



**SLOVENSKI STANDARD**  
**SIST EN ISO 4126-4:2004**  
**01-september-2004**

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**Naprave za varovanje pred visokim tlakom - 4. del: Predkrmiljeni varnostni ventili  
(ISO 4126-4:2004)**

Safety devices for protection against excessive pressure - Part 4: Pilot operated safety valves (ISO 4126-4:2004)

Sicherheitseinrichtungen gegen unzulässigen Überdruck - Teil 4: Pilotgesteuerte Sicherheitsventile (ISO 4126-4:2004)

Dispositifs de sécurité pour protection contre les pressions excessives - Partie 4:  
Soupapes de sureté pilotées (ISO 4126-4:2004)

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**en**

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ICS 13.240

English version

Safety devices for protection against excessive pressure - Part  
4: Pilot operated safety valves (ISO 4126-4:2004)

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This European Standard was approved by CEN on 16 May 2003.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

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of an identical text or by endorsement, at the latest by August 2004, and conflicting national standards shall be withdrawn at the latest by August 2004.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

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 4. The various parts are:

- STANDARD PREVIEW  
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- Part 1 : Safety valves
  - Part 2 : Bursting disc safety devices [SIST EN ISO 4126-4:2004](https://standards.iteh.ai/catalog/standards/sist/ce5388b-4adb-486b-b338-673608d36c40/sist-en-iso-4126-4-2004)
  - 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**

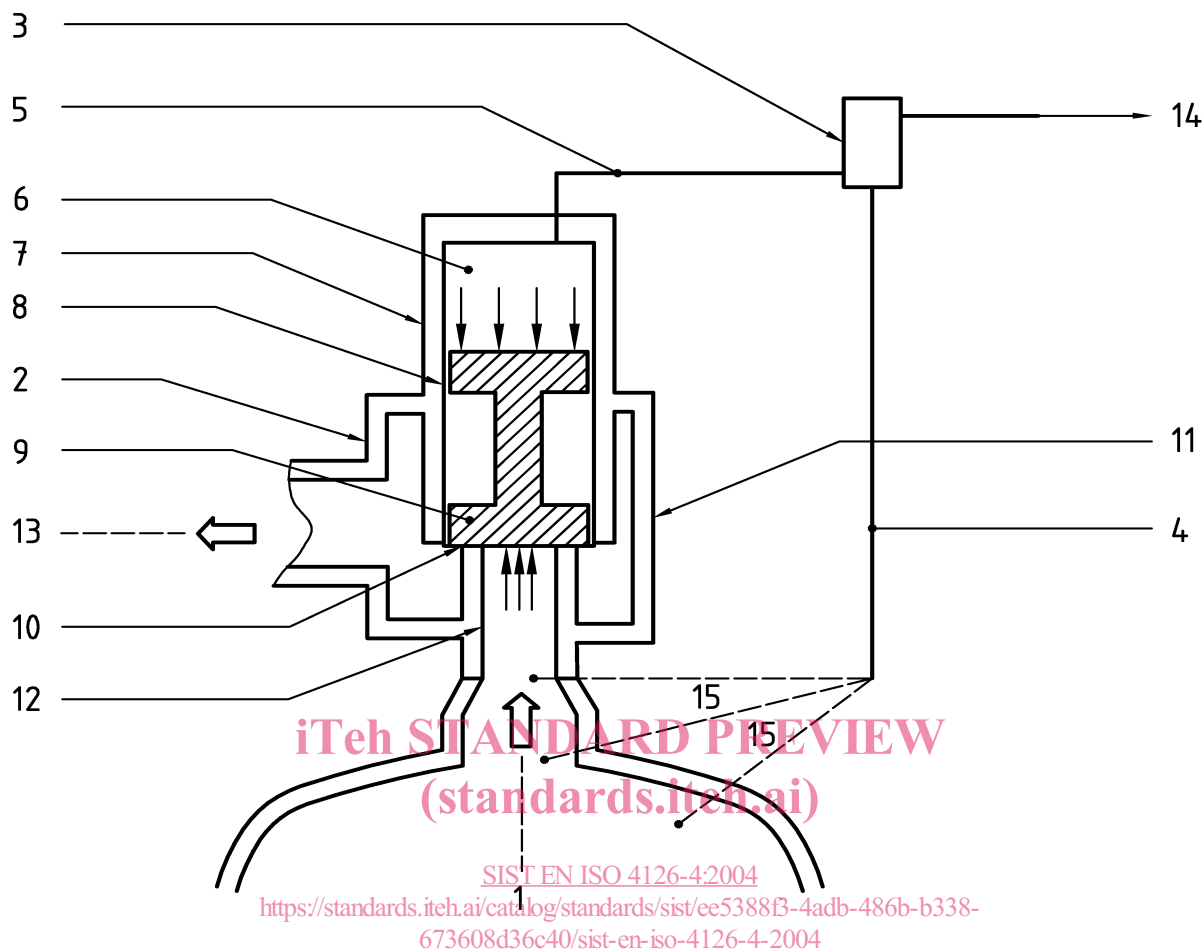
action characterised by a gradual opening and closing of the disc of the main valve which is a function of the pressure, proportional but not necessarily linear

**3.2**  
**list of main components**  
see Figure 1

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**Key**

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

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.

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**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

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**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

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**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

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## 4 Symbols and units

Table 1 — Symbols and their descriptions

Symbol	Description	Unit
$A$	Flow area of a safety valve (not curtain area)	mm <sup>2</sup>
$C$	Function of the isentropic exponent	-
$K_b$	Theoretical capacity correction factor for subcritical flow	-
$K_d$	Coefficient of discharge <sup>a</sup>	-
$K_{dr}$	Certified derated coefficient of discharge ( $K_d \times 0,9$ ) <sup>a</sup>	-
$K_v$	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·mm <sup>2</sup> )
$q'_m$	Specific discharge capacity determined by tests	kg/(h·mm <sup>2</sup> )
$R$	Universal gas constant	-
$T_o$	Relieving temperature	K
$T_c$	Actual critical temperature	K
$\mu$	Dynamic viscosity	Pa·s
$v_o$	Specific volume at actual relieving pressure and temperature	m <sup>3</sup> /kg
$x_o$	Dryness fraction of wet steam at the valve inlet at actual relieving pressure and temperature <sup>b</sup>	-
$Z$	Compressibility factor at actual relieving pressure and temperature	-
<sup>a</sup>	$K_d$ and $K_{dr}$ are expressed as 0,xxx.	
<sup>b</sup>	$x$ 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.

**5.1.4** In the case of main valves with restricted lift, the lift restricting device shall limit the main valve lift but shall not otherwise interfere with the operation of the main valve. The lift restricting device shall be designed so that, if adjustable, the adjustable feature can be mechanically locked and 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 1 mm.

**5.1.5** Pilot operated safety valves for toxic or flammable fluids shall have the pilot vented to a safe place.

**5.1.6** The main valve shall be provided with a drain connection at the lowest point where liquid can collect unless other provisions for draining are provided.

**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 any sealing elements, the pilot operated safety valve shall discharge its certified capacity at not over 1,1 times the maximum allowable pressure of the equipment to be protected.

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

**5.1.10** In the case of reasonably foreseeable damage to connections between the various components the resulting flow areas shall be such that the pilot operated safety valve will discharge its certified capacity at not more than 1,1 times the maximum allowable pressure.

**5.1.11** When the superimposed back pressure is higher than the inlet pressure, means shall be provided that the main valve shall not open.

**5.1.12** The fitting of any additional device to a pilot and valve combination shall not prevent the pressurized system from being protected under any circumstances.

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## 5.2 End connections

### 5.2.1 Types

The types of end connections for pilot operated safety valves 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 ASME 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 2a).