INTERNATIONAL STANDARD

ISO 4126-4

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Safety devices for protection against excessive pressure —

Part 4: Pilot-operated safety valves

Dispositifs de sécurité pour protection contre les pressions excessives —

Partie 4: Soupapes de sûreté pilotées

Reference number
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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 4126-4 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 185, *Safety devices for protection against excessive pressure*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

ISO 4126-4 cancels and replaces ISO 6718:1991, which has been technically revised.

ISO 4126 consists of the following parts, under the general title *Safety devices for protection against excessive pressure*:

— *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*

For the purposes of this part of ISO 4126-4, the CEN annex regarding fulfilment of European Council Directives has been removed.

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Foreword

This document (EN ISO 4126-4:2004) 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.

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

This standard for safety devices for protection against excessive pressure consists of seven parts of which this is Part 4. 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.

Annex A is informative.

1 Scope

This part of this European Standard specifies general requirements for pilot operated safety valves, other than those covered in Part 1, irrespective of the fluid for which they are designed. In all cases, the operation is carried out by the fluid in the system to be protected.

It is applicable to pilot operated safety valves having a valve 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 it is not concerned with applications for pilot operated 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 and composite flanges.*

prEN 1759-1, *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, Class designated – Part 1: Steel flanges NPS1/2 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.*

ASME B1.20.1, *NPT threads.*

3 Terms and definitions

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

3.1
pilot operated safety valve
self actuated device comprising a valve and an attached pilot

NOTE The pilot responds to the pressure of the fluid without any other energy than the fluid itself and controls the operation of the valve. The valve opens when the fluid pressure that keeps it closed is removed or reduced. The valve re-closes when the pressure is re-applied.

3.1.1
types of pilot

3.1.1.1
flowing pilot
pilot which discharges the fluid throughout the relieving cycle of the pilot operated safety valve

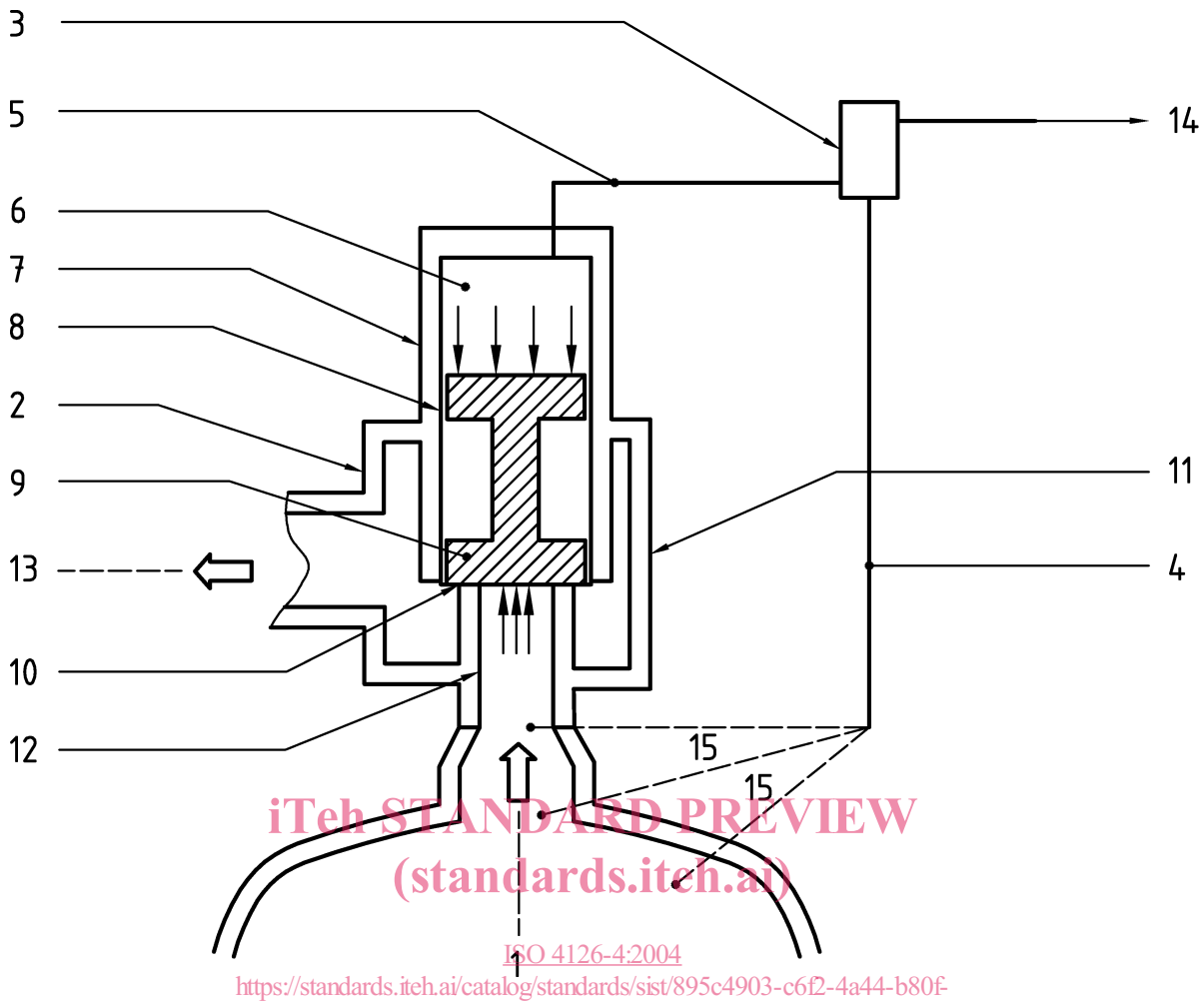
3.1.1.2
non-flowing pilot
pilot in which the fluid flows only during the opening and/or closing of the pilot operated safety valve

3.1.2
types of action of the pilot operated safety valve

3.1.2.1
ON/OFF
action characterised by stable operation resulting in fully open or fully closed main valve position

3.1.2.2
modulating
action characterised by a gradual opening and closing of the disc of the main valve which is a function of the pressure, proportional but not necessarily linear

3.2
list of main components
see Figure 1



Key

1 Equipment to be protected
2 Main valve
3 Pilot valve
4 Sensing line
5 Loading/unloading line
6 Pressure chamber
7 Cover
8 Guide
9 Disc
10 Seat
11 Body
12 Inlet
13 Outlet
14 Pilot outlet
15 Connection of the sensing line : see the following note

NOTE The sensing line from the pilot can be either connected to the main valve inlet or connected directly to the equipment to be protected. In cases where the sensing line is not connected to the main valve inlet, considerations should be given to the length and to the protection from damage of the sensing line.

Figure 1 — Nomenclature of main components of a pilot operated safety valve

3.3
pressure

3.3.1
set pressure
predetermined pressure at which the valve of a pilot operated 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.

3.3.2
maximum allowable pressure, PS
maximum pressure for which the equipment is designed as specified by the manufacturer

3.3.3
opening sensing pressure
pressure at which the pilot commences to open in order to achieve the set pressure

3.3.4
overpressure (of a pilot operated safety valve)
pressure increase over the set pressure, at which the main 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 pilot operated safety valve.

3.3.5
reseating pressure (of a pilot operated safety valve)
value of the inlet static pressure at which the disc re-establishes contact with the seat or at which the lift becomes zero

3.3.6
cold differential test pressure
inlet static pressure at which a pilot operated 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.

3.3.7
relieving pressure
pressure used for the sizing of a pilot operated safety valve which is greater than or equal to the set pressure plus overpressure

3.3.8
built-up back pressure
pressure existing at the outlet of the main valve caused by flow through the main valve and the discharge system

3.3.9
superimposed back pressure
pressure existing at the outlet of the main 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.

3.3.10
blowdown (of a pilot operated safety valve)
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

3.4
lift
actual travel of the main valve disc away from the closed position

3.5
flow area
minimum cross-sectional flow area (but not the curtain area) between inlet and seat which is used to calculate the theoretical flowing capacity of the main valve, with no deduction for any obstruction

NOTE The symbol is A.

3.6
flow diameter
diameter corresponding to the flow area

3.7
discharge capacity

3.7.1
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 main valve

3.7.2
coefficient of discharge
value of actual flowing capacity (from tests) divided by the theoretical flowing capacity (from calculation)

3.7.3
certified (discharge) capacity
that portion of the measured capacity permitted to be used as a basis for the application of a pilot operated safety valve

NOTE It may, for example, equal the :

a) measured flow rate times the derating factor ; or

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

c) theoretical flow rate times the certified derated coefficient of discharge.

3.8
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	Actual critical temperature	K
μ	Dynamic viscosity	Pa·s
v_o	Specific volume at actual relieving pressure and temperature	m^3/kg
x_o	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 the main 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 Means shall be provided to lock and/or to seal all external adjustments in such a manner so as to prevent or reveal unauthorized adjustments of the pilot operated safety valve.