INTERNATIONAL STANDARD

ISO 4126-4

Second edition
2013-07-15

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
ISO 4126-4:2013(E)

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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.

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 Technical Committee ISO/TC 185, *Safety devices for protection against excessive pressure*.

This second edition cancels and replaces the first edition (ISO 4126-4:2004), which has been technically revised. It also incorporates the Technical Corrigendum ISO 4126-4:2004/Cor 1:2007.

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*

— *Part 9: Application and installation of safety devices excluding stand-alone bursting disc safety devices*

— *Part 10: Sizing of safety valves for gas/liquid two-phase flow*

— *Part 11: Performance testing*[1)]

Part 7 contains data that is common to more than one of the parts of ISO 4126 to avoid unnecessary repetition.

1) Under development.

Safety devices for protection against excessive pressure —

Part 4:
Pilot operated safety valves

1 Scope

This part of ISO 4126 specifies general requirements for pilot operated safety valves, 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 4 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 applicable to applications of pilot operated safety valves.

2 Normative references

The following referenced documents are indispensable for the application 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 4126-7:2013, *Safety devices for protection against excessive pressure — Part 7: Common data*

3 Terms and definitions

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

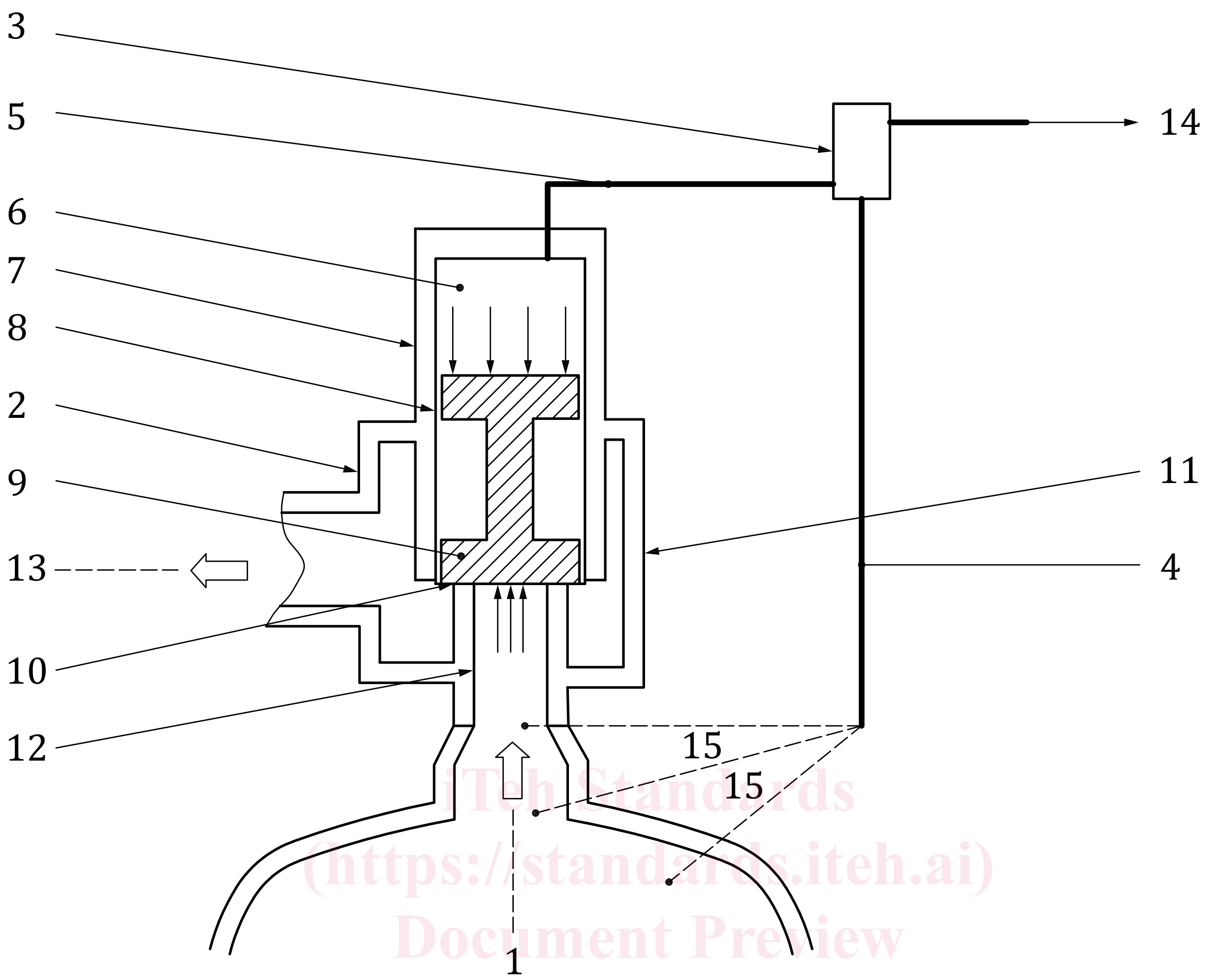
3.1
pilot operated safety valve
self-actuated device comprising a main valve and an attached pilot

Note 1 to entry: The pilot responds to the pressure of the fluid without any other actuating energy than the fluid itself and controls the operation of the main valve. The main valve opens when the fluid pressure that keeps it closed is removed or reduced. The main valve re-closes when the pressure is re-applied.

Note 2 to entry: See Figure 1 for a list of main components.

3.2
main valve
parts of a pilot operated safety valve, through which the discharge capacity is achieved

3.3
flowing pilot
pilot which discharges the fluid throughout the relieving cycle of the pilot operated safety valve



Key

1 equipment to be protected
2 main valve
3 pilot valve
4 sensing line
5 loading/unloading line
6 pressure chamber
7 cover (or cap)
8 guide
9 disc (or piston)
10 seat
11 main valve body
12 main valve inlet
13 main valve outlet
14 pilot outlet
15 connection of the sensing line (see 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

3.4
non-flowing pilot
pilot in which the fluid flows only during the opening and/or closing of the pilot operated safety valve

3.5
ON/OFF
action characterized by stable operation resulting in fully open or fully closed main valve position

Note 1 to entry: This is an action of the pilot operated safety valve.

3.6
modulating
action characterized 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

Note 1 to entry: This is an action of the pilot operated safety valve.

3.7
set pressure
predetermined pressure at which the main valve of a pilot operated safety valve under operating conditions commences to open

Note 1 to entry: It is the gauge pressure measured at the main valve inlet at which the pressure forces tending to lift the main valve disc for the specific service conditions are in equilibrium with the forces retaining the main valve disc on its seat.

3.8
maximum allowable pressure
PS
maximum pressure for which the protected equipment is designed

3.9
opening sensing pressure
pressure at which the pilot commences to open in order to achieve the set pressure

3.10
overpressure
pressure increase over the set pressure, usually expressed as a percentage of the set pressure

3.11
reseating pressure
value of the inlet static pressure at which the main valve disc re-establishes contact with the seat or at which the lift becomes zero

3.12
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 1 to entry: This test pressure includes corrections for service conditions, e.g. back pressure and/or temperature.

3.13
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

3.14
back pressure
pressure that exists at the outlet of a safety valve as a result of the pressure in the discharge system

Note 1 to entry: The back pressure is the sum of the superimposed and built-up back pressures.

3.15
built-up back pressure
pressure existing at the outlet of the main valve caused by flow through the main valve and the discharge system

3.16
superimposed back pressure
pressure existing at the outlet of the main valve at the time when the device is required to operate

Note 1 to entry: It is the result of pressure in the discharge system from other sources.

3.17
blowdown
difference between set and reseating pressures

Note 1 to entry: Blowdown is normally stated as a percentage of set pressure except for pressures of less than 3 bar when the blowdown is expressed in bar.

3.18
lift
actual travel of the main valve disc away from the closed position

3.19
flow area
minimum cross-sectional flow area (but not the smallest area between disc and seat) between inlet and seat which is used to calculate the theoretical flowing capacity of the main valve, with no deduction for any obstruction

3.20
flow diameter
diameter corresponding to the flow area

3.21
theoretical discharge capacity
calculated capacity of a theoretically perfect nozzle having a cross-sectional flow area equal to the flow area of the main valve of a pilot operated safety valve

Note 1 to entry: It is expressed in mass or volumetric units.

3.22
coefficient of discharge
value of actual flowing capacity (from tests) divided by the theoretical flowing capacity (from calculation)

3.23
certified (discharge) capacity
portion of the measured capacity permitted to be used as a basis for the application of a pilot operated safety valve

Note 1 to entry: It may, for example, equal the: a) measured flow rate times the de-rating factor; or b) theoretical flow rate times the coefficient of discharge times the de-rating factor; or c) theoretical flow rate times the certified de-rated coefficient of discharge.

3.24
DN (nominal size)
alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters DN followed by a dimensionless number having an indirect correspondence to the physical size of the bore or outside diameter of the component end connection

Note 1 to entry: The dimensionless number does not represent a measurable value and is not used for calculation purposes.

Note 2 to entry: Prefix DN usage is applicable to components bearing PN designations according to ISO 7268.

Note 3 to entry: Adapted from ISO 6708:1995, definition 2.1.

4 Symbols and units

Table 1 — Symbols and their descriptions

Symbol	Description	Unit
A	Flow area of a safety valve (not smallest area between seat and disc)	mm^2
K_d	Coefficient of discharge[a]	—
K_{dr}	Certified de-rated coefficient of discharge (K_d × 0,9)[a]	—
n	Number of tests	—
q_m	Theoretical specific discharge capacity	kg/(h·mm^2)
q'_m	Specific discharge capacity determined by tests	kg/(h·mm^2)

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

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 in accordance with the design of the manufacturer.

The 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 pressure-retaining shells shall not exceed that specified in the appropriate standards.

NOTE For example, EN 12516 or ANSI/ASME B 16.34 may be used as reference.

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

5.1.9 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.

5.1.10 When the superimposed back pressure can be higher than the inlet pressure, means shall be provided so that the main valve does not open.

5.1.11 Easing gear shall be provided when specified or alternatively means for connecting and applying pressure to the pilot adequate to verify that the moving parts critical to proper operation are free to move.

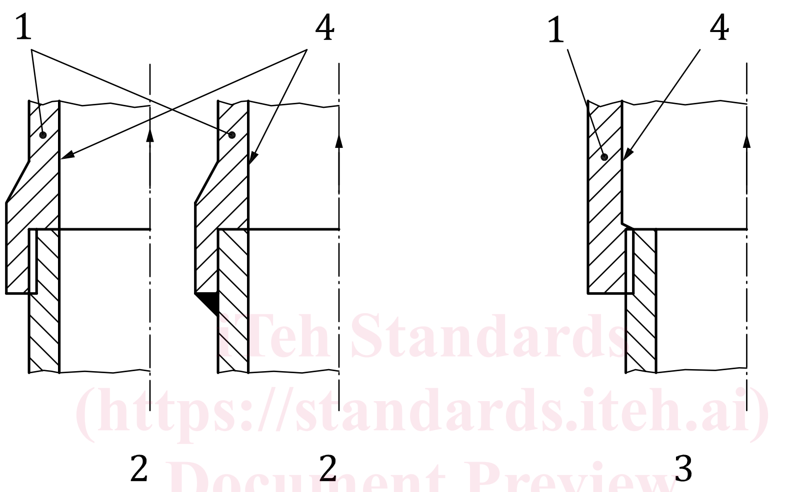
5.1.12 The fitting of any additional device to a pilot and main valve combination shall not prevent the pressurized system from being protected under any circumstances.

5.2 Valve end connections

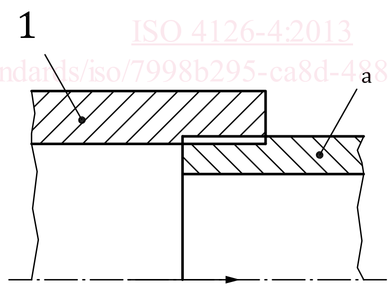
The inlet design of valve end connections, regardless of type, shall be such that the internal area of the external pipe or stub connection at the safety valve inlet is at least equal to that of the valve inlet connection [see Figure 2 a)].

The outlet design of valve end connections, regardless of type, shall be such that the internal area of the external pipe connection at the safety valve outlet is at least equal to that of the valve outlet, except those valves with female threaded outlet connections [see Figure 2 b)].

NOTE See Clause 7 regarding type testing.



a) Inlet



b) Outlet

Key

1 main valve

2 satisfactory

3 unsatisfactory

4 required internal diameter of the pilot operated safety valve for the valve to function properly

[a] If the nominal diameter of the pipe is not equal to the nominal diameter of the valve outlet as shown, then a suitable pipe shall be fitted during testing as specified in 7.1.4.

Figure 2 — Design of end connections

5.3 Minimum requirements for springs

Pressure setting springs, as applicable, shall be in accordance with ISO 4126-7.

