SLOVENSKI STANDARD
SIST EN 13648-1:2002

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Kriogene posode - Varnostna oprema proti prekoračitvi tlaka - 1. del: Varnostni ventili za kriogeno področje

Cryogenic vessels - Safety devices for protection against excessive pressure - Part 1: Safety valves for cryogenic service

Kryo-Behälter - Sicherheitseinrichtungen gegen Drucküberschreitung - Teil 1: Sicherheitsventile für den Kryo-Betrieb

Récipients cryogéniques - Dispositifs de protection contre les supressions - Partie 1: Soupapes de sureté pour service cryogénique

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Cryogenic vessels - Safety devices for protection against excessive pressure - Part 1: Safety valves for cryogenic service

Récipients cryogéniques - Dispositifs de protection contre les supressions - Partie 1: Soupapes de sûreté pour service cryogénique

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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 Management Centre 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

Contents

Foreword

This document (EN 13648-1:2002) has been prepared by Technical Committee CEN/TC 268 "Cryogenic vessels", the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.

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(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

This document also supports the objectives of the framework Directives on Transport of Dangerous Goods. This standard has been submitted for reference into the RID and/or the technical annexes of the ADR.

This European Standard is composed of the following Parts :

EN 13648-1, *Cryogenic vessels – Safety devices for protection against excessive pressure – Part 1 : Safety valves for cryogenic service ;*

EN 13648-2, *Cryogenic vessels – Safety devices for protection against excessive pressure – Part 2 : Bursting discs safety devices for cryogenic service ;*

prEN 13648-3, *Cryogenic vessels – Safety devices for protection against excessive pressure – Part 3 : Determination of required discharge - Capacity and sizing.*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements for the design, manufacture and testing of safety valves for cryogenic service, i.e. for operation with cryogenic fluids below – 10 °C in addition to operation at ambient temperature. It is a requirement of this standard that the valves comply with prEN ISO 4126-1:2001. In the event of different requirements, this standard takes precedence over that standard.

This standard is restricted to valves not exceeding a size of DN 100 designed to relieve single phase vapours or gases. A valve can be specified, constructed and tested such that it is suitable for use with more than one gas or with mixtures of gases.

NOTE This standard does not provide methods for determining the capacity of relief valve(s) for a particular cryogenic vessel. Such methods are provided in prEN 13648-3.

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 1251-1:2000, *Cryogenic vessels - Transportable vacuum insulated vessels of not more than 1000 litres volume - Part 1: Fundamental requirements.*

EN 1252-1:1998, *Cryogenic vessels - Materials - Part 1: Toughness requirements for temperatures below -80°C.*

EN 1797, *Cryogenic vessels - Gas/material compatibility.*

EN 12300:1998, *Cryogenic vessels - Cleanliness for cryogenic service.*

EN ISO 6708:1995, *Pipework components - Definition and selection of DN (nominal size) (ISO 6708:1995).*

EN 1252-2, *Cryogenic vessels - Materials - Part 2: Toughness requirements for temperatures between -80°C and -20°C.*

EN 13458-1, *Cryogenic vessels – Static vacuum insulated vessels – Part 1 : Fundamental requirements.*

EN 13530-1, *Cryogenic vessels – Large transportable vacuum insulated vessels – Part 1 : Fundamental requirements.*

prEN 13648-3, *Cryogenic Vessels – Safety devices for protection against excessive pressure – Part 3 : Determination of required discharge - Capacity and sizing.*

prEN ISO 4126-1:2001, *Safety devices for protection against excessive pressure – Part 1 : Safety valves.*

3 Terms and definitions and symbols

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

3.1
DN (nominal size)
alphanumeric designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

[EN ISO 6708:1995]

3.2
pressure
pressure for which the value is equal to the algebraic difference between the absolute pressure and the atmospheric pressure

3.3
specified minimum temperature
lowest temperature for which the safety valve is specified

3.4
valve category A
relief valve which might be expected to relieve during normal operation of the cryogenic vessel

3.5
valve category B
relief valve which would not be expected to relieve during normal operation due to the provision of an alternative relieving or control device, e.g. a pressure regulating vent valve designed for frequent operation

3.6
cryogenic fluid
fluid defined as cryogenic fluid in EN 1251-1:2000 or prEN 13458-1 or prEN 13530-1

NOTE This includes totally evaporated liquids and supercritical fluids.

4 Requirements

4.1 General

The valve shall satisfy all the requirements of prEN ISO 4126-1:2001 except in event of different requirements, where this standard takes precedence.

4.2 Design

4.2.1 Design temperature

The valve shall be suitable for operation at all temperatures between the specified minimum temperature and + 65 °C.

4.2.2 Drainage

The valve shall be self draining such as to avoid accumulation of water within it, even when the specified outlet connection is fitted.

4.2.3 Stem guiding

The design of guiding shall avoid malfunction of the valve due to deposition and freezing of atmospheric moisture on and within the valve during normal operation. The valve shall be sufficiently robust such that the effectiveness of the guiding can not be defeated by normal handling.

4.2.4 Inserts

Where soft plug inserts are used to ensure leak tight shut off (see 5.2.1), the design shall be such as to prevent cold flow of the insert to a degree that results in the valve failing to operate correctly.

4.2.5 Sublimating cryogens

Where the valve is specified as suitable for service with products that, when vented to atmosphere from a pressure anywhere between the valve's accumulation and re-seat pressures and at temperature anywhere within the valve's specified operating temperature range, condense from gas or vapour directly to solid, e.g. CO_2 , the design shall be such as to avoid the valve failing to operate correctly due to deposition of solid product within the valve body or its outlet.

4.3 Materials

NOTE This clause indicates important material properties for safe use of safety valves (absence of brittleness, gas compatibility, etc.). It does not address all the PED essential requirements relevant to materials (e.g. no recommended materials are listed).

4.3.1 General

Material shall be compatible with the process fluid.

4.3.2 Metallic materials

Metallic materials shall be in conformance with EN 1252-1:1998 or EN 1252-2 as appropriate to the specified minimum temperature.

4.3.3 Corrosion resistance

In addition to resistance to normal atmospheric corrosion, particular care shall be taken to ensure that the valve can not be rendered inoperative by accumulation of corrosion products. Some copper alloys are susceptible to stress corrosion cracking, consequently careful consideration shall be given before selection of these materials for components under stress.

4.3.4 Oxygen compatibility

If the specified minimum temperature is equal to or below the boiling point of air or the valve is intended for service with oxygen or oxidising products, the materials shall be oxygen compatible in accordance with EN 1797.

4.3.5 Acetylene compatibility

Metallic materials shall contain less than 70 % copper if specified for use with mixtures containing acetylene.

4.3.6 Non-metallic materials

Non-metallic materials are, so far, well established only for use for inserts within the plug/stem assembly to provide leak tightness across the seat when the valve is closed. If such materials are to be used for structural parts, they shall have properties appropriate to the application and at least meet the requirements of 4.3.2.

Non-metallic materials shall also :

— have mechanical properties that will allow the valve to pass the sample valve test defined in 5.2 ;

— be oxygen compatible if relevant (see 4.3.4 above).

5 Testing

5.1 Production testing

It shall be performed in accordance with the requirements of clause 6 of prEN ISO 4126-1:2001. Where a pressure test is required the test medium shall be clean water for hydraulic tests or oil free air or an inert gas such as nitrogen for pneumatic tests.

5.2 Sample valve tests

5.2.1 Operating and flow characteristics tests

The tests shall be performed in accordance with the requirements of prEN ISO 4126-1:2001. The leak rate shall not exceed 3 $N \cdot mm^3/s \cdot DN$ at the re-seat pressure and the valve shall be audibly leak tight.

5.2.2 Test of the repeatability of leak tightness at re-seat

Adjustment or maintenance of the sample relief valves is not permitted during these tests. The relief valves tested in 5.2.1 above shall be tested additionally such that each category A valve is lifted to its manufacturer's specified maximum over-pressure and re-seated a minimum of 1 000 times. The valves shall then be re-tested in accordance with 5.2.1 and shall meet the appropriate tolerances and limits and shall retain their leak tightness.

For category B valves the number of cycles is reduced to 20.

5.2.3 Cryogenic tests

5.2.3.1 General

Adjustment or maintenance of the sample relief valves is not permitted during these tests.

5.2.3.2 Configuration

Each relief valve tested in 5.2.1 and 5.2.2 shall be subjected to a cryogenic test. The sample relief valve shall be connected to a reservoir, containing a cryogenic fluid, which may be controlled to achieve and maintain a pressure in excess of the manufacturer's specified maximum set pressure plus over-pressure of the valve while providing vapour to the valve at the valve's maximum flow capacity. The reservoir should be fitted with a proven pressure protection system with an operating pressure in excess of the sample valve's maximum set pressure plus over-pressure. The reservoir shall be of a design which ensures that the cryogenic fluid relieved by the sample valve will be at a temperature which does not exceed by more than 30 °C the equilibrium temperature of its contents.

An isolation valve may be installed between the reservoir and the sample relief valve to interrupt flow to the sample relief valve to cause it to re-seat. Where so fitted the volume of the piping between the isolation valve and the sample relief valve shall be not less than 10 l. It is thus ensured that there is an adequate quantity of gas available upstream of the sample relief valve to demonstrate its audible leak tightness.

The orientation of the valve during the test shall be in accordance with the installation instructions on the manufacturers data sheet. If the manufacturers specifies more than one acceptable orientation of the valve then the cryogenic testing shall be repeated for each orientation. The valve shall be fitted with any outlet pipe which the manufacturer has specified as necessary for the satisfactory operation of the valve.

5.2.3.3 Test medium

The test cryogenic fluid shall be selected from those for which the valve is to be approved and shall be that which has the lowest equilibrium temperature at a pressure of 1 bar absolute. Alternatively the test fluid within the reservoir may be liquid nitrogen. In the case where the valve is intended to relieve a fluid that can condense from gas or vapour directly to solid, e.g. CO_2, at a relieving pressure and temperature within the range for which the valve is to be approved, the valve shall in addition be tested with this fluid at a pressure and temperature where the fluid will readily condense from gas or vapour directly to solid.

5.2.3.4 Operational testing

5.2.3.4.1 General

All tests shall be completed sequentially and there shall be no delay between tests. Specified times have a tolerance of ± 1 min. The sample valve shall open without restriction and re-seat audibly leak tight within its specified pressure tolerances throughout the following tests.

5.2.3.4.2 Test 1 – Effect of rainwater if deposited on or retained in the valve when warm

The sample valve shall be sprayed externally from above and on all sides with water from a horticultural watering can rose or alternative device that will simulate heavy rainfall for a period of 3 (three) min. The water spray shall then be removed and the sample valve permitted to drain for a period of 5 (five) min.

Immediately thereafter the pressure shall be raised in the cryogenic reservoir to the sample valve set pressure plus over-pressure. The sample valve shall be permitted to relieve for a period of 10 (ten) min. The pressure in the reservoir shall be reduced or the supply to the sample valve may be isolated to allow the sample valve to re-seat. The sample valve shall remain closed for 5 (five) min.