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Del 1: Säkerhetsventiler (ISO 4126-1:2004)

Safety devices for protection against excessive pressure –
Part 1: Safety valves (ISO 4126-1:2004)

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English version

Safety devices for protection against excessive pressure - Part 1: Safety valves (ISO 4126-1:2004)

Dispositifs de sécurité pour protection contre les pressions excessives - Partie 1 : Soupapes de sûreté (ISO 4126-1:2004)

Sicherheitseinrichtungen gegen unzulässigen Überdruck - Teil 1: Sicherheitsventile (ISO 4126-1:2004)

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Contents

Foreword

This document (EN ISO 4126-1:2004) has been prepared by Technical Committee CEN/TC 69 “Industrial valves”, the secretariat of which is held by AFNOR, in collaboration with Technical Committee ISO/TC 185 “Safety devices for protection against excessive pressure”.

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of an identical text or by endorsement, at the latest by August 2004, and conflicting national standards shall be withdrawn at the latest by August 2004 .

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.

For relationship with EU Directive, see informative annex ZA, which is an integral part of this document.

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

This standard for safety devices for protection against excessive pressure consists of seven parts of which this is Part 1. The various parts are:

— *Part 1 : Safety valves*

— *Part 2 : Bursting disc safety devices*

— *Part 3 : Safety valves and bursting disc safety devices in combination*

— *Part 4 : Pilot operated safety valves*

— *Part 5 : Controlled safety pressure relief systems (CSPRS)*

— *Part 6 : Application, selection and installation of bursting disc safety devices*

— *Part 7 : Common data*

Part 7 contains data that is common to more than one of the parts of this standard to avoid unnecessary repetition.

1 Scope

This part of this European Standard specifies general requirements for safety valves irrespective of the fluid for which they are designed.

It is applicable to safety valves having a flow diameter of 6 mm and above which are for use at set pressures of 0,1 bar gauge and above. No limitation is placed on temperature.

This is a product standard and is not concerned with applications for safety valves.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1092-1, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories PN designated – Part 1: Steel flanges.*

EN 1092-2, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories PN designated – Part 2: Cast iron flanges.*

EN 1092-3 , *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories PN designated – Part 3: Copper alloy flanges.*

prEN 1759-1, *Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, Class designated - Part 1: Steel flanges NPS 1/2 to 24.*

EN 12516-3, *Valves – Shell design strength – Part 3: Experimental method.*

EN 12627, *Industrial Valves – Butt welding ends for steel valves.*

EN 12760, *Valves – Socket welding ends for steel valves.*

EN ISO 6708, *Pipework components – Definition and selection of DN (nominal size) (ISO 6708:1995).*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation.*

ANSI B1.20.1, *NPT threads.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1
safety valve
valve which automatically, without the assistance of any energy other than that of the fluid concerned, discharges a quantity of the fluid so as to prevent a predetermined safe pressure being exceeded, and which is designed to re-close and prevent further flow of fluid after normal pressure conditions of service have been restored

NOTE The valve can be characterised either by pop action (rapid opening) or by opening in proportion (not necessarily linear) to the increase in pressure over the set pressure.

3.1.1
types of safety valve

3.1.1.1
direct loaded safety valve
safety valve in which the loading due to the fluid pressure underneath the valve disc is opposed only by a direct mechanical loading device such as a weight, lever and weight, or a spring

3.1.1.2
assisted safety valve
safety valve which, by means of a powered assistance mechanism, may additionally be lifted at a pressure lower than the set pressure and will, even in the event of failure of the assistance mechanism, comply with all the requirements for safety valves given in this standard

3.1.1.3
supplementary loaded safety valve
safety valve which has, until the pressure at the inlet to the safety valve reaches the set pressure, an additional force which increases the sealing force

NOTE 1 This additional force (supplementary load), which may be provided by means of an extraneous power source, is reliably released when the pressure at the inlet of the safety valve reaches the set pressure. The amount of supplementary loading is so arranged that if such supplementary loading is not released, the safety valve will attain its certified discharge capacity at a pressure not greater than 1,1 times the maximum allowable pressure of the equipment to be protected.

NOTE 2 Other types of supplementary loaded safety devices are dealt with in Part 5 of this standard.

3.1.1.4
pilot operated safety valve
safety valve, the operation of which is initiated and controlled by the fluid discharged from a pilot valve which is itself a direct loaded safety valve subject to the requirement of this standard

NOTE Other types of pilot operated safety valves with flowing, non-flowing and modulating pilots are in Part 4 of this standard.

3.2
pressure
pressure unit used in this standard is the bar (1 bar = 10^5 Pa), quoted as gauge (relative to atmospheric pressure) or absolute as appropriate

3.2.1
set pressure
predetermined pressure at which a safety valve under operating conditions commences to open

NOTE It is the gauge pressure measured at the valve inlet at which the pressure forces tending to open the valve for the specific service conditions are in equilibrium with the forces retaining the valve disc on its seat.

3.2.2
maximum allowable pressure, PS
maximum pressure for which the equipment is designed as specified by the manufacturer

3.2.3
overpressure
pressure increase over the set pressure, at which the safety valve attains the lift specified by the manufacturer, usually expressed as a percentage of the set pressure

NOTE This is the overpressure used to certify the safety valve.

3.2.4
reseating pressure
value of the inlet static pressure at which the disc re-establishes contact with the seat or at which the lift becomes zero

3.2.5
cold differential test pressure
inlet static pressure at which a safety valve is set to commence to open on the test bench

NOTE This test pressure includes corrections for service conditions, e.g. back pressure and/or temperature.

3.2.6
relieving pressure
pressure used for the sizing of a safety valve which is greater than or equal to the set pressure plus overpressure

3.2.7
built-up back pressure
pressure existing at the outlet of a safety valve caused by flow through the valve and the discharge system

3.2.8
superimposed back pressure
pressure existing at the outlet of a safety valve at the time when the device is required to operate

NOTE It is the result of pressure in the discharge system from other sources.

3.2.9
balanced bellows
bellows device which minimises the effect of superimposed back pressure on the set pressure of a safety valve

3.2.10
blowdown
difference between set and reseating pressures, normally stated as a percentage of set pressure except for pressures of less than 3 bar when the blowdown is expressed in bar

3.3
lift
actual travel of the valve disc away from the closed position

3.4
flow area
minimum cross-sectional flow area (but not the curtain area) between inlet and seat which is used to calculate the theoretical flow capacity, with no deduction for any obstruction

NOTE The symbol is A.

3.5
flow diameter
diameter corresponding to the flow area

3.6
discharge capacity

3.6.1
theoretical discharge capacity
calculated capacity expressed in mass or volumetric units of a theoretically perfect nozzle having a cross-sectional flow area equal to the flow area of a safety valve

3.6.2
coefficient of discharge
value of actual flowing capacity (from tests) divided by the theoretical flowing capacity (from calculation)

3.6.3
certified (discharge) capacity
that portion of the measured capacity permitted to be used as a basis for the application of a safety valve

NOTE It may, for example, equal the :

a) measured capacity times the derating factor ; or

b) theoretical capacity times the coefficient of discharge times the derating factor ; or

c) theoretical capacity times the certified derated coefficient of discharge.

3.7
DN (nominal size)
see EN ISO 6708

4 Symbols and units

Table 1 — Symbols and their descriptions

Symbol	Description	Unit
A	Flow area of a safety valve (not curtain area)	mm^2
C	Function of the isentropic exponent	–
K_b	Theoretical capacity correction factor for subcritical flow	–
K_d	Coefficient of discharge [a]	–
K_{dr}	Certified derated coefficient of discharge ($K_d \times 0{,}9$) [a]	–
K_v	Viscosity correction factor	–
k	Isentropic exponent	–
M	Molar mass	kg/kmol
n	Number of tests	–
p_o	Relieving pressure	bar (abs.)
p_b	Back pressure	bar (abs.)
p_c	Critical pressure	bar (abs.)
Q_m	Mass flow rate	kg/h
q_m	Theoretical specific discharge capacity	$kg/(h \cdot mm^2)$
q'_m	Specific discharge capacity determined by tests	$kg/(h \cdot mm^2)$
R	Universal gas constant	–
T_o	Relieving temperature	K
T_c	Critical temperature	K
μ	Dynamic viscosity	Pa·s
v	Specific volume at actual relieving pressure and temperature	m^3/kg
x	Dryness fraction of wet steam at the valve inlet at actual relieving pressure and temperature [b]	–
Z	Compressibility factor at actual relieving pressure and temperature	–

[a] K_d and K_{dr} are expressed as 0,xxx.

[b] x is expressed as 0,xx.

5 Design

5.1 General

5.1.1 The design shall incorporate guiding arrangements necessary to ensure consistent operation and seat tightness.

5.1.2 The seat of a safety valve, other than when it is an integral part of the valve shell, shall be fastened securely to prevent the seat becoming loose in service.

5.1.3 In the case of valves where the lift can be reduced to conform to the required discharge capacity, restriction of the lift shall not interfere with the operation of the valve. The lift restricting device shall be designed so that, if adjustable, the adjustable feature can be mechanically locked and access sealed. The lift restricting device shall be installed and sealed by the valve manufacturer.

Valve lift shall not be restricted to a value less than 30 % of unrestricted lift or 1 mm whichever is the greater.

5.1.4 Means shall be provided to lock and/or to seal all external adjustments in such a manner so as to prevent or reveal unauthorised adjustments of the safety valve.

5.1.5 Safety valves for toxic or flammable fluids shall be of the closed bonnet type to prevent leakage to atmosphere or if vented it shall be disposed of to a safe place.

5.1.6 Provision shall be made to prevent liquid collecting on the discharge side of the safety valve shell.

5.1.7 The design stress of load carrying parts shall not exceed that specified in the appropriate European Standard e.g. EN 12516-3.

5.1.8 In the case of failure of a balanced bellows, if any, the safety valve shall discharge its certified capacity at not more than 1,1 times the maximum allowable pressure of the equipment being protected.

5.1.9 The materials for adjacent sliding surfaces such as guide(s) and disc/disc holder/spindle shall be selected to ensure corrosion resistance and to minimise wear and avoid galling.

5.1.10 Sealing elements, which may adversely affect the operating characteristics by frictional forces, are not permitted.

5.1.11 Easing gear shall be provided when specified.

5.1.12 Safety valves shall be so constructed that breakage of any part, or failure of any device, will not obstruct free and full discharge through the valve.

5.2 End connections

5.2.1 Types

The types of end connections shall be as follows:

Butt welding	EN 12627 ;
Socket welding	EN 12760 ;
Flanged	EN 1092-1 ;
	EN 1092-2 ;
	EN 1092-3 ;
	prEN 1759-1;
Threaded	ISO 7-1 or ANSI B1.20.1.

Other types of end connections are possible by agreement between the manufacturer and purchaser.

5.2.2 Design of valve end connections

The design of valve end connections, whatever their type, shall be such that the internal area of the external pipe or stub connection at the safety valve inlet is at least equal to that of the valve inlet connection (see Figure 1 a).

The internal area of the external pipe connection at the safety valve outlet shall be at least equal to that of the valve outlet, except those valves with female threaded outlet connections (see Figure 1 b).

NOTE See clause 7 regarding type testing.