SLOVENSKI STANDARD
SIST EN 17893:2024

01-september-2024

Toplotna cestna vozila - Varnostni standard za toplotno upravljane sisteme, ki pri prevozu blaga uporabljajo vnetljiva hladilna sredstva - Zahteve in proces analize tveganja

Thermal road vehicles - Safety standard for temperature-controlled systems using flammable refrigerants for the transport of goods - Requirements and risk analysis process

Anforderungen und Risikoanalyseverfahren für Kühlanlagen für den Straßentransport von temperaturempfindlichen Gütern, die mit brennbaren Kältemitteln betrieben werden

Véhicules routiers réfrigérés - Norme de sécurité applicable aux systèmes sous contrôle de température utilisant des fluides frigorigènes inflammables pour le transport de marchandises - Exigences et processus d'analyse des risques

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EUROPEAN STANDARD

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English Version

Thermal road vehicles - Temperature-controlled systems using flammable refrigerants for transport of goods - Requirements and risk analysis process

Véhicules routiers réfrigérés - Systèmes sous contrôle de température utilisant des fluides frigorigènes inflammables pour le transport de marchandises - Exigences et processus d'analyse des risques

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This European Standard was approved by CEN on 8 April 2024.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 17893:2024) has been prepared by Technical Committee CEN/TC 413 “Insulated means of transport for temperature sensitive goods with or without cooling and/or heating device”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2024, and conflicting national standards shall be withdrawn at the latest by December 2024.

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

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

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Introduction

For many years, hydrofluorocarbons (HFCs) have been the preferred refrigerants used in refrigerating systems of truck and trailer road vehicles and vans (TRV). However, the use of these refrigerants is being now considered as unacceptable due to their contribution to global warming. Regulation (EU) No 517/2014 of the European Parliament and of the Council imposes provisions for the reduction of the use of HFCs, in order to reduce the emissions of these fluorinated gases and lower the impact of their use on climate change. The use of HFCs is regulated in all EU Member States, the United Kingdom and EFTA countries and these fluorinated gases are to be phased down.

The continuous improvement of refrigerating systems in terms of reduction of greenhouse gas (GHG) emissions and energy efficiency results in the deployment of technologies which has entailed the use of flammable refrigerants. The use of these flammable refrigerants in transport refrigeration units (TRU's) may raise specific safety concerns or pose additional hazards which should be considered in the design phase and during operation, correspondingly in all phases of the product life cycle. Leakage of flammable refrigerants may lead to fire, explosion, or toxicity when decomposed.

This document has been developed to enable the safe use of flammable refrigerants in TRU's. This document enables system manufacturers, owners, and operators to understand and validate the risks associated with operation, especially for maintenance and repair. This document provides requirements and methodology to an acceptable level of safety.

For TRV's this document supplements EN 378 (all parts) with specific additional requirements. It provides minimum requirements for a risk-based approach to reduce the threat to persons, assets, and the environment.

The working group which developed this document consisted of representatives from refrigerating system manufacturers, refrigerated vehicle body builder, notified body, equipment owners and other interested industry experts.

1 Scope

This document specifies requirements for the use of flammable refrigerants class A2L, A2 and A3 as defined in ISO 817 with regard to:

— design and construction of the refrigerating system (as far as not specified in EN 378-2);

— operation;

  — in all anticipated operational modes and locations;

  — including continuous idling during standstill;

— service, maintenance and decommissioning;

— for the investigation and mitigation of risk for thermally insulated means of transport, including: trucks, trailers, tanks, vans (light commercial vehicles), wagons, containers for land transport, small containers, packaging.

This document describes an Operational Mode Risk Assessment (OMRA), which uses methods such as Hazard and Operability Analysis (HAZOP), Failure Mode and Effects and Criticality Analysis (FMECA), or Fault Tree Analysis (FTA) or a combination of these methods.

The document specifies requirements:

— for the validation of possible safety concepts and protective devices within the OMRA process, including charge release tests, simulation, and function tests of the associated protective equipment;

— for tests related to the application;

— using methodologies to achieve tolerable risk values.

Mobile air conditioning systems in cars are covered in ISO 13043 and refrigerated containers conforming to ISO 20854 are excluded.

This document could be used for class “B” refrigerants providing the OMRA is adjusted to account for their specific properties.

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.

EN 378-1:2016+A1:2020, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Basic requirements, definitions, classification and selection criteria*

EN 378-2:2016, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

EN 378-4:2016+A1:2019, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 4: Operation, maintenance, repair and recovery*

EN 1127-1:2019, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 1736:2008, *Refrigeration systems and heat pumps — Flexible pipe elements, vibration isolators, expansion joints and non-metallic tubes — Requirements, design and installation*

EN 14624, *Performance of portable locating leak detectors and of fixed gas detectors for all refrigerants*

EN ISO 7010:2020, *Graphical symbols — Safety colours and safety signs — Registered safety signs (ISO 7010:2019, Corrected version 2020-06)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal) (IEC60068-2-6)*

EN 60068-2-75, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests (IEC 60068-2-75)*

IEC 60079-10-1:2020, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*

EN 60079-14, *Explosive atmospheres — Part 14: Electrical installations, design, selection and erection (IEC 60079-14)*

IEC 60079-15:2020, *Explosive atmospheres — Part 15: Equipment protection by type of equipment "n"*

IEC 60079-29-1, *Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*

IEC 60335-2-40:2018, *Household and similar electrical appliances — Safety — Part 2-40: Particular requirements for electrical heat pump, air-conditioners and dehumidifiers*

ISO 817:2014, *Refrigerants — Designation and safety classification*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
air ventilation duct
connection between an inside compartment volume and an outside and/or other compartment volume as part of a protective device that can be used for ventilation of the compartment volume to dilute unexpected refrigerant release

3.2
alarm system
system constituting all electrical and electronic parts of the refrigerating system which monitor the correct function of the refrigerating system and the protective device(s) and may give a warning in case of malfunctioning or refrigerant leakage

3.3
authorized service facility
service facility that is authorized by the manufacturer to repair and to maintain the TRU

3.4
compartment volume
insulated closed space (cargo compartment) which is cooled by the refrigerating system or heated and not intended to be occupied, except periodically for loading and unloading

Note 1 to entry: The compartment volume can have several separate sections.

Note 2 to entry: The compartment volume can include the evaporator space.

Note 3 to entry: The compartment volume can also be built in a vehicle using an heat insulation kit, refer to EN 17066-1:2019, 3.1.8.

Note 4 to entry: For the definition of a compartment refer to EN 17066-1:2019, 3.1.1.6.

3.5
condenser space
space in the outside of the TRU where condenser, condenser fan and associated pipes are located

Note 1 to entry: The air-cooled condenser section is not a confined space.

Note 2 to entry: The condenser section corresponds to control volume II described in Annex A.

3.6
control volume
CV
theoretical volume representing a space in which a flammable atmosphere can occur as a consequence of a refrigerant leak and the ventilating condition

Note 1 to entry: It can be delimited by the internal or external space of the vehicle dimensions , and/or by specific component compartments.

Note 2 to entry: A description of CVs is included in Annex A.

3.7
enhanced tightness
absence of refrigerant leakage in the circuit when due to the design and measures of maintenance any of the tightness tests or tightness monitoring appropriate for the application does not reveal any hazardous leaks during normal operations and expected malfunctions

[SOURCE: EN 1127-1:2019, 3.2, modified — The words “refrigerant” and “in the circuit” and the Note 1, 2, 3 to entry have been added.]

Note 1 to entry: Fugitive emissions (see 3.31.1) are regarded in this application as leaks which will not result to significant hazards according to EN ISO 12100:2010, 3.8.

Note 2 to entry: Additional information can be found in EN 1127-1:2019, Annex B.

Note 3 to entry: Clause 6, Clause 8 and especially Clause 9 provide information on design and operational aspects to maintain tightness, permanently ensured by means of enhanced maintenance and supervision.

3.8
environment ventilation
environmental condition related to the footprint of the vehicle, on which the TRU is mounted, capable of diluting releases of hazardous substances

Note 1 to entry: Defined ventilation conditions are sufficient to dilute fugitive emissions to non-hazardous concentration.

3.8.1
open air
any unenclosed space, possibly but not necessarily roofed, with, as a minimum, natural ventilation

Note 1 to entry: The environment ventilation "open air" refers to or represents areas or operating sites such as loading/unloading areas, inspection, (roofed) repair areas.

[SOURCE: EN 378-1:2016+A1:2020, 3.2.8, modified — The words "with, as a minimum, natural ventilation" and Note 1 to entry have been added.]

3.8.2
well-ventilated
area which is naturally or mechanically ventilated

Note 1 to entry: The environment ventilation "well-ventilated" refers or represent areas or operating sites such as workshops, system repair areas where ventilation requirements are established according to workplace requirements.

3.8.3
non-well-ventilated
area other than open air or well-ventilated

Note 1 to entry: The environment ventilation "non-well-ventilated" should be considered if an artificial or forced ventilation system is not in operation (due to power failures or other type of malfunction).

Note 2 to entry: For release rate and accumulation time of hazardous substances in non-well-ventilated areas or operating sites see Annex D.

3.9
evaporator space
space containing the evaporator, associated piping, connections, housing and air ducts inside the cold compartment volume

Note 1 to entry: The evaporator space corresponds to CV III (see Annex A).

3.10
external power supply
connected to grid or independent generator

3.11
type of failure

3.11.1
rare malfunction
type of malfunction which may happen only in rare instances

Note 1 to entry: Rare malfunctions could include unanticipated conditions that are not covered by the TRU design such as unexpected loose connection, or unexpected corrosion that results in a release. Where releases due to corrosion or similar conditions may or could reasonably be expected as part of the plant operations then this is not considered as a rare malfunction.

[SOURCE: IEC 60079-10-1:2020, 3.7.3 modified — NOTE 1 has been omitted and NOTE 2 has been modified]

3.11.2
catastrophic failure
reasonably unexpected occurrence which exceeds the design parameters of the TRU and control system resulting in an accidental type release of flammable refrigerant

Note 1 to entry: Catastrophic failures in the context of this standard include, for example, major accidents, crash such as the rupture of a component, equipment or piping such as total breakdown of a flange or seal.

[SOURCE: IEC 60079-10-1:2020, 3.7.4, modified — In the definition, the word “process plant” has been replaced with “TRU” and the words “an accidental type” have been added. In addition, NOTE 1 is modified.]

3.12
flammable atmosphere
mixture with air, under atmospheric conditions, of flammable refrigerant in the form of gas or vapour, which after ignition, permits self-sustained flame propagation

Note 1 to entry: For example, a mixture of flammable refrigerant fluid with air under atmospheric conditions.

[SOURCE: IEC 60079-10-1:2020, 3.2]

3.13
flammability limit
Note 1 to entry: The flammability limits are function of temperature and humidity. For refrigerants flammability, ISO 817:2014 defines test conditions of 50 % relative humidity at 23,0 °C and 101,3 kPa for burning velocity and LFL/UFL measurements. The effect of a reduced lower flammability limit and an increased upper flammability limit at higher operational humidity and temperature levels can be taken into account in the operational mode risk assessment.

3.13.1
lower flammability limit
LFL
minimum concentration of the refrigerant that is capable of propagating a flame through a homogeneous mixture of the refrigerant and air under the specified test conditions at 23,0 °C and 101,3 kPa

[SOURCE: ISO 817:2014, 3.1.24, modified — NOTE 1 and NOTE 2 have been omitted.]

3.13.2
upper flammability limit
UFL
concentration of flammable gas or vapour in air, above which the gas atmosphere is not flammable

[SOURCE: IEC 60079-10-1:2020, 3.6.13, modified — In the definition, the words “or mist” have been removed after “vapour”. Also, at the end, after “above which”, “an explosive gas atmosphere will not be formed” has been changed to “the gas atmosphere is not flammable”.]

3.14
flammable refrigerant
refrigerant with a classification of class 2L, 2 or 3 in compliance with ISO 817:2014 classification

3.14.1
auto-ignition temperature
AIT
lowest temperature of a hot surface at which, under specified conditions, an ignition of a flammable gas or vapour in mixture with air occurs

[SOURCE: IEC 60079-10-1:2020, 3.6.11, modified — In the definition, the words “/inert gas” have been removed after “air”]

3.14.2
reaction threshold temperature
RTT
lowest temperature of a substance at which a chemical can be decomposed spontaneously in a normal atmosphere, in the presence of an external source of ignition, such as an open flame, hot surface or spark

Note 1 to entry: As an estimation, the following values may be used: RTT_{est} = AIT − 100 °C.

3.14.3
hot surface ignition temperature
HSIT
highest temperature at which a refrigerant does not ignite when tested in accordance with Annex KK in IEC 60335-2-40:2018

[SOURCE: IEC 60335-2-40:2018]

3.15
flammable substance
substance in the form of gas, vapour, liquid, or mixtures of these, able to propagate a flame from an ignition source

3.16
hazardous area
area in which a flammable or toxic atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for construction, installation or use of apparatus

[SOURCE: IEC 60079-10-1:2020, 3.3.1, modified — In the definition, the word “explosive” has been replaced with “flammable and toxic”.]