SLOVENSKI STANDARD
oSIST prEN 12693:2023

01-maj-2023

Hladilni sistemi in toplotne črpalke - Varnostnotehnične in okoljevarstvene zahteve - Kompresorji za hladilne tekočine z iztiskavanjem

Refrigerating systems and heat pumps - Safety and environmental requirements - Positive displacement refrigerant compressors

Kälteanlagen und Wärmepumpen - Sicherheitstechnische und umweltrelevante Anforderungen - Verdrängerverdichter für Kältemittel

Systèmes de réfrigération et pompes à chaleur - Exigences de sécurité et d'environnement - Compresseurs volumétriques pour fluides frigorigènes

Ta slovenski standard je istoveten z: **prEN 12693**

ICS:

23.140	Kompresorji in pnevmatični stroji	Compressors and pneumatic machines
27.080	Toplotne črpalke	Heat pumps
27.200	Hladilna tehnologija	Refrigerating technology

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

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ICS

Will supersede EN 12693:2008

English Version

Refrigerating systems and heat pumps - Safety and environmental requirements - Positive displacement refrigerant compressors

Systèmes de réfrigération et pompes à chaleur - Exigences de sécurité et d'environnement - Compresseurs volumétriques pour fluides frigorigènes

Kälteanlagen und Wärmepumpen - Sicherheitstechnische und umweltrelevante Anforderungen - Verdrängerverdichter für Kältemittel

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 182.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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Contents

European foreword

This document (prEN 12693:2023) has been prepared by Technical Committee CEN/TC 182 “Refrigerating systems, safety and environmental requirements”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12693:2008.

The main changes with respect to the previous edition are listed below:

a) normative referenced updated

b) thermal hazards added to Clause 4 Table 2

c) requirements on vibration added to 5.1

d) requirements for spacings in 5.6.4 Table 3 adjusted

e) NOTE in 6.2.3 transferred to normative text

f) requirements for testing in 6.3.4 modified

g) editorially revised

This document has been prepared under a Standardization Request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s) / Regulation(s).

For relationship with EU Directive(s) / Regulation(s), see informative Annex ZA, which is an integral part of this document.

Introduction

This standard is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered are indicated in the scope of this standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

1 Scope

This document applies to positive displacement refrigerant compressors for stationary and mobile refrigerating systems and heat pumps defined in 3.1, hereafter called compressors.

It applies for compressors used in commercial and industrial appliances and with electrical energy supply including integral motors, up to 1 000 VAC and 1 500 VDC.

It applies to open drive, semi hermetic and hermetic motor compressors, which contain a positive compression function.

This document is not applicable to:

— compressors used in household appliance for which EN 60335-2-34 applies;

— compressors using water or air as refrigerant;

— compressors in vehicle air conditioning systems covered by a specific product standard, e.g. ISO 13043

This document does not deal with requirements for emission of noise and vibration .

NOTE 1 Compressors for automotive comfort air conditioning systems can be developed according e.g. SAE J 639.

NOTE 2 Noise emission depends on the complete installation of the built-in compressors and the corresponding operating conditions.

For semi-hermetic and open drive compressors which include moving parts and for which the external envelope is primarily designed for mechanical loads, thermal loads (to limit the possible deformation due to temperature), stiffness of the structure (external mechanical loads and weight of the equipment), taking into account established safe industrial practice, it is considered that pressure is not a significant design factor.

Attached parts covering other functions e.g. oil separators, oil coolers, suction accumulators comply to EN 14276-1 or EN 13445-6 (cast iron) or EN 13445-8 (aluminium) or show compliance to the relevant European requirements. This applies also to shells for hermetic compressors either welded or with any kind of permanent joint.

Requirements for compressors used in explosive atmospheres are not covered by this document.

NOTE 3 For further guidance see EN 13463-1.

This document deals with significant hazards, hazardous situations and events relevant to compressors, when they are used as intended and under conditions for misuse which are reasonably foreseeable by the manufacturer (see Clause 4).

This document specifies safety requirements for the design, construction, manufacture and testing, documentation and marking of compressors, including integral accessories, e.g. shut-off valve, if necessary.

The requirements in this document take account of the intended use, as defined in EN ISO 12100:2010, 3.12.

This document relates to the compressor itself which is to be incorporated in a refrigerating system.

This document is not applicable to compressors as defined in the scope which are manufactured before the date of publication.

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 1515-1:1999, *Flanges and their joints - Bolting - Part 1: Selection of bolting*

EN 1515-2:2001, *Flanges and their joints - Bolting - Part 2: Classification of bolt materials for steel flanges, PN designated*

EN 1515-3:2005, *Flanges and their joints - Bolting - Part 3: Classification of bolt materials for steel flanges, class designated*

EN 1515-4:2021, *Flanges and their joints - Bolting - Part 4: Selection of bolting for equipment subject to the Pressure Equipment Directive 2014/68/EU*

EN 1779:1999[1], *Non-destructive testing - Leak testing - Criteria for method and technique selection*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 13136:2013+A1:2018, *Refrigerating systems and heat pumps - Pressure relief devices and their associated piping - Methods for calculation*

EN 20898 (series), *Mechanical properties of fasteners*

EN 60034-1:2010,[2] *Rotating electrical machines - Part 1: Rating and performance (IEC 60034-1:2010, modified)*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2016, modified)*

EN 60529:1991,[3] *Degrees of protection provided by enclosures (IP Code) (IEC 60529 1989 + A1:1999 + A2:2013 + Cor.1:2019)*

EN 60999-1:2000, *Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included) (IEC 60999-1:1999)*

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[1] Document impacted by A1:2003.

[2] Document impacted by Corrigendum October 2010.

[3] Document impacted by A1:2000, A2:2013 and AC:2019-02.

EN 60999-2:2003, *Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units - Part 2: Particular requirements for clamping units for conductors above 35 mm² up to 300 mm² (included) (IEC 60999-2:2003)*

EN 61010-1:2010,[4] *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 1: General requirements (IEC 61010-1:2010 + COR:2011 + A1:2016, modified + A1:2016/COR1:2019)*

EN ISO 898-1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs with specified property classes - Coarse thread and fine pitch thread (ISO 898-1:2013)*

EN ISO 898-2:2022, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 2: Nuts with specified property classes – Coarse thread and fine pitch thread (ISO 898-2:2022)*

EN ISO 898-3:2018,[5] *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 3: Flat washers with specified property classes (ISO 898-3:2018 + Amd 1:2020)*

EN ISO 898-5:2012, *Mechanical properties of fasteners made of carbon steel and alloy steel - Part 5: Set screws and similar threaded fasteners with specified hardness classes - Coarse thread and fine pitch thread (ISO 898-5:2012)*

EN ISO 4126 (series), *Safety devices for protection against excessive pressure (ISO 4126 series)*

EN ISO 9606-1:2017, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1:2012 including Cor 1:2012 and Cor 2:2013)*

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

EN ISO 13732-1:2008, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13857:2019, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*

EN ISO 14120:2015, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

EN ISO 15607:2019, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2019)*

EN ISO 15614-1:2017,[6] *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2017 + Amd 1:2019)*

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[4] Document impacted by A1:2019 and A1:2019/AC:2019.

[5] Document impacted by A1:2021.

[6] Document impacted by A1:2019.

EN ISO 15614-2:2005, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 2: Arc welding of aluminium and its alloys (ISO 15614-2:2005)*

EN ISO 21922:2021, *Refrigerating systems and heat pumps - Valves - Requirements, testing and marking (ISO 21922:2021)*

CEN ISO/TR 15608:2017, *Welding — Guidelines for a metallic material grouping system (ISO/TR 15608:2017)*

ISO 9606-2:2004, *Qualification test of welders - Fusion welding - Part 2: Aluminium and aluminium alloys*

ISO 10816-3:2009,[7] *Mechanical vibration – Evaluation of machine vibration by measurements on nonrotating parts – Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 r/min and 15 000 r/min when measured in situ*

ISO 20816-1:2016, *Mechanical vibration — Measurement and evaluation of machine vibration — Part 1: General guidelines*

ISO 20816-8:2018, *Mechanical vibration — Measurement and evaluation of machine vibration — Part 8: Reciprocating compressor systems*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 378-1:2016+A1:2020, EN ISO 12100:2010 and the following apply.

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

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

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

NOTE All pressures are gauge pressures unless otherwise specified.

3.1.1
positive displacement compressor
compressor in which compression is obtained by changing the internal volume of the compression chamber

[7] Document impacted by Amd.1:2017.

3.1.2
maximum allowable pressure
PS
maximum allowable pressure as stated by the compressor manufacturer, chosen by the manufacturer for each pressure stage of the compressor

Note 1 to entry: The common situation is that different values for PS are chosen for each pressure stage of the compressor.

Note 2 to entry: There are in minimum two pressure stages on each compressor: the low pressure side (LP) and the high pressure side (HP), but additional intermediate pressure stage(s) can be present.

Note 3 to entry: The individual pressure stage of a compressor is connected to the corresponding "part of the refrigerating system", as defined in EN 378-1:2016+A1:2020, 3.1.8.

3.1.3
compressor overflow device
device specifically intended to protect only the compressor against bursting caused by abnormal conditions, e.g. the discharge valve shut

Note 1 to entry: The device relieves from the high pressure/intermediate side of the compressor to a lower pressure side.

Note 2 to entry: The device may be a bursting disc or may be a spring loaded overflow valve. Spring loaded overflow valves can be either back pressure compensating or back pressure dependent type.

3.1.4
corrosion
all forms of material waste (e. g. oxidation, erosion, wear and abrasion)

3.1.5
maximum operating temperature
highest temperature that can occur during operation or standstill of the refrigerating system or during testing under test conditions

3.1.6
minimum operating temperature
lowest temperature that can occur during operation or standstill of the refrigerating system or during testing under test conditions

3.1.7
pressure bearing part
part, which is subject to stress due to internal pressure greater than 50 kPa (0,5 bar) gauge

3.1.8
main pressure bearing part
part, which constitute the envelope under pressure, essential for the integrity of the equipment

Note 1 to entry: Examples are housings, ends and flanges.

[SOURCE: EN 13445-1:2021]

3.1.9
maximum allowable pressure at ambient temperature (–10 °C to + 50 °C)
***PS*$_0$**
maximum pressure for which the refrigerant compressor is designed, as specified by the manufacturer, at ambient temperature (–10 °C to + 50 °C)

3.2 Symbols

For the purposes of this document, the symbols of Table 1 apply.

Table 1 — Symbols

A_L	Elongation after fracture where the measured length is equal or greater than 0,4 times of diameter of the rod	mm
A_5	Elongation after fracture where the measured length is equal to 5 times of diameter of the rod	%
a	Lifetime in years for calculating effect of corrosion; typically 20 years	—
C_Q	Factor to compensate for the quality of a casting	—
δ_e	Negative wall thickness tolerance	mm
e_{act}	Actual wall thickness at given measuring points of the refrigerant compressor to be tested	mm
e_B	Reference thickness is the minimum material thickness needed to give adequate strength to pressure bearing parts	mm
e_c	Reduction in wall thickness caused by occurrence of corrosion	mm
e_{con}	Wall thickness as specified in the design drawing	mm
KV	Impact rupture energy	J
KV_0	Threshold value of impact rupture energy, where the impact rupture energy is defined as independent of the temperature	J
KV_0^t	Standard value of impact rupture energy at standard temperature of the material	J
$KV_{TS\ min}$	Impact rupture energy at minimum operating temperature TS_{min}	J
P_F	Maximum allowable design test pressure	bar
PS	Maximum allowable pressure	bar
PS_0	Maximum allowable pressure at ambient temperature (–10 °C to + 50 °C)	bar
$PS_{TS\ max}$	Maximum allowable pressure at maximum operating temperature	bar
$PS_{TS\ min}$	Maximum allowable pressure at minimum operating temperature	bar
P_{Test}	Minimum burst test pressure (greater than P_F)	bar
$R_{p\ 0,2}$	Proof strength, 0,2 % offset at ambient temperature	MPa, N/mm^2
$R_{p\ 0,2\ TS\ min}$	Proof strength, 0,2 % offset at minimum operating temperature	MPa, N/mm^2
$R_{p\ 0,2/t}$	Proof strength, 0,2 % offset at temperature t	MPa, N/mm^2

$R_{p\ 0,2\ TS\ max}$	Proof strength, 0,2 % offset at maximum operating temperature	MPa, N/mm²
$R_{p\ 1,0}$	Proof strength, 1,0 % offset at ambient temperature	MPa, N/mm²
R_{eH}	Upper yield strength	MPa, N/mm²
$R_{eH\ TS\ max}$	Upper yield strength at maximum operating temperature	MPa, N/mm²
R_m	Tensile strength	MPa, N/mm²
$R_{m\ TS\ max}$	Tensile strength at maximum operating temperature	MPa, N/mm²
$R_{m\ act}$	Actual tensile strength of the material of the refrigerant compressor to be tested	MPa, N/mm²
$R_{m\ con}$	Tensile strength used for the design	MPa, N/mm²
S_C	Factor to compensate effects of corrosion	—
S_{fast}	relation between maximum allowable strength at operating temperature and the maximum allowable strength at ambient temperature	—
$S_{TS\ min}$	Factor taking into consideration the impact rupture energy reduction due to minimum operating temperature	—
$S_{TS\ max}$	Factor to allow for the reduction in strength due to the maximum operating temperature	—
S_σ	Factor to allow for the test pressure	—
σ_{con}	Initial design stress	MPa, N/mm²
σ_{corr}	Allowable stress values derived from σ_{con}	MPa, N/mm²
$t_{min\ 25}$	Lowest temperature at which pressure bearing parts can be used, if their load amounts to 25 % of the allowable design stress at 20 °C, taking the safety factors according to Table A.1 into account	°C
$t_{min\ 75}$	Lowest temperature at which pressure bearing parts can be used, if their load amounts to 75 % of the allowable design stress at 20 °C, taking the safety factors according to Table A.1 into account	°C
$t_{min\ 100}$	Lowest temperature at which pressure bearing parts can be used, if their load amounts to 100 % of the allowable design stress at 20 °C, taking the safety factors according to Table A.1 into account	°C
T_R	Design reference temperature is the minimum operating temperature TS_{min} adjusted. Used when determining TS_{min} based on reference thickness e_B	
T_S	Temperature adjustment of the design reference temperature T_R	
T_{KV}	Impact test temperature	
TS	Operating temperature	°C