



SLOVENSKI STANDARD

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

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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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 413.

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European foreword

This document (prEN 17893:2022) 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 document is currently submitted to the CEN Enquiry.

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association.

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Introduction

For many years, hydrofluorocarbons (HFCs) have been the preferred refrigerants used in truck and trailer road vehicles and vans (TRV). However, the use of these refrigerants is being now considered as unacceptable by industry and civil society, 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 hydrofluorocarbons (HFCs), in order to reduce the emissions of these fluorinated gases and lower the impact of their use on the climate change. The use of HFC refrigerants is regulated in all EU Member States, the United Kingdom and EFTA countries and these fluorinated gases are expected to be phased-down in the next 10 years in several steps.

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 entail the use of flammable refrigerants. The use of these flammable refrigerants in transport refrigeration units (TRU) 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. The market requires the introduction of any new technology to be "as safe as or safer than before", this document provides requirements and methods to achieve this goal and an acceptable level of safety.

For truck and trailer road vehicles and vans this document supplements EN 378 (all parts) with specific additional requirements for the design, operation, service, and repair. It provides minimum requirements for a risk-based approach to reduce the risks to persons, assets, and the environment.

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

prEN 17893:2022 (E)**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 (as far as not specified in EN 378-2);
- operation;
 - in all anticipated operational modes and locations;
 - including continuous idling during standstill;
- service and maintenance 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 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;
- for tests related to the application;

using methodologies to achieve tolerable risk values.

Passenger air conditioning or equivalent mobile air conditioning systems covered in ISO 13043 and refrigerated containers on skeletal trailers conforming to ISO 20854 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.

EN 378 (all parts), *Refrigerating systems and heat pumps — Safety and environmental requirements*

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

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

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

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

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

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

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

IEC 60079-15:2010, *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, *Refrigerants — Designation and safety classification*

ISO 5149-2:2014, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

ISO 13971, *Refrigeration systems and heat pumps — Flexible pipe elements, vibration isolators, expansion joints and non-metallic tubes — Requirements and classification*

ISO 14903, *Refrigerating systems and heat pumps — Qualification of tightness of components and joints*

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 inside compartment volume and outside 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/or 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

prEN 17893:2022 (E)**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 insulation kit.

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 described in Annex A.

3.6**control volume**

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

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

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

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3.7**enhanced tightness**

absence of leakage 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]

Note 1 to entry: Fugitive emissions (see 3.31.1) are regarded as non-hazardous leaks in this application.

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

Note 3 to entry: Clauses 6, 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 C.

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 control volume III (see Annex A).

3.10

failure

—

3.10.1

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 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]

prEN 17893:2022 (E)**3.10.2****catastrophic failure**

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

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.]

3.11**external power supply**

condition where a connection to electric power supply is present

3.12**flammable atmosphere**

mixture with air, under atmospheric conditions, of flammable substances 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**flammable limit¹**

—

3.13.1**lower flammable 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 flammable 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”.]

¹ 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 flammable limit and an increased upper flammable limit at higher operational humidity and temperature levels can be taken into account in the operational mode risk assessment.

3.14

flammable refrigerant

refrigerant with a classification of class 2L, 2 or 3 in compliance with ISO 817 classification, refrigerants excluding ammonia

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 or above 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: $RTT_{est} = AIT - 100 \text{ }^\circ\text{C}$.

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”.]

3.16.1

non-hazardous area

area in which a flammable or toxic atmosphere is not expected to be present in quantities such as to require special precautions for construction, installation and use of equipment

[SOURCE: IEC 60079-10-1:2020, 3.3.2, modified — In the definition, the word “explosive” has been replaced with “flammable and toxic”.]