

Safety valves —

Part 2: Specification for safety valves for compressed air or inert gases

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Pressure Vessel Standards Committee (PVE/-) to Technical Committee PVE/12 upon which the following bodies were represented:

- Associated Offices Technical Committee
- Association of Shell Boilermakers
- BEAMA Ltd.
- British Compressed Air Society
- British Compressed Gases Association
- British Valve Manufacturers' Association Ltd.
- Combustion Engineering Association
- Electricity Supply Industry in England and Wales
- Energy Industries Council
- Engineering Equipment and Materials Users' Association
- GAMBICA (BEAMA Ltd.)
- Health and Safety Executive
- Institution of Chemical Engineers
- Institution of Mechanical Engineers
- Liquefied Petroleum Gas Industry Technical Association (UK)
- Process Plant Association
- Spring Research and Manufacturers' Association
- Water-tube Boilermakers Association

This British Standard, having been prepared under the direction of the Pressure Vessel Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 August 1984

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ISBN 0 580 14008 3

Amendments issued since publication

Amd. No.	Date of issue	Comments
5494	March 1987	
9276	January 1997	Indicated by a sideline in the margin

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Foreword

The preparation of this British Standard has been undertaken under the direction of the Pressure Vessel Standards Committee to incorporate such requirements as are necessitated by technical developments and to comply with the requirements of ISO 4126 “*Safety valves, general requirements*”, published by the International Organization for Standardization.

The opportunity has been taken to bring together in one standard the requirements for safety valves. The standard will be published in three Parts as follows:

- *Part 1: Specification for safety valves for steam and hot water;*
- *Part 2: Specification for safety valves for compressed air or inert gases;*
- *Part 3: Specification for safety valves for process fluids.*

This Part of this standard requires that safety valve designs shall be type tested for their operational and flow characteristics to the satisfaction of an independent authority. In order to give manufacturers a period of grace in which to align their products with this standard, BS 1123 will be retained as an obsolescent standard until it is withdrawn in December 1987.

To assist manufacturers and independent authorities, a list of testing establishments, together with details of facilities available, has been compiled and is available on request from the Enquiry Section (London), British Standards Institution.

The hydraulic pressure testing requirements for components to this standard are in many cases equal to or greater than those for the vessel or system to which they may be fitted, but in any case it can be taken that any safety valve body will be capable of sustaining a hydraulic test pressure equal to 1.5 times the design pressure of the valve as specified to the valve supplier by the purchaser. For this purpose a safety valve is gagged or the seat blanked off as appropriate during the test.

This Part of this standard deals with the materials, construction, and testing of safety valves and associated capacity calculations, but is not intended to cover all details of their installation, for which additional reference should be made to the appropriate British Standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This Part of this British Standard specifies requirements for the design, inspection, testing and flow certification relating to safety valves for air receivers and compressed air or inert gases. It is not applicable to the following:

- a) the protection of low pressure storage tanks storing liquefied gases at or near atmospheric pressure within the scope of BS 799-5, BS 2594, BS 2654 and BS 5387;
- b) the protection of vessels and containers used for the transport of fluids under pressure.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6759 the following definitions apply.

2.1 safety valve

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

2.1.1

closed bonnet safety valve

a safety valve in which the spring is totally enclosed within the bonnet

NOTE The closed bonnet prevents leakage to the atmosphere and protects the spring from environmental conditions and damage. Where pressure build up within the bonnet is not acceptable a suitable means of venting is provided.

2.1.2

direct loaded safety valve

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

2.1.3

enclosed discharge safety valve

a safety valve having an outlet connection enabling the discharge to be piped to a safe place. Sometimes referred to as a piped discharge safety valve

2.1.4

open bonnet safety valve

a safety valve where the spring is exposed to the environment

2.1.5

open discharge safety valve

a safety valve which has an inlet connection only and discharges directly to atmosphere through holes in the body or bonnet

2.2

blowdown of a safety valve

the difference between the set and the reseating pressures, normally stated as a percentage of set pressure except for very low set pressure when the blowdown is then expressed in bar¹⁾

2.3

built-up back pressure

the pressure existing at the outlet of the safety valve caused by flow through the valve and the discharge system

2.4

certified discharge capacity

that portion of the measured capacity permitted to be used as a basis for the application of a safety valve

NOTE The certified discharge capacity is derived from either measured flow rate X derating factor, or theoretical flow rate X coefficient of discharge X derating factor, or theoretical flow rate X derated coefficient of discharge.

2.5

coefficient of discharge (K_d)

the actual flowing capacity, determined by flow testing, divided by the theoretical capacity, determined by calculation

2.6

cold differential test pressure

the inlet static pressure at which a safety valve is set to commence to lift on the test stand. This test pressure includes corrections for service conditions of back pressure and/or temperature

2.7

commencement of lift

initial lift such as would cause the first indication of movement on a linear transducer or equivalent

NOTE Provision of such instrument facility only applies to valves under operating characteristics tests.

2.8

derated coefficient of discharge (K_{dr})

the coefficient of discharge (K_d) multiplied by a derating factor of 0.9

2.9

derating factor

the factor of 0.9 used in calculating the certified discharge capacity

¹⁾ 1 bar = 10^5 N/m² = 100 kPa.

NOTE This factor takes account of the manufacturing tolerances and permitted variation of test results.

**2.10
equivalent calculated capacity**

the calculated capacity of a safety valve for conditions of pressure, temperature or nature of the fluid which differ from those for which certified capacities are available

**2.11
flow area**

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

NOTE See Figure 1.

**2.12
flow diameter**

the diameter corresponding to the flow area

**2.13
independent authority**

that competent independent authority which bears responsibility for all aspects of surveillance of tests, checking of calculations and certification of safety valve discharge capacities

**2.14
inspecting authority**

the competent independent authority or association which verifies compliance with this standard

**2.15
lift**

the travel of the disk away from the closed position

**2.16
nominal size (DN)**

a numerical designation of size which is common to all components in a piping system other than components designated by outside diameter or by thread size. It is a convenient round number for reference purposes and it is only loosely related to manufacturing dimensions

**2.17
overpressure of a safety valve**

a pressure increase over the set pressure of a safety valve, usually expressed as a percentage of set pressure

**2.18
relieving pressure (flow rating pressure)**

set pressure plus overpressure

**2.19
reseating pressure of a safety valve**

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

**2.20
set pressure**

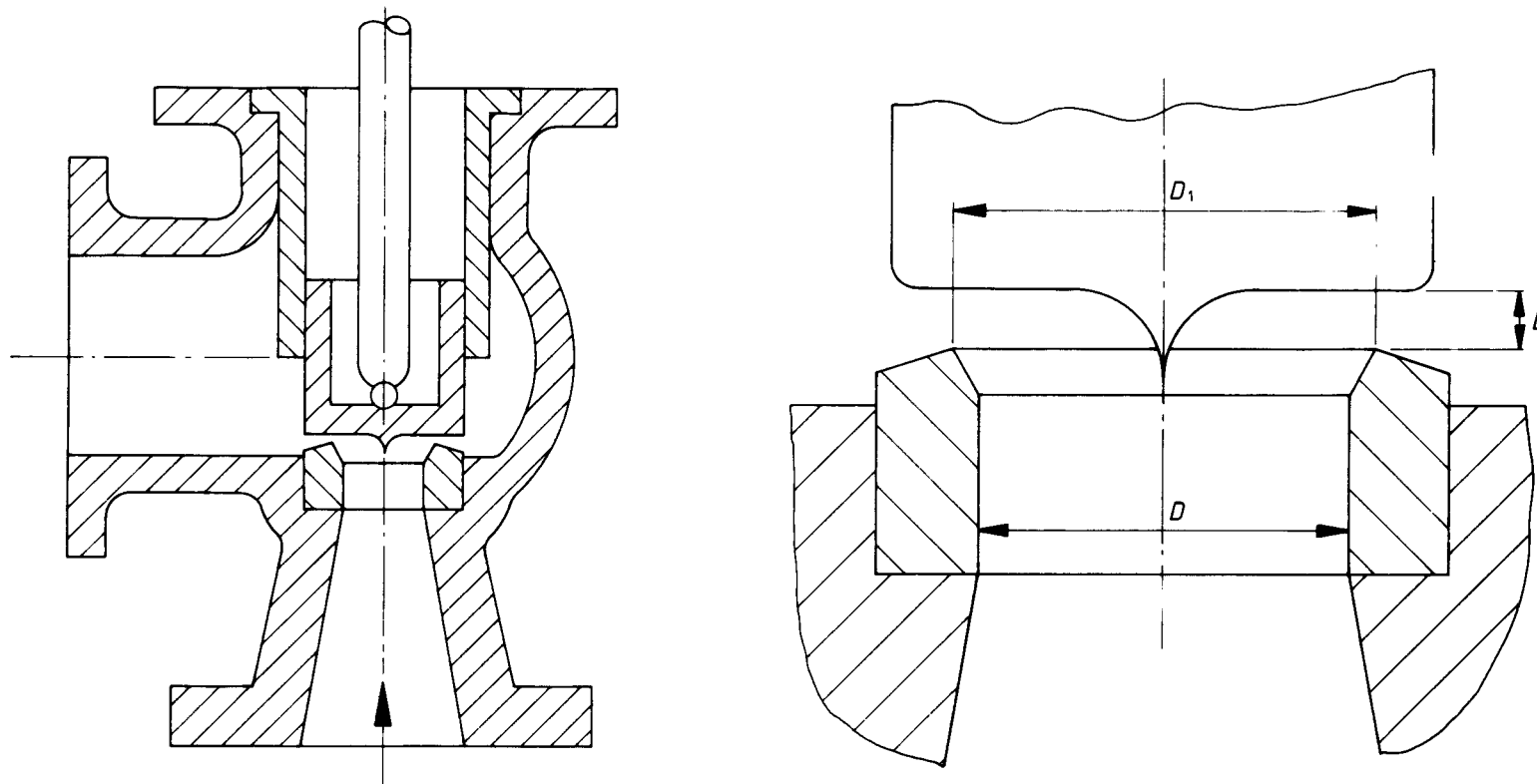
the predetermined pressure at which a safety valve under operating conditions should commence to lift. It is the gauge pressure measured at the valve inlet at which the pressure forces tending to open the valve for the specified service conditions are in equilibrium with the forces retaining the valve disk on its seat

**2.21
superimposed back pressure**

the static pressure existing at the outlet of a safety valve at the time the device is required to operate. It is the result of pressure in the discharge system from other sources

**2.22
theoretical flowing (discharge) capacity**

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



NOTE The flow area is $\frac{\pi}{4} D^2$ (see 2.11). The curtain area is $\pi D_1 L$.

Figure 1 — Illustration of area definitions

Section 2. Material requirements and limitations

3 Pressure containing components

3.1 Material specification

The materials used in the manufacture of bodies and other pressure containing components of safety valves shall be selected from the following taking into account the appropriate temperature and pressure limitations for the materials that are given:

- a) cast carbon steel to BS 1504-161, grade 430 or BS 3146-1; maximum temperature 400 °C;
- b) wrought carbon steel bar to BS 970-1, 070M20; maximum temperature 480 °C;
- c) forged carbon steel to BS 1503-221-430; maximum temperature 480 °C;
- d) grey cast iron with minimum mechanical properties equal to those specified in BS 1452 grade 220; maximum temperature 220 °C and maximum pressure 13 bar;
- e) spheroidal graphite iron with minimum mechanical properties equal to those specified in BS 2789, grade 420/12; maximum temperature 350 °C;
- f) copper alloy with minimum mechanical properties equal to those specified in BS 1400 LG 2 or BS 2874 CZ121; maximum temperature 260 °C;
- g) austenitic chromium nickel steel bar to BS 970-1, grade 316 S33; maximum temperature 450 °C;

h) other material having properties at least equal to those of the material to which it is an intended alternative, subject to agreement between the manufacturer and the purchaser.

3.2 Seats and disks

The seats and disks of valves shall be made from corrosion and erosion resistant material. Materials shall not be used which distort or degrade under operating conditions, such as to cause a rise in the set pressure, leakage or change in the discharge capacity.

Grey cast iron shall not be used for the seats or disks of valves.

3.3 Safety valve springs

Material requirements for safety valve springs are given in clause 5.

3.4 Pressure containing joints

3.4.1 Bolting. The dimensions and finish of bolting shall comply with the following British Standards as appropriate.

Metric	Inch
BS 3692	BS 1768 (Below ½ in)
BS 4190	BS 1769
BS 4439	BS 2708
BS 4882	BS 4882

3.4.2 Jointing. The jointing material and type shall be suitable for the application.