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Thermal containers — Safety standard for refrigerating systems using flammable refrigerants — Requirements for design and operation

Conteneurs thermiques — Norme de sécurité pour les systèmes réfrigérants utilisant des fluides frigorigènes inflammables — Exigences de conception et de fonctionnement

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 104, *Freight containers*, SC 2, *Specific purpose containers*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document has been developed to enable the use of flammable refrigerants in refrigerated thermal containers. This document enables container owners and operators to understand and validate the risks associated with operating refrigerating equipment using previously non-acceptable flammable refrigerants. The goal is to achieve an acceptable level of safety for container refrigerating systems using flammable refrigerants as for container refrigerating systems using non-flammable refrigerants.

The background for initiating the development of this document was the foreseeable impact of global and national regulations on hydrofluorocarbons (HFCs) currently used in thermal containers. Hydrofluorocarbons are listed in the Kigali Amendment to the Montreal Protocol from 2016 due to the high global warming potential (GWP) of HFCs and a phase down in the use and availability of R134a, R404A and, for low temperature, R23, is expected in intermodal transport refrigeration.

This document is intended to complement ISO 1496-2 but not to replace existing standards such as the ISO 5149 series. It provides minimum requirements for the design of a refrigerating system and follows a risk-based approach to reduce, but not eliminate, the risks to persons, assets and the environment.

The working group, which developed this document consisted of representatives from refrigerating system manufacturers, refrigerated container box manufacturers, shipping lines, classification societies, equipment owners and other interested industry experts.

Thermal containers — Safety standard for refrigerating systems using flammable refrigerants — Requirements for design and operation

1 Scope

This document describes the design of the mechanical refrigeration unit (MRU) and operation of container refrigerating systems in all anticipated operational modes and locations.

It describes the industry's best practices for the safe operation of flammable refrigerants in refrigerating systems used in thermal freight containers operated on board ships, in terminals, on road, on rail and on land.

This document addresses the use of flammable refrigerants with classifications defined in ISO 817, defined as 2L, 2 and 3, except R717 (Ammonia).

This document describes an operational mode risk assessment (OMRA) which uses methods such as HAZOP (Hazard and operability analysis), FMEA (Failure mode and effects analysis), or FTA (Fault tree analysis) or combination of methods.

This document specifies requirements for the validation and consideration of possible safety concepts and protective devices within the OMRA process, including charge release tests, simulation, and function tests of the associated protective equipment. It defines test requirements for shock, impact, and vibration. A validation procedure is given to demonstrate that risks from hazardous events are investigated and their severity and frequency are meaningfully reduced, with the aim of achieving tolerable risk values.

The obligations of the manufacturer, the container owner as well as the responsible operator are described, as well as how stakeholders can investigate and mitigate risks associated with the use of flammable refrigerants.

Finally, this document describes the requirements of service and maintenance when working with flammable refrigerants.

This document is restricted to refrigerating systems integrated with or mounted on ISO thermal containers according to ISO 1496-2. It provides minimum requirements for reducing the risk associated with the use of flammable refrigerants.

The scope is limited to container refrigerating systems operated in conjunction with the carriage of refrigerated cargo as operating reefer (OR) or when used as a non-operating reefer (NOR) or when empty for positioning — while in intermodal transit. Static land-based continuous operations are excluded.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 817, *Refrigerants — Designation system*

ISO 1496-2, *Freight containers — Specification and testing — Thermal containers*

ISO 5149 (all parts), *Refrigerating systems and heat pumps — Safety and environmental requirements*