

Transportable gas container valves —

Part 4: Pressure relief devices

ICS 23.060.40

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee, PVE/3, Gas containers, to Subcommittee PVE/3/1, Valve fittings for gas cylinders, upon which the following bodies were represented:

British Compressed Gases Association
DoH – Medical Devices Agency
Health and Safety Executive
Home Office
L P Gas Association
Ministry of Defence
Personal Safety Manufacturer's Association
Scuba Industries Trade Association Ltd.

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Foreword

This part of BS 341 has been prepared by Subcommittee PVE/3/1 on behalf of Technical Committee PVE/3 and partially supersedes BS 341-1:1991, which is obsolescent.

BS 341-1:1991 detailed all aspects of the design, manufacture and testing of valves fitted to containers used for the conveyance of permanent, liquefiable and dissolved gases, except those for liquefied petroleum gas (LPG) applications.

The scope of the 1991 version has been progressively superseded by a series of standards originating in the European Committee for Standardization (CEN). This part of BS 341 has been issued to cover requirements for pressure relief devices. However, it is anticipated that it will be withdrawn on the publication of a future CEN standard on this subject.

BS 341, *Transportable gas container valves*, is published in four parts:

- Part 1: *Specification for industrial valves for working pressures up to and including 300 bar (obsolescent)*;
- Part 2: *Valves with taper stems for use with breathing apparatus (obsolescent)*;
- Part 3: *Valve outlet connections*;
- Part 4: *Pressure relief devices*.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

Summary of pages

This document comprises of a front cover, an inside front cover, pages i and ii, pages 1 to 3 and a back cover.

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1 Scope

This part of BS 341 specifies requirements for the design and application of pressure relief devices for use with transportable gas cylinders manufactured for conveyance and storage of compressed, liquefied and dissolved gases for industrial and medical applications.

This part of BS 341 does not include requirements for pressure relief devices for liquefied petroleum gas (LPG).

This part of BS 341 applies to pressure relief devices for containers limited to a charging pressure of 300 bar)¹⁾ gauge. (Developed pressures for particular gases may exceed this pressure.)

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.

BS 2915:1990, *Specification for bursting discs and bursting disc devices*.

BS EN 1802, *Transportable gas cylinders — Periodic inspection and testing of seamless aluminium gas cylinders*.

BS EN 1803, *Transportable gas cylinders — Periodic inspection and testing of welded carbon steel gas cylinders*.

BS EN 1968, *Transportable gas cylinders — Periodic inspection and testing of seamless steel gas cylinders*.

BS EN 12863, *Transportable gas cylinders — Periodic inspection and maintenance of dissolved acetylene cylinders*.

BS EN ISO 11114-1, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials*.

BS EN ISO 11114-2, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials*.

BS EN ISO 14246, *Transportable gas cylinders — Gas cylinder valves — Manufacturing tests and inspections*.

3 Terms and definitions

For the purposes of this part of BS 341, the following terms and definitions apply.

3.1

pressure relief device

device designed to reduce the possibility of failure of a charged container from excessive pressure particularly when the container is exposed to heat

3.2

pressure relief valve

pressure relief device that is in direct contact with the gas, and is designed to open and close within predetermined pressure limits

3.3

bursting disc

pressure relief device consisting of a disc that is in direct contact with the gas and is designed to rupture between predetermined pressure limits

3.4

fusible plug

device containing a material of low melting point which is intended to yield or melt within predetermined limits of temperature and permit the discharge of the contained gas

¹⁾ 1 bar = 10⁵ N/m² = 100 kPa.

3.5

flow rating pressure

pressure at the inlet of a pressure relief device which is used for establishing its rated flow capacity

3.6

rated flow capacity

capacity of a pressure relief device measured in cubic metres per minute of free air at the designed flow rating pressure

3.7

specified bursting pressure

nominal pressure at which a bursting disc is designed to rupture

3.8

maximum bursting pressure

specified bursting pressure plus the upper permitted design tolerance

3.9

leakage

unintended flow of gas or liquid in excess of 5 mbar·l/h²⁾

4 Design of pressure relief devices

4.1 There shall be no significant change in the function of the device and no detrimental corrosion or deterioration of the materials due to normal service conditions of the container to which it is fitted within the following period.

- For valves fitted to seamless steel containers (excluding dissolved acetylene containers) of water capacity 0.5 l and above, the inspection periods shall be as specified in BS EN 1968.
- For valves fitted to welded steel containers (excluding dissolved acetylene containers) of water capacity 0.5 l up to 150 l, the inspection periods shall be as specified in BS EN 1803.
- For valves fitted to seamless aluminium alloy containers (excluding dissolved acetylene containers) of water capacity 0.5 l and above, the inspection periods shall be as specified in BS EN 1802.
- For valves fitted to dissolved acetylene containers, the inspection periods shall be as specified in BS EN 12863.

4.2 The breakage or failure of any internal component shall not obstruct free and full discharge of the gas through the pressure relief device.

4.3 The materials of construction shall be mutually compatible and compatible with the gas(es) to be conveyed (see BS EN ISO 11114-1 and BS EN ISO 11114-2) and other service conditions, e.g. to prevent room temperature bonding of relief valve seat pads to relief valve seats.

4.4 The design shall be such as to deter tampering.

4.5 The outlets from all pressure relief devices shall be so designed and constructed as to minimize the collection of moisture or other foreign matter that could adversely affect the performance of the device. The outlets from all pressure relief devices shall be so sited that free discharge from the devices is not impaired, and the jet thrust effect of such discharges does not impose destabilizing forces on the container.

4.6 All pressure relief devices shall be designed and fitted so as to ensure that the cooling effect of the discharge does not prevent the effective operation of the devices.

4.7 Pressure relief devices shall be sized to be capable, under the most severe design requirements (e.g. exposure to fire), of a discharge rate that prevents the pressure of the container contents exceeding the test pressure of the container.

The minimum rated flow capacity for pressure relief devices fitted to non-insulated containers having water capacities of 11 l or more shall be as follows.

²⁾ 5 mbar·l/h \approx 10⁻³ torr·l/s = 133.3 \times 10⁻⁶ N·m/s. An approximate indication of this leakage rate would be the formation of four 3.5 mm diameter or ten 2.5 mm diameter bubbles per minute.

a) For compressed gases:

$$Q_1 = 0.00967W_c$$

where

Q_1 is the rated flow capacity in cubic metres per minute of free air at 7 bar absolute;

W_c is the water capacity of the container in litres.

b) For liquefied gases: the rated flow capacity of the pressure device shall be twice that given by the equation in item a).

For containers having water capacities of less than 11 l, the rated flow capacity shall be as given in items a) and b), except that the value of W_c shall be 11, i.e. the rated flow capacity shall be 0.106 37 m³/min.

4.8 The yield temperature for fusible plugs used with acetylene containers shall be $(100 \pm 2) ^\circ\text{C}$.

4.9 The methods of manufacture, inspection and test shall conform to those of the valve, as specified in BS EN ISO 14246.

4.10 Bursting discs shall conform to BS 2915:1990, except that flat discs may be used, and shall be designed so as to ensure that rupture occurs at a pressure not greater than the test pressure of the container. If a container is liable to be subject to vacuum conditions during service, the bursting disc shall be fitted with vacuum supports.

NOTE Where flat discs are used, special measures should be taken in valve production to ensure it is not possible for more than one disc to be fitted to a valve.

4.11 Where practicable, fusible plugs shall be externally marked to indicate the temperature at which they are designed to operate.

5 Relief pressure

Where the pressure relief device is a bursting disc fitted to the valve of a seamless or welded container, the maximum bursting pressure shall not exceed the test pressure of the container.

Container valves are designed to operate between $-20 ^\circ\text{C}$ and $+60 ^\circ\text{C}$ and relief devices shall therefore be specified to operate within this temperature range.

For containers used in carbon dioxide service, the minimum burst pressure shall be no less than 180 bar g.

6 Bursting disc test

A number of bursting discs shall be subjected to a burst test in accordance with BS 2915:1990 to check that disc rupture occurs within its prescribed range (see Clause 5).

The number of bursting discs to undergo this test shall be subject to agreement between purchaser and manufacturer.

NOTE These burst tests should be carried out with the disc in the valve body.

7 Installation and application of pressure relief devices

Valves to be fitted to containers filled with a toxic gas shall not be fitted with a pressure relief device.

The design and location of a pressure relief device shall be compatible with the intended duty.

Containers of 3.5 l water capacity and above which are filled with CO₂ for industrial purposes shall be fitted with pressure relief devices.

Bursting discs may be fitted to any container intended for the conveyance of non-toxic and non-flammable gases.

Where pressure relief devices are fitted to dissolved acetylene containers, they shall have either one or more fusible plugs set to operate at $(100 \pm 2) ^\circ\text{C}$ or other such pressure relief devices as approved by the Health and Safety Executive.

NOTE The Health and Safety Executive should be consulted if it is proposed to fit containers, other than dissolved acetylene containers, with fusible plugs.

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