INTERNATIONAL STANDARD

ISO 21013-2

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Cryogenic vessels — Pressure-relief accessories for cryogenic service —

Part 2: Non-reclosable pressure-relief devices

Récipients cryogéniques — Dispositifs de sécurité pour le service cryogénique —

Partie 2: Dispositifs de sécurité non refermables

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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 21013-2 was prepared by Technical Committee ISO/TC 220, *Cryogenic vessels.*

ISO 21013 consists of the following parts, under the general title *Cryogenic vessels — Pressure-relief accessories for cryogenic service*:

— *Part 1: Reclosable pressure-relief valves*

— *Part 2: Non-reclosable pressure-relief devices*

— *Part 3: Sizing and capacity determination*

Cryogenic vessels — Pressure-relief accessories for cryogenic service —

Part 2: Non-reclosable pressure-relief devices

1 Scope

This International Standard specifies the requirements for the design, manufacture and testing of non-reclosable pressure-relief devices for cryogenic service, i.e. for operation with cryogenic fluids in addition to operation at temperatures from ambient to cryogenic.

This International Standard is restricted to bursting-disc and buckling-pin devices not exceeding a size of DN 200 designed to relieve single-phase vapours or gases. A bursting-disc or buckling-pin assembly may be specified, constructed and tested such that it is suitable for use with more than one gas or with mixtures of gases.

NOTE This International Standard does not provide methods for determining the capacity of bursting-disc or buckling-pin devices for a particular cryogenic vessel. Such methods are provided in ISO 21013-3.

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 4126-2, *Safety devices for protection against excessive pressure — Part 2: Bursting disc safety devices*

ISO 20421-1, *Cryogenic vessels — Large transportable vacuum-insulated vessels — Part 1: Design, fabrication, inspection and testing*

ISO 21009-1, *Cryogenic vessels — Static vacuum-insulated vessels — Part 1: Design, fabrication, inspection, and tests*

IS 21010, *Cryogenic vessels — Gas/materials compatibility*

ISO 21028-1, *Cryogenic vessels — Toughness requirements for materials at cryogenic temperature — Part 1: Temperatures below –80 °C*

ISO 21028-2, *Cryogenic vessels — Toughness requirements for materials at cryogenic temperature — Part 2: Temperatures between –80 °C and –20 °C*

ISO 21029-1, *Cryogenic vessels — Transportable vacuum insulated vessels of not more than 1 000 litres volume — Part 1: Design, fabrication, inspection and tests*

ISO 23208, *Cryogenic vessels — Cleanliness for cryogenic service*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4126-2 and the following apply.

3.1
DN (nominal size)
alphanumeric designation of size for components of a pipework system, which is used for reference purposes and which 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

NOTE Adapted from ISO 6708:1995.

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

3.3
rated minimum temperature
lowest temperature for which the pressure-relief device is rated

3.4
rated maximum temperature
highest temperature for which the pressure-relief device is rated

3.5
coincident temperature
temperature of the bursting disc associated with a burst pressure (see 3.11, 3.12 and 3.13 of ISO 4126-2:2003) and which is the expected temperature of the bursting disc when it is required to burst

3.6
cryogenic fluid
fluid defined as cryogenic fluid in ISO 21029-1 or ISO 21009-1 or ISO 20421-1

NOTE This includes totally evaporated liquids and supercritical fluids.

4 Requirements

4.1 General

Non-reclosing pressure-relief devices shall satisfy the requirements of ISO 4126-2. In the event of conflicting requirements, this International Standard takes precedence over ISO 4126-2.

4.2 Design

4.2.1 Design temperature

The rated minimum temperature shall be equal to the equilibrium temperature at atmospheric pressure of the coldest fluid to be relieved. The rated maximum temperature shall be +65 °C unless a higher temperature is specified in the purchase order.

4.2.2 Coincident temperature

Unless otherwise specified in the purchase order, the coincident temperatures for normal ambient conditions and for fire conditions shall be 20 °C and 427 °C, respectively. Coincident temperatures for other conditions shall be specified in the purchase order.

4.2.3 Sublimating fluid service

Where the pressure-relief device is specified as suitable for service with products that — when vented to atmosphere from a pressure anywhere between the device's specified maximum and minimum operating pressures and at a temperature anywhere between the device's specified maximum and minimum temperatures — condense from gas or vapour directly to solid (e.g. CO_2), the design shall be such as to avoid reduction of the discharge area below that required due to accumulation of solid product.

4.2.4 Inserts

Where soft inserts are used to ensure leak tightness, the design shall be such as to prevent cold flow of the insert to a degree that results in the device failing to operate correctly.

4.3 Materials

4.3.1 General

Materials shall be compatible with the process fluid and shall be controlled by the manufacturer of the device by a specification ensuring control of chemical content and physical properties, and quality at least equivalent to an internationally recognized standard. A test certificate providing the chemical content and physical property test results shall be provided with the pressure-relief device. Materials shall also be oxygen compatible if relevant (see 4.3.5.1).

4.3.2 Metallic materials

Metallic materials shall be in conformity with ISO 21028-1 or ISO 21028-2 as appropriate to the rated minimum temperatures. These requirements apply to parts exposed to low temperatures in normal service. Metallic materials which do not exhibit ductile/brittle transition, and non-ferrous materials which can be shown to have no ductile/brittle transition do not require impact tests.

Forged, rolled, wrought and fabricated components from raw materials from these processes need not be impact tested if the rated minimum temperature is higher than the ductile/brittle transition range temperatures of the material. Castings meeting the requirements of one of the applicable mandatory Appendices I and IV or II and III for Forgings and Rolled or Wrought Materials of ASME B16.34 need not be impact tested if the rated minimum temperature is higher than the ductile/brittle transition range temperatures of the material. At least one randomly selected sample material from each castings production lot not meeting the requirements of this paragraph shall be impact tested at the rated minimum temperature.

4.3.3 Non-metallic materials

Non-metallic materials are well established for use in non-integral bursting discs and in seals and gaskets. If such materials are to be used for structural parts, such as the holder, they shall have properties appropriate to the application and be in conformity with ISO 21028-1 or ISO 21028-2.

Non-metallic materials shall also

— have mechanical properties that allow the device to pass the tests defined in Clause 5;

— be resistant to sunlight, weather and aging;

— be compatible with 4.3.5.1.

4.3.4 Corrosion resistance

In addition to normal atmospheric corrosive agents associated with industrial atmospheres, the environment surrounding cryogenic vessels is characteristically one of persistent low ambient temperatures together with high humidity. Thus particular care shall be taken to ensure that the selected materials of the devices,

together with any coating of the pressure-relief device, preclude the possibility of premature failure or any other malfunction. Aluminium discs shall be protected from corrosion on the atmospheric side only.

Some copper alloys are susceptible to stress corrosion cracking; therefore, careful consideration is necessary before selection of these materials for components under stress.

4.3.5 Gas/material compatibility

4.3.5.1 Oxygen compatibility

If the rated minimum temperature is equal to or below the boiling point of air or the device is intended for service with oxygen products, the materials shall be oxygen compatible in accordance with ISO 21010.

4.3.5.2 Hydrogen

For hydrogen service, see ISO 11114-1 and ISO 11114-2.

4.3.5.3 Acetylene compatibility

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

5 Testing

5.1 Type approval of bursting-disc holders

Bursting-disc holder designs which pass the tests specified in 14.2 and 14.4 of ISO 4126-2:2003 shall be considered type approved.

5.2 Production testing

5.2.1 Pressure and operational tests

They shall be performed in accordance with the requirements of ISO 4126-2. Pressure-relief devices with a corrosion-resistant coating shall be tested with the coating. The pressure test medium shall be dry oil-free air or an inert gas such as nitrogen.

5.2.2 Additional tests for pressure-relief devices with non-replaceable bursting-disc assemblies

5.2.2.1 Leak tests

Each pressure-relief device with a non-replaceable bursting-disc assembly shall be subjected to an appropriate leak test that will demonstrate the integrity of the joint between the bursting disc and its holder. Typical tests might include, but are not restricted to, the following:

— a mass spectrometer sensing helium, calibrated for a leak of 10^{-9} cm^3/s with vacuum on the outlet;

— a pneumatic leak test under water with a pressure of 70 % of the burst pressure on the inlet.

There shall be no detectable leakage. The requirements of ISO 4126-2 apply.

5.2.2.2 Visual examination

Each pressure-relief device with a non-replaceable bursting-disc assembly shall be subjected to an appropriate examination which will demonstrate that only a single bursting disc or bursting-disc assembly is built into each device. The requirements of ISO 4126-2 apply.

6 Cleanliness

All parts shall be clean such that they satisfy the requirements of ISO 23208.

7 Burst-pressure tolerances

The burst-pressure tolerance for bursting-disc devices at the rated disc temperature shall not exceed ± 15 % of marked burst pressure up to 3 bar and ± 5 % of marked burst pressure 3 bar and over.

8 Marking

Marking shall be permanent and visible after installation. Marking shall consist of the following minimum information:

a) manufacturer's name or trade mark;

b) manufacturer's model/type reference;

c) nominal size designation;

d) material identification;

e) rated maximum bursting pressure and rated minimum bursting pressure with coincident temperature, with appropriate units; or

f) rated bursting pressure and performance tolerance with coincident temperature, with appropriate units;

g) direction of flow, if appropriate;

h) number of this International Standard, i.e. ISO 21013-2;

i) batch identity;

j) manufacturer's reference of the bursting-disc holder into which the bursting disc or bursting-disc assembly is to be installed (except where separate holders are not required);

k) rated flow area of the bursted disc or bursted disc and assembly;

l) year of manufacture;

m) certified flow resistance coefficient or rated coefficient of discharge.

9 Prevention of substitution

Where bursting discs and their holders are specified with pin-coding or an equivalent system to prevent a replacement bursting disc with an incorrect specified bursting pressure being fitted, the disc manufacturer shall maintain records of the coding appropriate to the specified bursting pressure of each type of disc. The continued availability of such records shall be guaranteed by the manufacturer by effective back-up procedures. The manufacturer shall operate a Quality System that guarantees that the appropriate coding is applied to his products.