INTERNATIONAL STANDARD

**ISO 4126-5**

First edition
2004-03-15

# Safety devices for protection against excessive pressure —

## Part 5: Controlled safety pressure relief systems (CSPRS)



*Dispositifs de sécurité pour protection contre les pressions excessives —*

*Partie 5: Dispositifs de sûreté à décharge contrôlés contre les surpressions (DSDCS)*



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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 4126-5 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).



This first edition of ISO 4126-5, together with those of ISO 4126-2, ISO 4126-3, ISO 4126-4 and ISO 4126-6, cancels and replaces ISO 6718:1991, of which it constitutes a technical revision.



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



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, the CEN annex regarding fulfilment of European Council Directives has been removed.

It should be noted that, with regard to the corresponding EN standard, the designations given in Clause 10 have been adapted to the needs of international standardization.

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## Foreword

This document (EN ISO 4126-5:2004) 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, 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 5. 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 the requirements for Controlled Safety Pressure Relief Systems irrespective of the fluid for which they are designed.

It is applicable for main valves having a flow diameter of 6 mm and above which are for use at 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.

## 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 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).*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety related systems.*

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**
**controlled safety pressure relief system (CSPRS)**
system consisting of a main valve in combination with control units (see Figure 1a, 1b and 1c)

NOTE On reaching the set pressure the controlling forces on the main valve are by means of the control unit automatically applied, released or so reduced that a main valve discharges a specified quantity of the fluid so as to prevent the predetermined

pressure being exceeded. The system is so designed that the main valve re-closes and prevents a further flow of fluid after normal pressure conditions of service have been restored.

**3.1.1**
**main valve**
valve, including the body and actuator, which opens without the assistance of any energy other than that of the fluid to be relieved under the principle of 3.1.1.1 or 3.1.1.2 (see Figure 2)

**3.1.1.1**
**relieving principle**
principle in which a main valve opens when the controlling force is released or reduced, and in which the main valve closes when the controlling force is re-applied (see Figure 2 type 1)

**3.1.1.2**
**loading principle**
principle in which a main valve opens when the controlling force is applied, and in which the main valve closes when the controlling force is removed (see Figure 2 type 2)

**3.1.2**
**control unit**
unit which establishes the opening and closing of the main valve

NOTE The arrangement shall consist of at least two individual control systems in operation. The individual control system may consist of pressure tapping line, pressure sensor, sensing line, control module and control line (see Figures 1a, 1b and 1c).

**3.1.2.1**
**pressure tapping line**
line to the pressure sensor



**3.1.2.2**
**sensing line**
line between the pressure sensor and control module



**3.1.2.3**
**control line**
line between the control module and the main valve

**3.1.2.4**
**pressure sensor**
comparator in which a predetermined adjustable value of pressure is compared with the actual system pressure

NOTE On reaching the predetermined pressure a signal is transmitted to the control unit. The signal to the control unit is removed when the system pressure has been lowered to a predetermined pressure.

**3.1.2.5**
**control module**
module which transforms the signal from the pressure sensor into a force to operate the actuator of the main valve

**3.1.3**
**circuit principle of the control unit**
**3.1.3.1**
**closed circuit principle**
principle characterized by the fact that on failure of the external control energy the control unit effects the loading or relief of the main valve

**3.1.3.2**
**open circuit principle**
principle characterized by the fact that on failure of the external control energy the control unit does not change the loading or relief of the main valve

**3.1.4**
**controlling force**
force which causes the main valve to operate and can be created by the fluid itself, mechanically e.g. springs or weight, hydraulically, pneumatically or electrically

**3.2**
**pressure**
**3.2.1**
**set pressure of a CSPRS**
predetermined pressure at which a CSPRS under operating conditions commences to open

NOTE It is the gauge pressure measured at the main valve inlet at which the pressure forces tending to open the main valve for the specified service conditions are in equilibrium with the forces retaining the main 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 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 CSPRS.

**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 the main valve is set to commence to open on the test bench

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

**3.2.6**
**relieving pressure**
pressure used for the sizing of a CSPRS 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 the main valve caused by flow through the valve and the discharge system

**3.2.8**
**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.

**3.2.9**
**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

**3.2.10**
**opening sensing pressure**
predetermined pressure which activates the pressure sensor

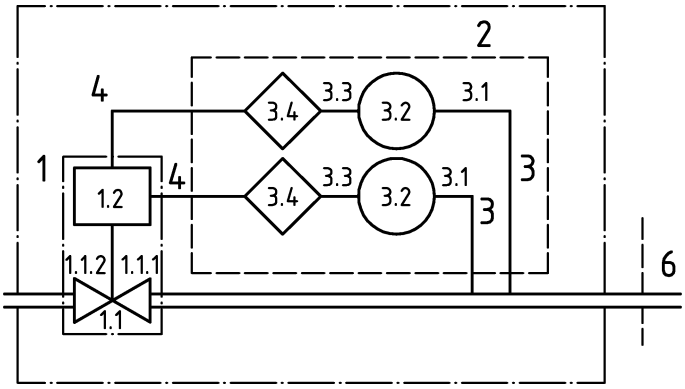



**Figure 1 a) — Two control lines, relieving principle**

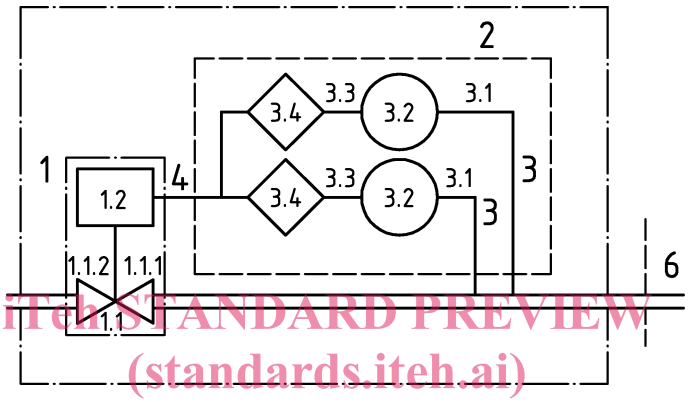





**Figure 1 b) — One control line, relieving principle**



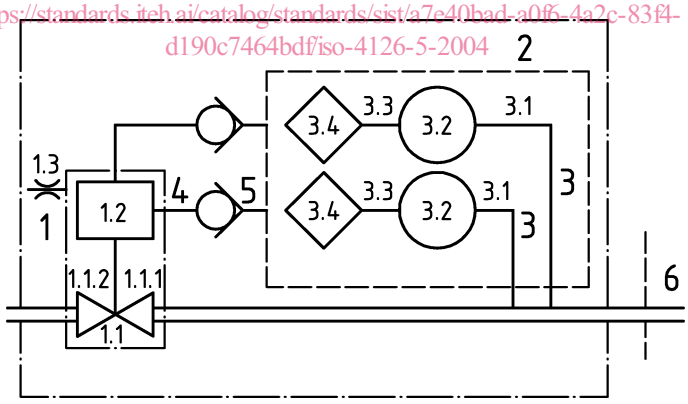
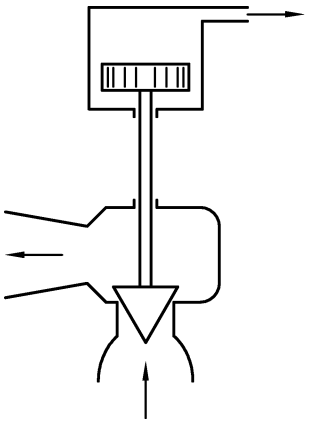



**Figure 1 c) — Two control lines, loading principle**

**Key**

| | | | |
|---|---|---|---|
| 1 | Main valve | 3.1 | Pressure tapping line |
| 1.1 | Body | 3.2 | Pressure sensor |
| 1.1.1 | Inlet port | 3.3 | Sensing line |
| 1.1.2 | Outlet port | 3.4 | Control module |
| 1.2 | Actuator | 4 | Control line |
| 1.3 | Vent | 5 | Check valve |
| 2 | Control unit | 6 | Protected system |
| 3 | Individual control system | | |

**Figure 1 — Typical examples of redundant individual control systems**



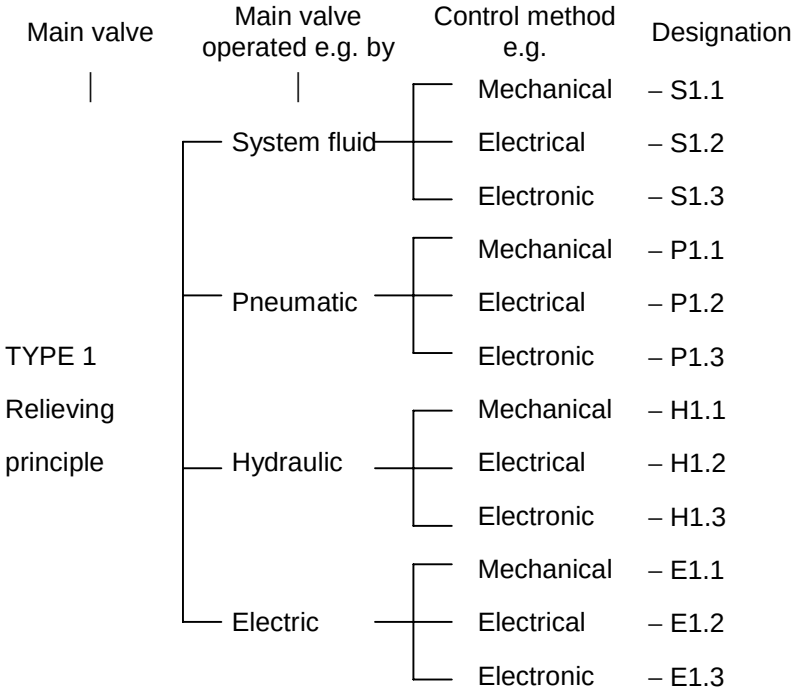
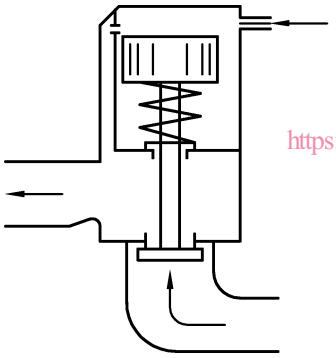



**Figure 2 a) — Type 1 : Relieving principle**





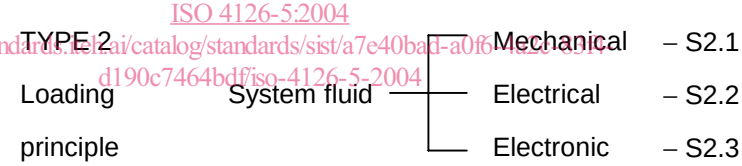



**Figure 2 b) — Type 2 : Loading principle**

**Figure 2 — Operating principle of the main valve**

**3.2.11**
**closing sensing pressure**
predetermined pressure which deactivates the pressure sensor

**3.3**
**lift**
actual travel of the main 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 the main 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 the CSPRS

NOTE It may, for example, equal :

a) the measured capacity times the derating factor ; or

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

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



**3.7**
**DN (nominal size)**
see EN ISO 6708



**3.8**
**functional times**
**3.8.1**
**opening time**
time interval for the main valve to move from the closed to the fully open position

**3.8.2**
**reseating time**
time interval for the main valve to move from the fully open to the closed position

**3.8.3**
**opening dead time**
time interval from the detection of the opening sensing pressure and the commencement of the opening of the main valve

**3.8.4**
**reseating dead time**
time interval from the detection of the closing sensing pressure and the commencement of the closing of the main valve