



SLOVENSKI STANDARD
oSIST prEN 12693:2016
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**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

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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.

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European foreword

This document (prEN 12693:2016) 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.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2006/42/EC.

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

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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.

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1 Scope

This European Standard 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 standard is not applicable to:

- compressors used in household appliance for which EN 60335-2-34 applies;
- compressors using water or air as refrigerant.

This European Standard does not deal with requirements for vibration and noise.

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 should comply to EN 14276-1 or EN 13445-6 (cast iron) or EN 13445-8 (aluminium) or showing 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 standard.

NOTE 3 For further guidance see EN 13463-1.

This European Standard deals with all 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 European Standard 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 standard take account of the intended use, as defined in EN ISO 12100:2010, 3.12.

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

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

2 Normative references

The following referenced documents are indispensable for the application 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 378-1:2008+A2:2012, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Basic requirements, definitions, classification and selection criteria*

EN 378-2:2008+A2:2012, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

EN 378-3, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 3: Installation site and personal protection*

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

EN 837-1, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*

EN 837-3, *Pressure gauges - Part 3: Diaphragm and capsule pressure gauges - Dimensions, metrology, requirements and testing*

EN 1515 (all parts), *Flanges and their joints — Bolting*

EN 1779, *Non-destructive testing - Leak testing - Criteria for method and technique selection*

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

EN 12178, *Refrigerating systems and heat pumps - Liquid level indicating devices - Requirements, testing and marking*

EN 12516-2, *Industrial valves - Shell design strength - Part 2: Calculation method for steel valve shells*

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

EN 13445-2:2014, *Unfired pressure vessels — Part 2: Materials*

EN 13445-3, *Unfired pressure vessels - Part 3: Design*

EN 20898 (all parts), *Mechanical properties of fasteners*

EN 60034-1:2010, *Rotating electrical machines - Part 1: Rating and performance*

EN 60204-1:2006, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529)*

EN 60999 (all parts), *Connecting Devices — Electrical copper conductors — Safety requirements for screw-type and screwless-type clamping units*

EN 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 1: General requirements (IEC 61010-1)*

EN ISO 148-1, *Metallic materials - Charpy pendulum impact test - Part 1: Test method (ISO 148-1)*

EN ISO 898 (all parts), *Mechanical properties of fasteners made of carbon steel and alloy steel*

EN ISO 4126-2, *Safety devices for protection against excessive pressure - Part 2: Bursting disc safety devices (ISO 4126-2)*

EN ISO 9606-1, *Qualification testing of welders - Fusion welding - Part 1: Steels (ISO 9606-1)*

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

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

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

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

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

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

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EN ISO 15614-1, *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)*

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

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

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 378-1:2008+A2:2012, EN ISO 12100-1:2010 and the following apply.

Note 1 to entry: 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

prEN 12693:2016 (E)**3.1.2****specified maximum allowable pressure*****PS***

maximum allowable pressure as stated by the compressor manufacturer

3.1.3**specified maximum allowable standstill pressure*****PS_s***

maximum allowable value for the equalisation pressure in the compressor as stated by the compressor manufacturer

Note 1 to entry: This pressure corresponds to different maximum permissible ambient temperatures for different refrigerants (see 5.5.2).

Note 2 to entry: $PS_s \leq PS$.

3.1.4**compressor overflow device**

device specifically intended to protect 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.

3.1.5**Temperature load cases****3.1.5.1****min $t_{0\ 100}$**

lowest temperature at which component material can be used at a load of up to 100 % of the allowable design stress at 20 °C, taking the safety factors according to Table B.2 into account

3.1.5.2**min $t_{0\ 75}$**

lowest temperature at which component material can be used, at a load of up to 75 % maximum of the allowable design stress at 20 °C, taking the safety factors according to Table B.2 into account

3.1.5.3**min $t_{0\ 25}$**

lowest temperature at which component material can be used, at a load of up to 25 % maximum of the allowable design stress at 20 °C, taking the safety factors according to Table B.2 into account

3.1.5.4**fasteners**

screws, double end studs, reduced shank bolts, studs and nuts with designation system according to EN ISO 898 and EN 20898 or EN 1515 (property classes)

3.2 Symbols

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

Table 1 — Symbols

Symbol	Term	Unit
A	Elongation after fracture	%
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_{burst}	Burst pressure	MPa
$\min t_{0\ 100}$	The lowest temperature according to the European Standards of the respective materials at which the compressor can be used at a load of up to 100 % of the allowable design stress at 20 °C, taking into account the safety factors	
$\min t_{0\ 75}$	The lowest temperature at which the compressor can be used, if its load amounts to 75 % maximum of the allowable design stress at 20 °C, taking into account the safety factors	
$\min t_{0\ 25}$	The lowest temperature at which pressure parts can be used, if their load amounts to 25 % maximum of the allowable design stress at 20 °C, taking into account the safety factors	
P_F	Maximum allowable design test pressure	MPa
PS	Maximum allowable pressure in common sense, without regarding any influence of temperature	MPa or bar ^a
PS_S	Maximum allowable standstill pressure	MPa or bar ^a
PS_0	Maximum allowable pressure at ambient temperature (- 10 °C to + 50 °C) according to strength design (without temperature correction)	MPa or bar ^a
$PS_{TS\ max.}$	Maximum allowable pressure at maximum operating temperature	MPa or bar ^a
$PS_{TS\ min.}$	Maximum allowable pressure at minimum operating temperature	MPa or bar ^a
$R_{p\ 0,2}$	Proof strength, 0,2 % offset at room temperature	MPa, N/mm ²
$R_{p\ 1,0}$	Proof strength, 1,0 % offset at room temperature	MPa, N/mm ²
$R_{p\ 0,2\ TS\ max.}$	Proof strength, 0,2 % offset at highest operating temperature	MPa, N/mm ²
$R_{p\ 1,0\ TS\ max.}$	Proof strength, 1,0 % offset at highest operating temperature	MPa, N/mm ²
R_{eH}	Upper yield strength	MPa, N/mm ²
$R_{eH\ TS\ max.}$	Upper yield strength at highest operating temperature	MPa, N/mm ²
R_m	Tensile strength	MPa, N/mm ²
$R_{m\ TS\ max.}$	Tensile strength at highest operating temperature	MPa, N/mm ²
S_{con}	Safety factor	—
$S_{TS\ min.}$	Factor taking into consideration the impact strength reduction due to the minimum operating temperature	—

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Symbol	Term	Unit
$S_{TS\max.}$	Factor to allow for the reduction in strength due to the highest operating temperature	—
σ_{con}	Initial design stress	MPa, N/mm ²
TS	Operating temperature	°C
$TS_{\text{min.}}$	Lowest operating temperature	°C
$TS_{\text{max.}}$	Highest operating temperature	°C
NOTE 1 bar = 0,1 MPa = 100 kPa = 100 000 PA = 14,5 PSI.		
^a 1 MPa = 10 bar.		

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4 List of significant hazards

See Table 2.

This clause contains all significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for type of compressors and which requires action to eliminate or reduce the risk. The risk assessment shall be made according to EN ISO 12100. The compressors shall be manufactured in accordance with the principle listed in EN ISO 12100 to eliminate or reduce the foreseeable risk.

Table 2 — List of significant hazards, hazardous situations, safety requirements and/or measures

Significant hazard according to EN ISO 12100	Hazardous situation	Safety requirements and/or measures	Reference	Verification
Mechanical				
Moving parts	Possible injuries to human body	Guards	5.2	V
Loss of stability	Possible injuries at transport and operation	Fixing points Lifting points Lifting points	5.3 5.4, 7.3.1 6.2.5	V D / V T
Rupture or bursting	Possible injuries from ejected parts or fluid	Design criteria Strength test Tightness test	5.5 6.2.2, 6.2.3, 6.3.2 6.3.3	D T T V
Electrical				
Contact live parts	Possible injuries from electrocution	Design criteria Earthing Internal wiring High potential test Protection devices	5.6.1, 5.6.2, 5.6.3, 5.6.4, 5.6.5, 5.6.9 5.6.6 5.6.7 5.6.8, 6.2.4, 6.3.4 5.6.10	D D D T V
Electrostatic phenomena	Possible injuries from electric shock	Earthing	5.6.6	D