

STN	Tlakové zariadenia chladiacich systémov a tepelných čerpadiel Časť 1: Nádoby Všeobecné požiadavky	STN EN 14276-1 14 3020
------------	--	--

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

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 07/20

Obsahuje: EN 14276-1:2020

Oznámením tejto normy sa ruší
STN EN 14276-1+A1 (14 3020) z júna 2011

130744

EUROPEAN STANDARD

EN 14276-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2020

ICS 23.020.30; 27.080; 27.200

Supersedes 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 European Standard was approved by CEN on 1 December 2019.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN 14276-1:2020 (E)

Contents	Page
European foreword.....	8
Introduction	9
1 Scope.....	10
2 Normative references.....	10
3 Terms and definitions	14
3.1 Terms and definitions	14
3.2 Symbols, descriptions and units	17
4 Materials.....	20
4.1 General.....	20
4.2 Requirements for materials to be used for pressurized parts	20
4.3 Requirements for materials.....	20
4.3.1 General.....	20
4.3.2 Cladding.....	21
4.3.3 Special considerations	21
4.4 Requirements for prevention of brittle fracture	22
4.4.1 General.....	22
4.4.2 Material requirements.....	23
4.5 Material documentation	23
4.6 Materials for non-pressure retaining parts.....	23
5 Pressure vessel classification	23
5.1 Category of vessel.....	23
5.2 Fluid classification	24
6 Design	25
6.1 General.....	25
6.2 Corrosion and corrosion protection	25
6.2.1 General.....	25
6.2.2 Internal corrosion.....	25
6.2.3 External corrosion	25
6.2.4 Corrosion allowance information	25
6.3 Stress corrosion cracking.....	26
6.4 Loading.....	26
6.5 Maximum allowable pressure PS	26
6.6 Design pressure P_d.....	26
6.7 Calculation pressure P or P_c.....	27
6.8 Design temperature t_d	27
6.9 Minimum material temperature	27
6.10 Calculation temperature t_c.....	27
6.10.1 General.....	27
6.10.2 Vessel without heater	27
6.10.3 Vessel with heater.....	28
6.11 Joint coefficient.....	28
6.12 Design stress.....	30

6.13	Access and inspection openings, venting and draining provisions, filling and discharge provisions and handling devices	32
6.13.1	Non corrosive fluids.....	32
6.13.2	Corrosive fluids	32
6.13.3	Venting and draining provisions.....	32
6.13.4	Filling and discharge provision	32
6.13.5	Handling devices.....	32
6.14	Methods for design.....	33
6.14.1	General	33
6.14.2	Design by formulas (DBF).....	33
6.14.3	Joint design	38
7	Manufacturing.....	40
7.1	General	40
7.2	Material traceability	40
7.3	Manufacturing tolerances.....	40
7.4	Permanent joints	40
7.4.1	General	40
7.4.2	Permanent joint and operator qualification.....	40
7.4.3	Permanent joint operations and traceability.....	40
7.4.4	Welding	40
7.4.5	Brazing.....	41
7.4.6	Permanent joints by deformation	43
7.4.7	Non-permanent joints.....	43
7.5	Forming of pressure parts.....	44
7.5.1	General	44
7.5.2	Deep drawing	44
7.6	Post weld heat treatment.....	45
7.7	Internal cleanness	45
7.8	Repairs/Reworks.....	45
7.9	Finishing operations.....	45
8	Testing and inspection.....	45
8.1	Performance of inspection and testing.....	45
8.2	Design documentation, review and approval.....	46
8.2.1	General	46
8.2.2	Design documentation	46
8.2.3	Design examination and design approval.....	47
8.2.4	Design documentation change.....	48
8.3	Type examination	48
8.4	Calibration.....	48
8.5	Material	48
8.6	Manufacturing.....	49
8.7	Non-destructive and destructive testing of welded joints.....	49
8.8	Brazed joints.....	50
8.9	Subcontracted elements.....	50
8.10	Final inspection	50
8.10.1	General	50
8.10.2	Visual examination	50
8.10.3	Examination of documentation	51
8.10.4	Pressure test.....	51
8.10.5	Leak test.....	51
8.11	Marking	52
8.12	Documentation	52

EN 14276-1:2020 (E)

8.12.1	General	52
8.12.2	Manufacturer's instruction	52
8.12.3	Technical documentation for user	53
8.12.4	Records	53
Annex A (normative) Alternative requirements for prevention of brittle fracture: Method according to temperature stress cases		
A.1	General	55
A.2	Temperature stress cases	57
A.3	Determination of lowest application temperatures for stress cases min $t_{0\ 75}$, min $t_{0\ 50}$ and min $t_{0\ 25}$	57
A.4	Welding conditions	58
A.4.1	Welded connections	58
A.4.2	Heat treatment after welding	59
A.5	Proof of notch impact energy	59
Annex B (normative) Specification and approval of brazing procedures		
B.1	Introduction	60
B.2	General	60
B.2.1	Responsibility	60
B.2.2	Specification of brazing procedures	60
B.2.3	Technical content of <i>BPS</i>	61
B.3	Test piece	66
B.4	Examination and testing	66
B.4.1	General	66
B.4.2	Visual examination	67
B.4.3	Tensile test	67
B.4.4	Bend test	67
B.4.5	Peel test	68
B.4.6	Metallographic examination	68
B.5	Range of approval	68
B.5.1	General	68
B.5.2	Related to the manufacturer	68
B.5.3	Related to the material	68
B.5.3.1	Parent metal	68
B.5.3.2	Thickness	69
B.5.4	Range of approval	69
B.5.4.1	General	69
B.5.4.2	Angle of branch connection	70
B.5.4.3	Brazing process	70

B.5.4.4 Flow position	70
B.5.4.5 Joint design	70
B.5.4.6 Filler material	70
B.5.4.7 Brazing temperature	71
B.5.4.8 Brazing flux	71
B.5.4.9 Fuel gas, atmosphere, nature of flame or type of energy	71
B.5.4.10 Post braze heat treatment	71
B.6 Brazing Procedure Approval Record (BPAR)	71
Annex C (normative) Pressure testing	72
C.1 Pressure test	72
C.1.1 General	72
C.1.2 Basic requirements	72
C.1.2.1 Pressure vessels	72
C.1.2.2 Accessories	72
C.1.2.3 Safety	72
C.1.2.4 Hydraulic test	72
C.1.2.5 Pneumatic test	73
C.1.3 Pressure test	73
C.1.3.1 Value of test pressure	73
C.1.3.2 Specific value of test pressure for compressor housing	73
C.1.3.3 Temperature requirement	73
C.1.3.4 Test procedure	74
C.1.3.5 Pass fail criteria	74
C.1.3.6 Requirements for pressure gauges	74
C.1.4 Final test report	74
C.2 Acoustic emission examination	75
Annex D (normative) Relations between the different pressures	76
Annex E (normative) Experimental design methods	77
E.1 Introduction	77
E.1.1 General	77
E.1.2 Methods	77
E.1.3 Documentation	78
E.1.4 Duplicate or similar parts	78
E.1.4.1 General	78
E.1.4.2 Duplicate parts	78
E.1.4.3 Geometrically similar part	78

EN 14276-1:2020 (E)

E.1.5	Examination of the components or the vessel	78
E.1.6	Application of pressure	78
E.1.7	Material properties	79
E.2	Strain gauge test method	79
E.2.1	General	79
E.2.2	Procedure	79
E.3	Burst test	80
E.3.1	General	80
E.3.2	Procedure	80
E.3.3	Burst pressure	80
E.4	Housings of hermetic compressors of testing group 2b and vessels of testing group 2b	80
E.4.1	General	80
E.4.2	Burst test method for housings of vessels	82
E.4.3	Burst test method for housings of compressor	82
E.4.4	Combined burst test / fatigue test method for housings of compressor	83
E.4.4.1	General and burst tests	83
E.4.4.2	Additional fatigue test	84
	Annex F (normative) Material characteristics for design	86
	Annex G (informative) Component classification in the sense of the Pressure Equipment Directive (PED)	90
	Annex H (informative) Selection of category	92
H.1	General	92
H.2	Definition of category for vessels for refrigerating pressure vessel	92
	Annex I (normative) Grouping system for materials (extracted from CEN ISO/TR 15608)	93
I.1	Grouping system for steels	93
I.2	Grouping system for aluminium and aluminium alloys	93
I.3	Grouping system for copper and copper alloys	94
	Annex J (informative) DN System	95
	Annex K (normative) Specification and approval of expansion procedures and operators	97
K.1	General	97
K.1.1	General rules	97
K.1.2	Responsibility	97
K.1.3	Specification of expansion procedures	97
K.1.4	Technical content of EPS	97
K.2	Test piece	99
K.3	Examination and testing	99

K.3.1	General	99
K.3.2	Visual examination	99
K.3.3	Dimensional verification	99
K.3.4	Tests	100
K.4	Range of approval	100
K.4.1	General	100
K.4.2	Related to the manufacturer	100
K.4.3	Related to the material	100
K.4.4	Tube dimensions	100
K.4.5	Expansion factor	100
K.4.6	Expansion process	100
K.4.7	Joint design	100
K.4.8	Tool	100
K.5	Expansion Procedure Approval Record (EPAR)	101
K.6	Expansion operator approval	101
K.6.1	General	101
K.6.2	Validity range of expansion operator qualification	101
K.6.3	Qualification tests	101
K.6.3.1	General	101
K.6.3.2	Test piece	101
K.6.3.3	Assessment of the test piece	101
K.6.4	Examination and testing	101
K.6.5	Period of validity	102
K.6.5.1	Initial approval	102
K.6.5.2	Prolongation	102
K.6.6	Certification	102
Annex ZA (informative) Relationship between this European Standard and the essential requirements of Directive 2014/68/EU (Pressure equipment Directive) aimed to be covered		103
Bibliography		105

EN 14276-1:2020 (E)**European foreword**

This document (EN 14276-1:2020) has been prepared by Technical Committee CEN/TC 182 “Refrigerating systems, safety and environmental requirements”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2020, and conflicting national standards shall be withdrawn at the latest by August 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document will supersede EN 14276-1:2006+A1:2011.

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).

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

EN 14276, *Pressure equipment for refrigerating systems and heat pumps*, is currently composed with the following parts:

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document 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 document should be read in conjunction with the various parts of the EN 13445 series.

When the text of this document modifies or supplements a clause within the EN 13445 series, then this document should prevail. Where this document does not modify or supplement the requirements of a clause, the requirements of the EN 13445 series 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 document);
- f) due to the maximum temperature limit of 200 °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.

Hermetic compressors are covered by this document.

EN 14276-1:2020 (E)

1 Scope

This document 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 document as refrigerating systems as defined in EN 378-1:2016.

The term “refrigerating system” used in this document includes heat pumps.

This document 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 document 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 document applies to both the mechanical loading conditions and thermal conditions as defined in EN 13445-3:2014¹ 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 13445-2:2014² and EN 13445-3:2014¹ or as specified in this document. In addition, vessels designed to this document can have a maximum allowable temperature not exceeding 200 °C and a maximum design pressure not exceeding 160 bar. Outside of these limits, it is important that the EN 13445 series 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 document, also be taken into account.

It is important that pressure vessels used in refrigerating systems and heat pumps of category less than II as defined in Annex H comply with other relevant clauses of EN 378-2:2016 for vessels.

This document 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 document.

This document 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 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, *Refrigerating systems and heat pumps — Safety and environmental requirements - Part 1: Basic requirements, definitions, classification and selection criteria*

¹ As impacted by EN 13445-3:2014/A1:2015, EN 13445-3:2014/A2:2016, EN 13445-3:2014/A3:2017, EN 13445-3:2014/A4:2018 and EN 13445-3:2014/A5:2018.

² As impacted by EN 13445-2:2014/A1:2016, EN 13445-2:2014/A2:2018 and EN 13445-2:2014/A3:2018.

EN 378-2:2016, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

EN 378-3:2016, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 3: Installation site and personal protection*

EN 378-4:2016, *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: Inspection documentation of metallic materials and compliance with the material specification*

CEN/TR 764-6:2012, *Pressure equipment — Part 6: Structure and content of operating instructions*

EN 837-1:1996,³ *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

EN 1005-2:2003+A1:2008, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 1045:1997, *Brazing — Fluxes for brazing — Classification and technical delivery conditions*

EN 1173:2008, *Copper and copper alloys — Material condition designation*

EN 10111:2008, *Continuously hot rolled low carbon steel sheet and strip for cold forming — Technical delivery conditions*

EN 10130:2006, *Cold rolled low carbon steel flat products for cold forming — Technical delivery conditions*

EN 10160:1999, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*

EN 10164:2018, *Steel products with improved deformation properties perpendicular to the surface of the product — Technical delivery conditions*

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

EN 12735-1:2016, *Copper and copper alloys — Seamless, round tubes for air conditioning and refrigeration — Part 1: Tubes for piping systems*

EN 12735-2:2016, *Copper and copper alloys — Seamless, round tubes for air conditioning and refrigeration — Part 2: Tubes for equipment*

³ A impacted by EN 837-1:1996/AC:1998.

EN 14276-1:2020 (E)

EN 12797:2000,⁴ *Brazing — Destructive tests of brazed joints*

EN 13445-2:2014,⁵ *Unfired pressure vessels — Part 2: Materials*

EN 13445-3:2014,⁶ *Unfired pressure vessels — Part 3: Design*

EN 13445-4:2014,⁷ *Unfired pressure vessels — Part 4: Fabrication*

EN 13445-5:2014,⁸ *Unfired pressure vessels — Part 5: Inspection and testing*

EN 13445-6:2014,⁹ *Unfired pressure vessels — Part 6: Requirements for the design and fabrication of pressure vessels and pressure parts constructed from spheroidal graphite cast iron*

EN 13445-8:2014,¹⁰ *Unfired pressure vessels — Part 8: Additional requirements for pressure vessels of aluminium and aluminium alloys*

EN ISO 2553:2013, *Welding and allied processes — Symbolic representation on drawings — Welded joints (ISO 2553:2013)*

EN ISO 3677:2016, *Filler metal for soldering and brazing — Designation (ISO 3677:2016)*

EN ISO 4063:2010, *Welding and allied processes — Nomenclature of processes and reference numbers (ISO 4063:2009)*

EN ISO 5173:2010,¹¹ *Destructive tests on welds in metallic materials — Bend tests (ISO 5173:2009)*

EN ISO 5817:2014, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2014)*

EN ISO 6892-1:2016, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2016)*

EN ISO 7438:2016, *Metallic materials — Bend test (ISO 7438:2016)*

EN ISO 9606-1:2017, *Qualification testing of welders — Fusion welding — Part 1: Steels (ISO 9606-1:2012)*

⁴ As impacted by EN 12797:2000/A1:2003.

⁵ As impacted by EN 13445-2:2014/A1:2016, EN 13445-2:2014/A2:2018 and EN 13445-2:2014/A3:2018.

⁶ As impacted by EN 13445-3:2014/A1:2015, EN 13445-3:2014/A2:2016, EN 13445-3:2014/A3:2017, EN 13445-3:2014/A4:2018 and EN 13445-3:2014/A5:2018.

⁷ As impacted by EN 13445-4:2014/A1:2016.

⁸ As impacted by EN 13445-5:2014/A1:2018.

⁹ As impacted by EN 13445-6:2014/A1:2015 and EN 13445-6:2014/A2:2018.

¹⁰ As impacted by EN 13445-8:2014/A1:2014.

¹¹ As impacted by EN ISO 5173:2010/A1:2011.

EN ISO 10012:2003, *Measurement management systems — Requirements for measurement processes and measuring equipment (ISO 10012:2003)*

EN ISO 10675-1:2016, *Non-destructive testing of welds — Acceptance levels for radiographic testing - Part 1: Steel, nickel, titanium and their alloys (ISO 10675-1:2016)*

EN ISO 13585:2012, *Brazing — Qualification test of brazers and brazing operators (ISO 13585:2012)*

EN ISO 14732:2013, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials (ISO 14732:2013)*

EN ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607:2003)*

CEN ISO/TR 15608:2017, *Welding — Guidelines for a metallic materials grouping system (ISO/TR 15608:2013)*

EN ISO 15609-1:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004)*

EN ISO 15609-2:2001,¹² *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 2: Gas welding (ISO 15609-2:2001)*

EN ISO 15611:2003, *Specification and qualification of welding procedures for metallic materials — Qualification based on previous welding experience (ISO 15611:2003)*

EN ISO 15612:2018, *Specification and qualification of welding procedures for metallic materials — Qualification by adoption of a standard welding procedure specification (ISO 15612:2018)*

EN ISO 15614-1:2017, *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)*

EN ISO 15614-8:2016, *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 8: Welding of tubes to tube-plate joints (ISO 15614-8:2016)*

EN ISO 17672:2016, *Brazing — Filler metals (ISO 17672:2016)*

ISO 817:2014, *Refrigerants — Designation and safety classification*

ISO 5187:1985, *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*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN

¹² As impacted by EN ISO 15609-2:2001/A1:2003.