BS EN ISO 24664:2024

BSI Standards Publication

Refrigerating systems and heat pumps — Pressure relief devices and their associated piping — Methods for calculation

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National foreword

This British Standard is the UK implementation of EN ISO 24664:2024. It is identical to ISO 24664:2024. It supersedes BS EN 13136:2013+A1:2018, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/18, Refrigeration safety.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 24664

December 2024

ICS 27.080; 27.200

Supersedes EN 13136:2013+A1:2018

English Version

Refrigerating systems and heat pumps - Pressure relief devices and their associated piping - Methods for calculation (ISO 24664:2024)

Systèmes de réfrigération et pompes à chaleur - Dispositifs de limitation de pression et tuyauteries associées - Méthodes de calcul (ISO 24664:2024)

Kälteanlagen und Wärmepumpen - Druckentlastungseinrichtungen und zugehörige Leitungen - Berechnungsverfahren (ISO 24664:2024)

This European Standard was approved by CEN on 17 September 2024.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN ISO 24664:2024) has been prepared by Technical Committee ISO/TC 86 "Refrigeration and air-conditioning" in collaboration with 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of an identical text or by endorsement, at the latest by June 2025, and conflicting national standards shall be withdrawn at the latest by June 2025.

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 supersedes EN 13136:2013+A1:2018.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

Any feedback and questions on this document should be directed to the users’ national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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, Türkiye and the United Kingdom.

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The text of ISO 24664:2024 has been approved by CEN as EN ISO 24664:2024 without any modification.

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Annex ZA
(informative)

Relationship between this European Standard and the essential requirements of Directive 2014/68/EU (Pressure equipment Directive) aimed to be covered

This European Standard has been prepared under a Commission's standardization request M/601 to provide one voluntary means of conforming to essential requirements of Directive 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 May 2014 on the harmonization of the laws of the Member States relating to the making available on the market pressure equipment.

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 and application of the edition of the normatively referenced standards as given in Table ZA.2 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2014/68/EU (Pressure equipment Directive)

Essential Requirements of Directive 2014/68/EU	Clause(s)/subclause(s) of this EN	Remarks/Notes
2.10	Clause 6	Protection against exceeding the allowable limits of pressure equipment
2.12	Clause 6.2.1	External Fire
2.11.2	Clause 5 Clause 7 Clause 8	Pressure limiting devices

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Table ZA.2 — Applicable Standards to confer presumption of conformity as described in this Annex ZA

Reference in Clause 2	European Standard Edition	Title	Corresponding European Standard Edition
ISO 4126-1:2013 /Amd 1:2016	ISO 4126-1:2013 ISO 4126-1:2013/Amd 1:2016	Safety devices for protection against excessive pressure — Part 1: Safety valves	EN ISO 4126-1:2013 EN ISO 4126-1:2013/A1:2016
ISO 4126-2:2018	ISO 4126-2:2018	Safety devices for protection against excessive pressure — Part 2: Bursting disc safety devices	EN ISO 4126-2:2019
ISO 21922:2021	ISO 21922:2021	Refrigerating systems and heat pumps — Valves — Requirements, testing and marking	EN ISO 21922:2021

The documents listed in the Column 1 of Table ZA.2, in whole or in part, are normatively referenced in this document, i.e. are indispensable for its application. The achievement of the presumption of conformity is subject to the application of the edition of standards as listed in Column 4 or, if no European Standard Edition exists, the European Standard Edition given in Column 2 of Table ZA.2.

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 1, *Safety and environmental requirements for refrigerating systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 182, *Refrigerating systems, safety and environmental requirements,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document is based on EN 13136:2013+A1:2018 and applicable parts of ISO 4126-1:2013, ISO 4126-2:2018 and ISO 21922:2021.

It is suited to the specific requirements, and includes the data, of refrigerating systems. It provides means of satisfying the pressure relief devices requirements of EN 378-2:2016 and ISO 5149-2:2014.

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Refrigerating systems and heat pumps — Pressure relief devices and their associated piping — Methods for calculation

1 Scope

This document describes the calculation of:

— mass flow for sizing pressure relief devices for parts of refrigerating systems;

— discharge capacities for pressure relief valves and other pressure relief devices in refrigerating systems including the necessary data for sizing these when relieving to atmosphere or to part of the refrigerating system at lower pressure;

— the pressure loss in the inlet and outlet lines of pressure relief valves and other pressure relief devices and includes the necessary data.

This document specifies the requirements for selection of pressure relief devices to prevent excessive pressure due to internal and external heat sources, the sources of increasing pressure (e.g. compressor, heaters, etc.) and thermal expansion of trapped liquid.

NOTE The term "refrigerating system" used in this document includes heat pumps.

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.

ISO 4126-1:2013/Amd 1:2016, *Safety devices for protection against excessive pressure — Part 1: Safety valves*

ISO 4126-2:2018, *Safety devices for protection against excessive pressure — Part 2: Bursting disc safety devices*

ISO 21922:2021, *Refrigerating systems and heat pumps — Valves — Requirements, testing and marking*

EN 13501-1:2018, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21922:2021, ISO 4126-1:2013/Amd 1:2016, and ISO 4126-2:2018 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/

3.1
refrigerant
fluid used for heat transfer in a refrigerating system

Note 1 to entry: A refrigerant absorbs heat at a low temperature and a low pressure of the fluid and rejects it at a higher temperature and a higher pressure of the fluid, usually involving changes of the phase of the fluid.

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[SOURCE: ISO 817:2024, 3.1.37]

3.2
part of the refrigerating system
several components assembled together and exposed to the same pressure in operation or pressure source, respectively, as determined by the manufacturer

3.3
pressure relief device
pressure relief valve or bursting disc device designed to relieve excessive pressure automatically

3.4
pressure relief valve
pressure actuated valve held shut by a spring or other means and designed to relieve excessive pressure automatically by starting to open at a set pressure and re-closing after the pressure has fallen below the set pressure

Note 1 to entry: For the purposes of this document, the definition of a safety valve as given in ISO 4126-1:2013 is regarded equivalent to a pressure relief valve.

3.5
pressure vessel
any refrigerant-containing component of a refrigerating system other than:

— coils (including their headers) consisting of pipes with air as secondary fluid;

— piping and its valves, joints and fittings;

— control devices;

— pressure switches, gauges, liquid indicators;

— safety valves, fusible plugs, bursting discs;

— equipment comprising casings or machinery where the dimensioning, choice of material and manufacturing rules are based primarily on requirements for sufficient strength, rigidity and stability to meet the static and dynamic operational effects or other operational characteristics and for which pressure is not a significant design factor. Such equipment may include: pumps and compressors.

Note 1 to entry: The semi-hermetic and open type compressors used in refrigerating systems may be subject to the exclusion article 1.2.j of the EU Directive 2014/68/EU by referring to the working party group guidelines WPG A-11, A-12 and B-34. The compressor manufacturer has to decide on the basis of a case by case assessment, if the exclusion article 1.2.j of the EU Directive 2014/68/EU is applicable.

Note 2 to entry: This definition is aligned to EU Directive 2014/68/EU.

3.6
nominal size
DN
alphanumeric designation of size for components of a pipework system, which is used for reference purposes comprising the letters *DN* followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

Note 1 to entry: The number following the letters *DN* does not represent a measurable value and should not be used for calculation purposes except where specified in this document.

Note 2 to entry: Where the nominal size is not specified, for the purpose of this document it is assumed to be the internal diameter of the pipe or component in mm (*DN*/*ID*).

Note 3 to entry: Nominal size is not the same as port size which is commonly used for the size of the valve seat opening.

[SOURCE: ISO 6708:1995, 2.1, modified — Note 2 and 3 to entry added.]

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4 Symbols

Symbol	Designation	Unit
A_{actual}	Actual flow area of the pressure relief device. The flow area at the most narrow cross section when the pressure relief device is fully open	mm^2
$A_{effective}$	Effective area of the pressure relief device	mm^2
A_{liq}	Calculated flow area of liquid after expansion	mm^2
A_R	Inside area of tube	mm^2
A_{surf}	External surface area of the vessel	m^2
A_{vap}	Calculated flow area of vapour after expansion	mm^2
DN	Nominal size	–
d	Actual most narrow flow diameter of the pressure relief device	mm
d_R	Inside diameter of tube	mm
f	Darcy friction factor	-
Δh_{vap}	Heat of vaporisation	kJ/kg
K_{cap}	Capacity correction factor	–
K_d	Certified coefficient of discharge considering the backpressure ratio p_b/p_0 and the possible reduced stroke of the pressure relief valve	–
K_{dr}	De-rated coefficient of discharge	–
K_{drl}	De-rated coefficient of discharge for liquid	–
K_{vs}	Valve constant (the rate of water flow for a pressure loss of 1 bar at the rated full opening)	m^3/h
K_{visc}	Viscosity correction factor	–
K_{volume}	Trapped liquid factor	mm^2/l
L	Length of pipe	mm
m	mass	kg
n	Rotational frequency	min^{-1}
p_{atm}	Atmospheric pressure (1,013 25 bar)	bar
p_b	Back pressure at outlet of pressure relief device, absolute	bar
p_c	Critical absolute pressure	bar
$p_{connection}$	Pressure in connection point	bar
$p_{r,choked}$	Choked pressure ratio	–
p_{set}	Set pressure, gauge (the pre-determined pressure at which a pressure relief device under operation starts to open)	bar
Δp	Pressure loss	bar
Δp_{common}	Pressure loss in common outlet line	bar
Δp_{in}	Pressure loss in the inlet line to the pressure relief device	bar
Δp_{out}	Pressure loss in the outlet line from the pressure relief device	bar
p_0	Actual absolute relieving pressure	bar
p_1	Absolute pressure at the inlet to the outlet line of the pressure relief device	bar
Q_h	Rate of heat production, internal heat source	kW
$Q_{m,adjusted}$	Adjusted discharge capacity, of the pressure relief device. Used for pressure drop calculation in piping	kg/h
$Q_{m,common}$	Mass flow in common outlet line	kg/h
$Q_{m,liq}$	Flow of liquid after expansion	kg/h
$Q_{m,relief}$	Calculated refrigerant mass flow rate of the pressure relief device	kg/h
$Q_{m,required}$	Minimum required discharge capacity, of refrigerant, of the pressure relief device	kg/h
NOTE 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.		

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