SLOVENSKI STANDARD
SIST CEN/TR 14739:2004

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Shema za izvedbo ocene tveganja za vnetljiva hladila pri gospodinjskih hladilnikih in zamrzovalnikih

Scheme for carrying out a risk assessment for flammable refrigerants in case of household refrigerators and freezers

Schema für die Durchführung einer Risikobewertung für brennbare Kältemittel bei Haushalt-Kühl- und Gefriergeräten

Schéma pour la réalisation d'une estimation des risques engendrés par les fluides frigorigenes inflammables dans les réfrigérateurs et congélateurs ménagers

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TECHNICAL REPORT

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Foreword

This document (CEN/TR 14739:2004) has been prepared by Technical Committee CEN/TC 182 "Refrigerating systems; safety and environmental requirements", the secretariat of which is held by DIN.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this CEN Technical Report: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The use of CFC and HCFC is restricted by Council Regulation 2037/2000 of the European Parliament.

Both HCs and HFCs can be used as refrigerants as well as blowing agents for insulation foams. HFC 134a is commonly used as refrigerant but can also be used as a blowing agent for insulation foam.

The environmental advantages of HCs are obvious as the Global Warming Potential (GWP) is lower compared to the GWP of HFC 134a. Therefore, a majority of household appliance manufacturers are phasing out HFCs in favour of HCs.

Table 1 — Values for GWP — Global Warming Potentials

Emissions with impact on the global warming	GWP 100 years
CFC-12	8 500
141b, HCFC	630
134a, HFC	1 300
245 fa, HFC	820
Cyclopentane, Isobutane	3
CO_2	1
Others (CH_4, N_2O)	(24,5; 320)

With regard to the global warming impact see as well Annex B of EN 378-1:2000 (TEWI).

1 Scope

The document gives a scheme for carrying out a risk assessment for flammable refrigerants in case of household refrigerators and freezers with refrigerants of group A3 according to EN 378-1, taking into consideration a sealed system and a refrigerant charge of not more than 150 g. Sealed systems are refrigerating systems in which all refrigerant containing parts are made tight by welding, brazing or similar permanent connection.

NOTE For risk assessment the method with flow diagrams is selected, because these are helpful for checking the possible ignition of the whole appliances and to estimate the probability of ignition. It takes EN ISO 12100, EN 1050, EN 1127, EN 60335-2-24/A53, E DIN 7003 into consideration.

At least the probability of deflagration is the product of multiplication of the probability of defects of different components and the probability for the presence of explosive atmosphere and the probability for the ignition sources.

2 Mode of consideration

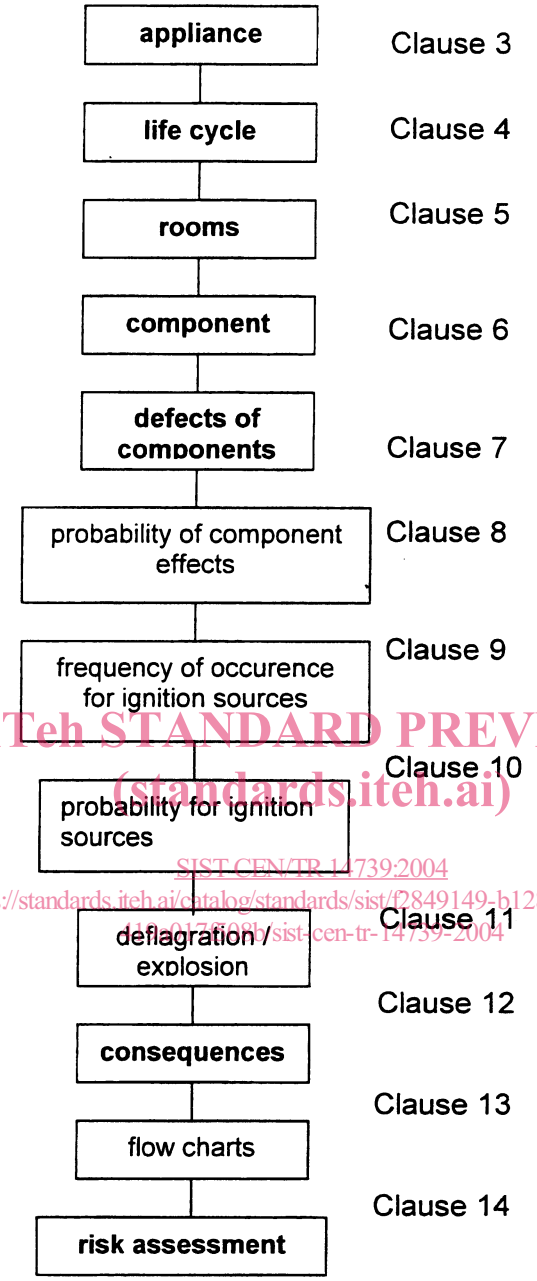


Figure 1 — Mode of consideration

Essential for the developed flow diagrams is the following mode of consideration:

First, each refrigerant containing component of a refrigerating system has to be considered for all stages of life cycle such as design, construction, production, storage, transportation, operation, maintenance, service and disposal. In principle it's necessary to sum up the risk assessment for each stage of life cycle. After considering the different stages of the life cycle it is necessary to consider the space in and around of the refrigerator and freezer where a leak may occur. At least the space is separated into four different rooms (see Figure 4). The next step of risk assessment is the estimation of possible defects of the different components. The single probability for all possible defects have to add up to the total frequency of occurrence of the hazard. The next step is the calculation of the probability for the presence of explosive atmosphere. And after that it's necessary to consider the different possible ignition sources such as vacuum cleaner, fan heater, etc.

At least the probability of deflagration is the product of multiplication of the probability of defects of different components and the probability for the presence of explosive atmosphere and the probability for the ignition sources.

3 Appliances

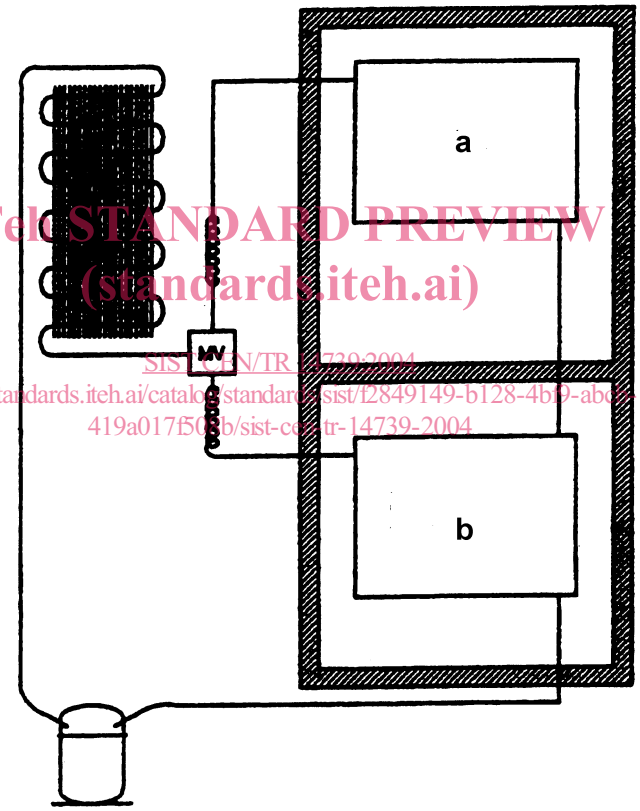
Examples of the most usual refrigerating systems:

Figure 2a: System with 1 compressor and 2 compartments

Figure 2b: System with 2 compressors and 2 compartments

Figure 2c: System with 1 compressor and 1 compartment

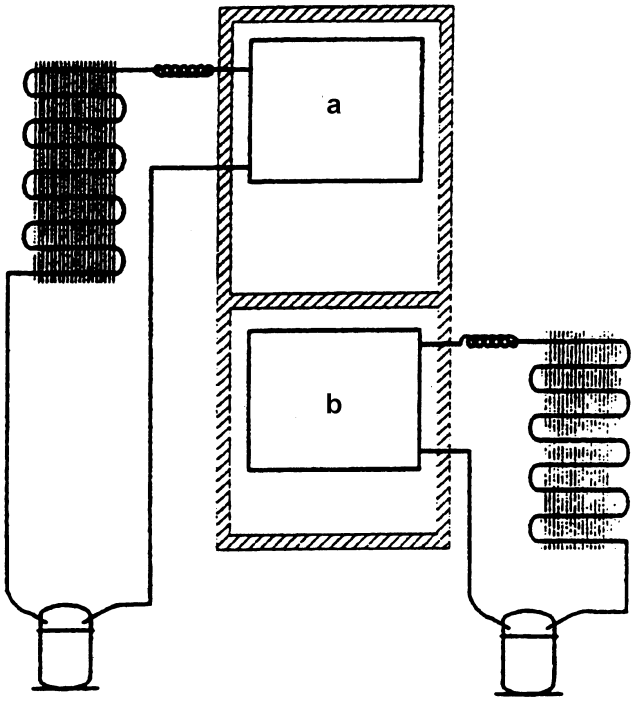
There are refrigerators, freezers and combinations of these appliances. They can be free-standing, installations in recess areas or beneath table tops.



Key

a Fridge
b Freezing compartment

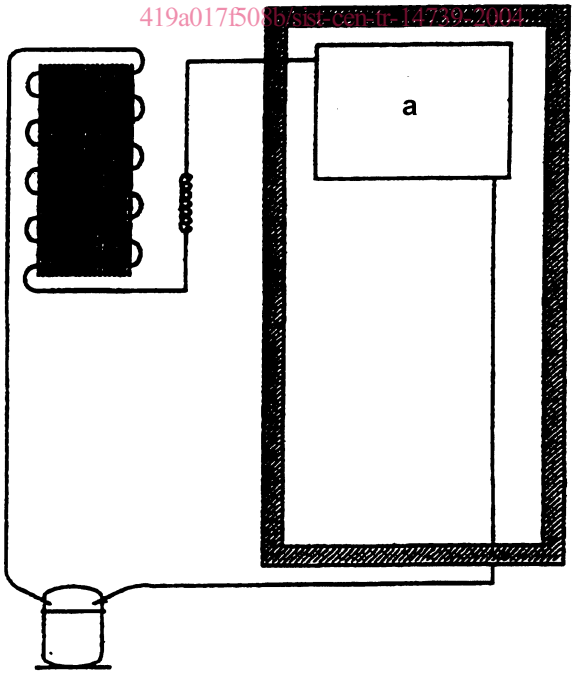
Figure 2a — System with one compressor and solenoid



Key

a Fridge
b Freezing compartment

Figure 2b — System with two compressors



Key

a Fridge/Freezing compartment

Figure 2c — System with one compressor

4 Life cycles

Important for customer and maintenance personal is transportation and storage with unpacked appliances, operation, maintenance, service and disposal (Figure 3). Responsible for design, construction, production, and to a certain degree for the transport and storage of packed appliances, is the manufacturer. The ad hoc group considered transportation and operation as the most important steps of life cycle. The typical life cycle time of a refrigerator or a freezer is 12 years[1].

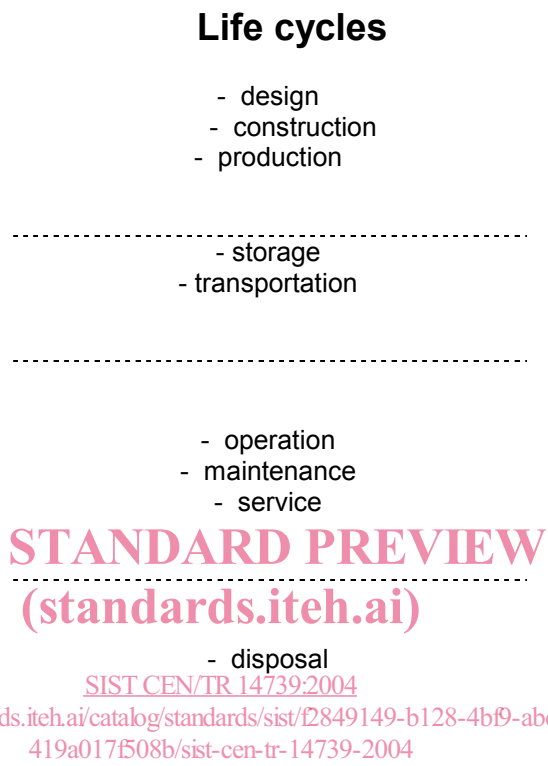


Figure 3 — Life cycles

Referring to operation it is necessary to consider the behaviour of refrigerators and freezers during "standstill" and "operation".

The influence factors for the appliance at standstill are the ambient temperature, charge of refrigerant, oil charge in the compressor and the inside volume of the refrigerating system. Only a quantity of refrigerant is vaporous in the system. The remaining quantity is dissolved in the oil of the compressor.

But if the appliance is in operation it's necessary to distinguish the following situations:

- compressor is running
- compressor is switched off

In general the behaviour of a leakage depends on it's location, if lying on the high or on the low pressure side.

[1] 12 years is the pragmatical value of the manufacturers.

5 Rooms

After considering the different stages of life cycles, the next step for risk assessment is to consider the different rooms. Because in case of a leak the space in and around the refrigerator is to be separated into four rooms, which are represented graphically in Figure 4. Room I consists of all inner rooms of the appliance, e.g. the fresh food storage compartment and the freezer compartment. Room II is defined as the room outside of the housing of the appliance between the back wall and the condenser of the compressor room. Room III is the room into which the appliance is built and the room for ventilation openings. And Room IV is the room in the surroundings of the appliance without rooms II and III.

In case of transport room IV includes room II and room III because an ignition source is only possible in the surroundings of the appliance (see as well Figure 4).

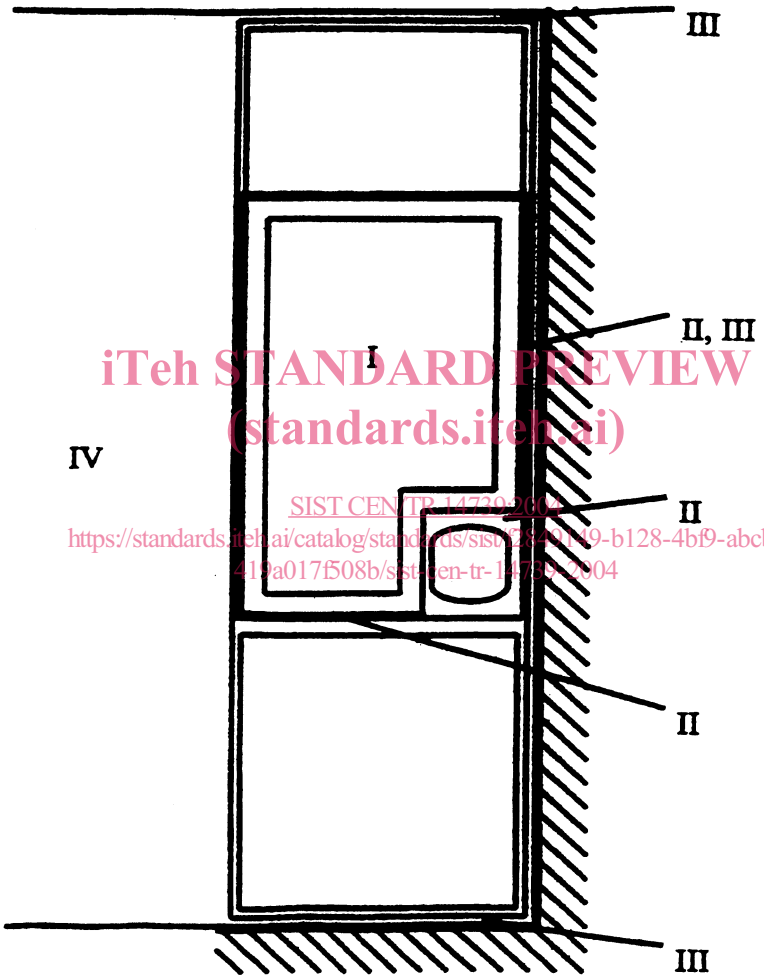


Figure 4 — Different rooms