident occurs, may be assessed by organoleptic or sensory examination, of which below the level of detection could be assessed as fit for consumption. In addition, comparison of the similarity in ammonia levels between uncontaminated samples and potentially contaminated samples (which are of similar in nature to the uncontaminated samples) could inform if the food is fit for consumption.

1 Scope

This standard provides the specification for safe design, installation and commissioning of an ammonia refrigeration system in cold chain for food businesses.

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.

ANSI/IIAR Standard 2:2014 Safe design of closed-circuit ammonia refrigeration systems

ANSI/IIAR Standard 3:2017	Ammonia refrigeration valves
SS 638	Code of practice for electrical installations
ISO 21922	Refrigeration systems and heat pumps – Valves – Requirements, testing and marking