
Tlačna oprema za hladilne sisteme in toplotne črpalke - 1. del: Posode - Splošne zahteve

Pressure equipment for refrigerating systems and heat pumps - Part 1: Vessels - General requirements

Druckgeräte für Kälteanlagen und Wärmepumpen - Teil 1: Behälter - Allgemeine Anforderungen

Équipements sous pression pour systèmes de réfrigération et pompes à chaleur - Partie 1 : Récipients - Exigences générales

<https://standards.iteh.ai/standards/sist/b0416c3a-0fd5-4e70-9d7b-b8874491c63d/sist-en-14276-1-2020>

Ta slovenski standard je istoveten z: prEN 14276-1

ICS:

23.020.32	Tlačne posode	Pressure vessels
27.080	Toplotne črpalke	Heat pumps
27.200	Hladilna tehnologija	Refrigerating technology

oSIST prEN 14276-1:2017

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 14276-1

January 2017

ICS 23.020.30; 27.080; 27.200

Will supersede EN 14276-1:2006+A1:2011

English Version

**Pressure equipment for refrigerating systems and heat
pumps - Part 1: Vessels - General requirements**

Équipements sous pression pour systèmes de
réfrigération et pompes à chaleur - Partie 1 : Récipients
- Exigences générales

Druckgeräte für Kälteanlagen und Wärmepumpen -
Teil 1: Behälter - Allgemeine Anforderungen

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.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

European foreword.....	6
Introduction	7
1 Scope	8
2 Normative references	8
3 Terms and definitions	10
3.1 Definitions	10
3.2 Symbols, descriptions and units	13
4 Materials.....	16
4.1 General.....	16
4.2 Requirements for materials to be used for pressurized parts	16
4.3 Requirements for materials	16
4.3.1 General.....	16
4.3.2 Cladding.....	17
4.3.3 Special considerations	17
4.4 Requirements for prevention of brittle fracture	18
4.4.1 General.....	18
4.4.2 Material requirements.....	18
4.5 Material documentation	18
4.6 Materials for non-pressure retaining parts.....	18
5 Pressure Vessel classification.....	18
5.1 Category of vessel.....	18
5.2 Fluid classification	19
6 Design	20
6.1 General.....	20
6.2 Corrosion and corrosion protection	20
6.2.1 General.....	20
6.2.2 Internal corrosion.....	20
6.2.3 External corrosion	20
6.2.4 Corrosion allowance information	20
6.3 Stress corrosion cracking.....	20
6.4 Loading.....	21
6.5 Maximum allowable pressure PS	21
6.6 Design pressure P_d	21
6.7 Calculation pressure P or P_c	21
6.8 Design temperature t_d	21
6.9 Minimum material temperature	21
6.10 Calculation temperature t_c	21
6.10.1 General.....	21
6.10.2 Vessel without heater	22
6.10.3 Vessel with heater.....	22
6.11 Joint coefficient for welds	22
6.12 Design stress.....	24
6.13 Access and inspection openings, venting and draining provisions, filling and discharge provisions and handling devices	25
6.13.1 Non corrosive fluids	25
6.13.2 Corrosive fluids.....	26

6.13.3	Venting and draining provisions.....	26
6.13.4	Filling and discharge provision.....	26
6.13.5	Handling devices.....	26
6.14	Methods for design.....	26
6.14.1	General.....	26
6.14.2	Design by formulas (DBF).....	26
6.14.3	Joint design.....	31
7	Manufacturing.....	31
7.1	General.....	31
7.2	Material traceability.....	31
7.3	Manufacturing tolerances.....	31
7.4	Permanent joints.....	31
7.4.1	General.....	31
7.4.2	Permanent joint and operator qualification.....	32
7.4.3	Permanent joint operations and traceability.....	32
7.4.4	Welding.....	32
7.4.5	Brazing.....	34
7.4.6	Permanent joints by deformation.....	35
7.4.7	Non-permanent joints.....	36
7.5	Forming of pressure parts.....	36
7.5.1	General.....	36
7.5.2	Deep drawing.....	36
7.6	Post weld heat treatment.....	37
7.7	Internal cleanness.....	37
7.8	Repairs/Reworks.....	37
7.9	Finishing operations.....	37
8	Testing and inspection.....	37
8.1	Performance of inspection and testing.....	37
8.2	Design documentation, review and approval.....	38
8.2.1	General.....	38
8.2.2	Design documentation.....	38
8.2.3	Design review and design approval.....	39
8.2.4	Design documentation change.....	39
8.3	Type approval.....	40
8.4	Calibration.....	40
8.5	Material.....	40
8.6	Manufacturing.....	41
8.7	Non-destructive testing of welded joints.....	41
8.8	Subcontracted elements.....	41
8.9	Final inspection.....	41
8.9.1	General.....	41
8.9.2	Visual examination.....	42
8.9.3	Examination of documentation.....	42
8.9.4	Pressure test.....	42
8.10	Marking.....	42
8.11	Documentation.....	43
8.11.1	General.....	43
8.11.2	Manufacturer's instruction.....	43
8.11.3	Technical documentation for user.....	44
8.11.4	Records.....	44
Annex A (normative)	Alternative requirements for prevention of brittle fracture: Method according to temperature stress cases.....	46
A.1	General.....	46

prEN 14276-1:2017 (E)

A.2	Temperature stress cases	47
A.3	Determination of lowest application temperatures for stress cases $\min t_{0\ 75}$, $\min t_{0\ 50}$ and $\min t_{0\ 25}$	47
A.4	Welding conditions.....	48
A.5	Proof of notch impact energy.....	49
Annex B (normative) Specification and approval of brazing procedures		50
B.1	Introduction.....	50
B.2	General.....	50
B.3	Test piece	56
B.4	Examination and testing.....	56
B.5	Range of approval	57
B.6	Brazing Procedure Approval Record (BPAR)	60
Annex C (normative) Pressure testing.....		61
C.1	Pressure test.....	61
C.2	Leak test.....	64
C.3	Acoustic emission examination	64
Annex D (normative) Relations between the different pressures.....		65
Annex E (normative) Experimental methods.....		66
E.1	Introduction	66
E.2	Strain gauge test method.....	68
E.3	Burst test.....	68
E.4	Housings of hermetic compressors and vessels	69
Annex F (normative) Material characteristics for design.....		71
Annex G (informative) Component classification in the sense of the Pressure Equipment Directive (PED)		74
Annex H (informative) Selection of category		75
H.1	General.....	75
H.2	Definition of category for vessels for refrigerating pressure vessel.....	75
Annex I (normative) Grouping system for materials (extracted from CEN ISO/TR 15608:2013).....		76
I.1	Grouping system for steels	76
I.2	Grouping system for aluminium and aluminium alloys	76
I.3	Grouping system for copper and copper alloys	77
Annex J (informative) DN System		78
Annex K (normative) Specification and approval of expansion procedures and operators.....		80
K.1	General.....	80
K.2	Test piece	82
K.3	Examination and testing.....	82
K.4	Range of approval	83

K.5	Expansion Procedure Approval Record (EPAR).....	83
K.6	Expansion operator approval	84
Annex ZA (informative)	Relationship between this European Standard and the Essential Requirements of EU Directive 2014/68/EU	86
Bibliography		88

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 14276-1:2020

<https://standards.iteh.ai/catalog/standards/sist/b0416c3a-0fd5-4e70-9d7b-b8874491c63d/sist-en-14276-1-2020>

prEN 14276-1:2017 (E)**European foreword**

This document (prEN 14276-1:2017) 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 14276-1:2006+A1:2011.

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(s).

For relationship with Directive 2014/68/EU see informative Annex ZA, which is an integral part of this document.

This document consists of the following parts under the general title *Pressure equipment for refrigerating systems and heat pumps*:

- *Part 1: Vessels – General requirements*
- *Part 2: Piping – General requirements.*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 14276-1:2020

<https://standards.iteh.ai/catalog/standards/sist/b0416c3a-0fd5-4e70-9d7b-b8874491c63d/sist-en-14276-1-2020>

Introduction

This European Standard recognizes the unique nature of vessels for refrigerating systems or heat pumps and is intended to address the specific needs of the refrigeration and heat pump industry. This standard should be read in conjunction with the various parts of EN 13445.

When the text of this standard modifies or supplements a clause within EN 13445, then this standard should prevail. Where this standard does not modify or supplement the requirements of a clause, the requirements of EN 13445 should prevail.

The unique nature of a refrigerating system is defined as follows:

- a) the purpose of the refrigerating system is to extract and reject heat (this involves both cooling and heating);
- b) to operate the refrigerating system a pressure-imposing element (e.g. a compressor or an energy source) is necessary;
- c) the refrigerating system has a defined refrigerant charge in a closed circuit;
- d) the refrigerant has a chemical composition and purity defined in the relevant standards;
- e) the pressure of the refrigerant decreases when the temperature decreases (see typical curve in Annex A of this standard);
- f) due to the maximum temperature limit of 150 °C and the maximum pressure limit of 160 bar, the time dependant creep and fatigue due to pressure variation or vibrations are not significant design factors except for some materials such as aluminium, copper and titanium where the fatigue should be taken into account;
- g) the risk of overpressure is due to:
 - 1) the pressure imposing element;
 - 2) an external heat source (e.g. fire or hot water);
 - 3) improper operation.
- h) the refrigerating system is designed to minimize refrigerant emissions and the ingress of contaminants.

Only hermetic compressors are covered by this standard.

1 Scope

This European Standard specifies the requirements for material, design, manufacturing, testing and documentation for stationary pressure vessels intended for use in refrigerating systems and heat pumps. These systems are referenced in this standard as refrigerating systems as defined in EN 378-1.

This European Standard applies to vessels, including welded or brazed attachments up to and including the nozzle flanges, screwed, welded or brazed connectors, or to the edge to be welded or brazed at the first circumferential joint connecting piping or other elements.

This European Standard applies to pressure vessels with an internal pressure down to – 1 bar, to account for the evacuation of the vessel prior to charging with refrigerant.

This European Standard applies to both the mechanical loading conditions and thermal conditions as defined in EN 13445-3 associated with refrigerating systems. It applies to pressure vessels subject to the maximum allowable temperatures for which nominal design stresses for materials are derived using EN 13445-2 and EN 13445-3 or as specified in this standard. In addition, vessels designed to this standard should have a maximum allowable temperature not exceeding 150 °C and a maximum design pressure not exceeding 160 bars. Outside of these limits, it is important that EN 13445 be used for the design, construction and inspection of the vessel. Under these circumstances, it is important that the unique nature of refrigerating plant, as indicated in the introduction to this standard, also be taken into account.

It is important that pressure vessels used in refrigerating systems and heat pumps of category less than II as de-fined in Annex H comply with other relevant clauses of EN 378-2 for vessels.

This European Standard applies to pressure vessels where the main pressure bearing parts are manufactured from metallic ductile materials as defined in Clause 4 and Annex I of this standard.

This European Standard does not apply to vessels of the following types:

- vessels of riveted construction;
- multi-layered, autofrettaged or prestressed vessels;
- vessels directly heated by a flame;
- « roll bond » heat exchangers.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *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 378-3, *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 764-1:2015+A1:2016, *Pressure equipment - Part 1: Vocabulary*

EN 764-2:2012, *Pressure equipment - Part 2: Quantities, symbols and units*

- EN 764-4:2014, *Pressure equipment - Part 4: Establishment of technical delivery conditions for metallic materials*
- EN 764-5:2014, *Pressure equipment - Part 5: Compliance and inspection documentation of materials*
- EN 837-1, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*
- EN 1005-2, *Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery*
- EN 1045, *Brazing - Fluxes for brazing - Classification and technical delivery conditions*
- EN 1173, *Copper and copper alloys - Material condition designation*
- EN 10111, *Continuously hot rolled low carbon steel sheet and strip for cold forming - Technical delivery conditions*
- EN 10130, *Cold rolled low carbon steel flat products for cold forming - Technical delivery conditions*
- EN 10160, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*
- EN 10164, *Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions*
- EN 10204, *Metallic products - Types of inspection documents*
- EN 12797, *Brazing - Destructive tests of brazed joints*
- EN 13445-2:2014, *Unfired pressure vessels - Part 2: Materials*
- EN 13445-3:2014, *Unfired pressure vessels - Part 3: Design*
- EN 13445-4, *Unfired pressure vessels - Part 4: Fabrication*
- EN 13445-5:2014, *Unfired pressure vessels - Part 5: Inspection and testing*
- EN 13445-6, *Unfired pressure vessels - Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron*
- EN 13445-8, *Unfired pressure vessels - Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys*
- EN ISO 2553, *Welding and allied processes - Symbolic representation on drawings - Welded joints (ISO 2553)*
- EN ISO 3677, *Filler metal for soldering and brazing - Designation (ISO 3677)*
- EN ISO 4063, *Welding and allied processes - Nomenclature of processes and reference numbers (ISO 4063)*
- EN ISO 5173, *Destructive tests on welds in metallic materials - Bend tests (ISO 5173)*
- EN ISO 5817, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817)*
- EN ISO 6892-1, *Metallic materials - Tensile testing - Part 1: Method of test at room temperature (ISO 6892-1)*

prEN 14276-1:2017 (E)

EN ISO 7438, *Metallic materials - Bend test (ISO 7438)*

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

EN ISO 10012, *Measurement management systems - Requirements for measurement processes and measuring equipment (ISO 10012)*

EN ISO 10675-1, *Non-destructive testing of welds - Acceptance levels for radiographic testing - Part 1: Steel, nickel, titanium and their alloys (ISO 10675-1)*

EN ISO 13585, *Brazing - Qualification test of brazers and brazing operators (ISO 13585)*

EN ISO 14732, *Welding personnel - Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732)*

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

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials - Welding procedure specification - Part 1: Arc welding (ISO 15609-1)*

EN ISO 15611, *Specification and qualification of welding procedures for metallic materials - Qualification based on previous welding experience (ISO 15611)*

EN ISO 15612, *Specification and qualification of welding procedures for metallic materials - Qualification by adoption of a standard welding procedure (ISO 15612)*

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 15614-8, *Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 8: Welding of tubes to tube-plate joints (ISO 15614-8)*

ISO 817, *Refrigerants - Designation and safety classification*

ISO 5187, *Welding and allied processes - Assemblies made with soft solders and brazing filler metals - Mechanical test methods*

ISO/TR 25901-3:2016, *Welding and allied processes - Vocabulary - Part 3: Welding processes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 378-1:2016, EN 764-1:2015+A1:2016, EN 764-2:2012, EN 764-4:2014, EN 764-5:2014, ISO/TR 25901-3:2016 and the following apply.

3.1 Definitions

3.1.1

temperatures stress cases

3.1.1.1

min

$t_{0\ 100}$

lowest temperature at which pressurized parts are allowed to be used at a stress of up to 100 % of the design stress at 20 °C (standard design stress)

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

lowest temperature at which pressurized parts are allowed to be used when their stress is a maximum of 75 % of the design stress at 20 °C (reduced stress)

3.1.1.3**min** $t_{0\ 50}$

lowest temperature at which pressurized parts are allowed to be used when their stress is a maximum of 50 % of the design stress at 20 °C (medium stress)

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

lowest temperature at which pressurized parts are allowed to be used when their stress is a maximum of 25 % of the design stress at 20 °C (low stress)

3.1.2**corrosion**

all forms of material wastage (e.g. oxidation, erosion, wear and abrasion)

3.1.3**safety data sheet**

document which gives all necessary information for prevention, safety, storage, transportation, labelling, use and disposal of substances and preparations which have a risk for health, safety or environment

3.1.4**maximum allowable temperature**

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

3.1.5**minimum allowable temperature**

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

3.1.6**main pressure bearing part**

components of the vessel retaining the pressure and contributing to the vessel strength such as shell, tubesheet, end plate, dished ends, connection or fitting

3.1.7**volume**

internal volume of a compartment ready for operation, including the volume of nozzles to the first connection (flange, coupling, weld, braze) and excluding the volume of permanent internal part

3.1.8**nominal diameter****DN**

numerical designation of the size of a component in a piping system as defined by EN ISO 6708 and the value is given in material standard; if it is not defined in the standard, it is a nominal outside diameter minus two times the nominal wall thickness

prEN 14276-1:2017 (E)

3.1.9

« roll bond » heat exchanger

heat exchanger consisting of two plates which are weld-bonded together with the exception of the printed circuit forming the refrigerant passage which is obtained by inflation under pressure

3.1.10

maximum operating pressure

maximum pressure which the vessel can withstand without the operation of any safety accessory with a continuous operation of the pressure generator (compressor, heat source...)

Note 1 to entry: This pressure determines the maximum operating conditions for equipment users.

3.1.11

maximum standstill pressure

maximum pressure which the vessel can withstand without operation of any safety accessory when the pressure generator is not in operation

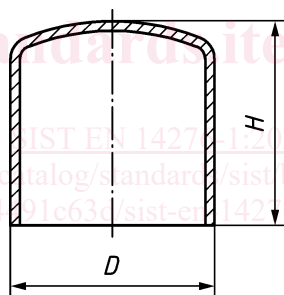
Note 1 to entry: This pressure occurs during transportation, storage or shut down of the pressure generator.

3.1.12

deep drawing

process of forming by stamping when the ratio of depth (H) by diameter (D) is greater than or equal to 0,45

Note 1 to entry: See Figure 1.

**Key**

H depth

D diameter

Figure 1 — Deep drawing

3.1.13

manual brazing

brazing operation performed and controlled by hand

3.1.14

semi-automatic brazing

brazing with equipment which controls only the brazing filler metal feed

Note 1 to entry: The advance of the brazing is manually controlled.

3.1.15

machine brazing

brazing with equipment which performs the brazing operation under the constant control of a brazing operator

3.1.16**automatic brazing**

brazing with equipment which performs the brazing operation without constant observation and adjustment by a brazing operator

3.1.17**brazer**

person who performs a manual or semiautomatic brazing operation

3.1.18**brazing operator**

person who operates a machine or automatic brazing equipment

3.1.19**semiautomatic expansion**

expansion with equipment which controls the operation and where the operator manually introduces the equipment to the inside of the tube

3.1.20**machine expansion**

expansion with equipment which performs the expansion operation under the constant control of operator

3.1.21**automatic expansion**

expansion with equipment which performs the expansion operation without constant observation and adjustment by an expansion operator

3.1.22**expansion operator**

person who makes an expansion joint

3.1.23**rolling**

plastic cold forming of tubes by means of a tool which have several rolls turning during the operation

3.1.24**micro channel heat exchanger**

heat exchanger using multiple multiport extruded tubes with flow channels of a nominal diameter $DN \leq 2$ which are connected in parallel on a circular header pipe

3.2 Symbols, descriptions and units

Symbols, descriptions and units used in this standard are listed in Table 1.