BRITISH STANDARD

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1251-1:2000

Cryogenic vessels — Transportable vacuum insulated vessels of not more than 1 000 litres volume —

Part 1: Fundamental requirements

The European Standard EN 1251-1:2000 has the status of a British Standard

ICS 23.020.40

National foreword

This British Standard is the official English language version of EN 1251-1:2000.

The UK participation in its preparation was entrusted to Technical Committee PVE/18, Cryogenic vessels, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Summary of pages

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Récipients cryogéniques - Récipients transportables, isolés sous vide, d'un volume n'excédant pas 1 000 litres - Partie 1: Exigences fondamentales

Kryo-Behälter - Ortsbewegliche, vakuum-isolierte Behälter mit einem Fassungsraum von nicht mehr als 1 000 Liter - Teil 1: Grundanforderungen

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Foreword

This European Standard 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of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

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, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

The standard has been submitted for reference into the RID and/or in the technical annexes of the ADR.

Therefore the standards listed in the normative references and covering basic requirements of the RID/ADR not addressed within the present standard are normative only when the standards themselves are referred to in the RID and/or in the technical annexes of the ADR.

The other parts of EN 1251 are:

— Part 2: Design, fabrication, inspection and testing;

— Part 3: Operational requirements.

1 Scope

This standard specifies the fundamental requirements for transportable vacuum insulated cryogenic vessels of not more than 1 000 litres volume and designed to operate above atmospheric pressure. Appropriate parts may be used as guidance for vessels designed to operate to the atmosphere.

This standard applies to transportable vacuum insulated cryogenic vessels for fluids as specified in 3.1 and is not applicable to such vessels designed for toxic fluids.

NOTE For the purposes of this standard, in the English and German versions, “cryogenic vessels” and “Tiefkalte Behälter” mean reciprocating “cryogenic receptacles” and “Kryo-Behälter” as defined in RID/ADR.

2 Normative references

This European Standard incorporates by dated or undated references provisions from other publications. These normative references are cited at 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.

EN 1251-2*, Cryogenic vessels - Transportable vacuum insulated vessels of not more than 1 000 litres volume - Part 2: Design, fabrication, inspection and testing*

EN 1251-3*, Cryogenic vessels - Transportable vacuum insulated vessels of not more than 1 000 litres volume - Part 3: Operational requirements*

EN 1252-1, *Cryogenic vessels - Materials - Part 1: Mechanical characteristics for temperature below - 80 °C*

EN 1626*, Cryogenic vessels - Valves for cryogenic service*

EN 1797-1*, Cryogenic vessels - Gas/material compatibility - Part 1: Oxygen compatibility*

EN 10204*, Metallic products - Types of inspection documents*

EN 12300*, Cryogenic vessels - Cleanliness for cryogenic service*

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1
cryogenic fluid (refrigerated liquefied gas)
a gas which is partially liquid because of its low temperature[1)]. In the context of all parts of prEN 1251, the (refrigerated but) non-toxic gases given in Table 1 and mixtures of them are referred to as cryogenic fluids

[1)] This includes totally evaporated liquids and supercritical fluids.

Table 1: Refrigerated but non-toxic gases

Item and group	Identification number, name and description[1)]	
3° A	Asphyxiant gases	
	1913	Neon, refrigerated liquid
	1951	Argon, refrigerated liquid
	1963	Helium, refrigerated liquid
	1970	Krypton, refrigerated liquid
	1977	Nitrogen , refrigerated liquid
	2187	Carbon dioxide, refrigerated liquid
	2591	Xenon, refrigerated liquid
	3136	Trifluoromethane, refrigerated liquid
	3158	Gas, refrigerated liquid, N.O.S.[2)]
3° O	Oxidizing gases	
	1003	Air, refrigerated liquid
	1073	Oxygen, refrigerated liquid
	2201	Nitrous oxide, refrigerated liquid
	3311	Gas, refrigerated liquid, oxidizing, N.O.S.[2)]
3° F	Flammable gases	
	1038	Ethylene, refrigerated liquid
	1961	Ethane, refrigerated liquid
	1966	Hydrogen, refrigerated liquid
	1972	Methane, refrigerated liquid or natural gas, refrigerated liquid, with high methane content
	3138	Ethylene, acetylene and propylene mixture, refrigerated liquid, containing at least 71,5 % ethylene with not more than 22,5 % acetylene and not more than 6 % propylene
	3312	Gas, refrigerated liquid, flammable, N.O.S.[2)]

[1)] Item group, identification number, name and description according to ADR '97.

[2)] N.O.S. = not otherwise specified.

3.2
transportable cryogenic vessel
a thermally insulated vessel intended for the transport of one or more cryogenic fluids, consisting of an inner vessel, an outer jacket, all of the valves and equipment together with any additional framework. This transportable cryogenic vessel represents a complete assembly ready for putting into service

3.3
thermal insulation
a vacuum interspace between the inner vessel and the outer jacket. The space may or may not be filled with material to reduce the heat transfer between the inner vessel and the outer jacket

3.4
inner vessel
the vessel intended to contain the cryogenic fluid

3.5
outer jacket
the gas-tight enclosure which contains the inner vessel and enables the vacuum to be established

3.6
normal operation
the intended operation of the vessel at maximum allowable pressure including the handling loads defined in 3.7

3.7
handling loads
the loads exerted on the transportable cryogenic vessel in all expected situations of transport including loading, unloading, moving by hand or fork lift truck

3.8
documentation
technical documents delivered by the manufacturer to the owner consisting of:

— all certificates establishing the conformity with this standard (e.g. material, pressure test, cleanliness, safety devices);

— a short description of the vessel (including characteristic data, etc.);

— a list of fluids and their net mass for which the cryogenic vessel is designed;

— an operating manual (for the user) which consists of:

1) a short description of the vessel (including characteristic data, etc.);

2) a statement that the vessel is in conformity with this standard; and

3) the instructions for normal operation

3.9
piping system
all pipes which can come in contact with cryogenic fluids including their valves, fittings, pressure relief devices as well as their supports

3.10
equipment
devices which have a safety related function with respect to pressure containment and/or control (e.g. protective or limiting devices, regulating and monitoring devices, valves, indicators)

3.11
manufacturer of the transportable cryogenic vessel
the company which carries out the final assembly of the transportable cryogenic vessel

3.12
volume of the inner vessel
the volume of the shell, excluding nozzles, pipes, etc., determined at minimum design temperature and atmospheric pressure

3.13
tare mass
the mass of the empty transportable cryogenic vessel

3.14
net mass
the maximum allowable mass of the cryogenic fluid which may be filled

3.15
gross mass
the sum of tare mass plus net mass

3.16
pressure
a pressure relative to atmospheric pressure, i.e. gauge pressure. As a consequence, vacuum is designated by a negative value

4 General requirements

The transportable cryogenic vessel shall safely withstand the mechanical and thermal loads and the chemical effects encountered during pressure test and normal operation. These requirements are deemed to be satisfied if clauses 5 to 9 are fulfilled. The vessel shall be marked in accordance with clause 10, tested in accordance with clauses 11 and 12 and operated in accordance with EN 1251-3.

5 Mechanical loads

5.1 General

The transportable cryogenic vessel shall resist the mechanical loads mentioned in clause 4 without such deformation which could affect safety and which could lead to leakage. This requirement can be validated by:

— calculation;

— experimental method;

— calculation and experimental method

in accordance with prEN 1251-2.

The mechanical loads to be considered are given in 5.2 and 5.3.

5.2 Load during the pressure test

The loads exerted during the pressure test are:

$$P_t \geq 1{,}3(P_S + 1) \text{ bar}$$

where:

P_t is the test pressure (in bar);

P_s is the maximum allowable pressure (= relief device set pressure) (in bar);

+ 1 is the allowance for external vacuum (in bar).

5.3 Other mechanical loads

5.3.1 The following loads shall be considered to act in combination where relevant:

— a pressure equal to the maximum allowable pressure in the inner vessel and pipework;

— the pressure exerted by the liquid when filled to capacity;

— loads produced by the thermal movement of the inner vessel, outer jacket and interspace piping;

— loads imposed in lifting and handling fixtures (at the vessel);

— full vacuum in the outer jacket;

— a pressure in the outer jacket equal to the set pressure of the relief device protecting the outer jacket;

— load due to dynamic effects, when the vessel is filled to capacity, giving consideration to:

  — the inner vessel support system including attachments to the inner vessel and outer jacket;

  — the interspace and external piping;

  — the outer jacket supports and where applicable the supporting frame.

5.3.2 Dynamic loads during normal operation equal to twice the mass of the inner vessel when filled to the capacity shown on the data plate exerted by the inner vessel both horizontally and vertically shall be considered.

5.3.3 If the vessel has a volume of more than 100 l or a gross mass of more than 150 kg or if the height of the centre of gravity of the fully loaded vessel is less than twice the smallest horizontal dimension at its base, the vertically upwards acting reference load may be reduced to one times the gross mass.

6 Chemical effects

Due to the cryogenic fluids, their temperatures and the materials of construction used, the possibility of chemical action on the inner surfaces in contact with the cryogenic fluids can be neglected.

Also due to the fact that the inner vessel is inside an evacuated outer jacket, neither external corrosion of the inner vessel, nor corrosion on the inner surfaces of the outer jacket will occur. Therefore inspection openings are not required in the inner vessel or the outer jacket.

Corrosion allowance is also not required on surfaces in contact with the operating fluid or exposed to the vacuum interspace between the inner vessel and the outer jacket.

7 Thermal conditions

The following thermal conditions shall be taken into account:

a) for the inner vessel and its associated equipment the full range of temperature expected;

b) for the outer jacket and equipment thereof [equipment other than covered by a)]:

  — a minimum working temperature of - 20 °C;

  — a maximum working temperature of 50 °C.

8 Material

For the materials used to manufacture the transportable cryogenic vessels, the following requirements shall be met.

8.1 Material properties

8.1.1 Materials which are or might be in contact with cryogenic fluids shall be in accordance with the relevant standards for compatibility; for oxygen compatibility, see EN 1797-1.

8.1.2 Materials used at low temperatures shall follow the toughness requirements of the relevant standard; for temperatures below - 80 °C, see EN 1252-1; for non-metallic materials low temperature suitability shall be validated by an experimental method, taking into account service conditions.

8.2 Inspection certificate

8.2.1 The material shall be declared by an inspection certificate 3.1B in accordance with EN 10204.

8.2.2 The material manufactured to a recognized international standard shall meet the testing requirements of EN 1252-1 and has to be certified by an inspection certificate 3.1B in accordance with EN 10204.

8.2.3 The first delivery of material which is not manufactured to a recognized standard has to be certified by an inspection certificate 3.1A in accordance with EN 10204 confirming that the material fulfils the requirements of 8.1. The following deliveries from the same source shall be accepted with an inspection certificate 3.1B in accordance with EN 10204.

8.3 Materials for outer jackets and equipment

The outer jacket and the equipment not subjected to cryogenic temperature shall be manufactured from material suitable for the intended service.

9 Design, fabrication, inspection and testing

9.1 Transportable cryogenic vessels shall be designed, fabricated, inspected and tested in accordance with EN 1251-2.

9.2 Transportable cryogenic vessels shall be equipped with valves, pressure relief devices, etc., configured and installed in such a way that the vessel can be operated safely.

The inner vessel, the outer jacket and any section of pipework containing cryogenic fluid which can be trapped, shall be protected against over pressurization.

Relief devices shall be in accordance with the relevant European Standards.

Valves shall be in accordance with EN 1626.

9.3 The transportable cryogenic vessel shall be cleaned for the intended service in accordance with EN 12300.

9.4 The manufacturer shall retain the documentation defined in 3.8 for a period required by regulation (e.g. product liability). In addition, the manufacturer shall retain all supporting and background documentation from his subcontractors (if any) which establishes that the vessel conforms to this standard.

10 Marking and labelling

The transportable cryogenic vessel shall bear the following markings in clearly legible and durable characters.

a) On the inner vessel:

   1) name and address, or other means of identification of the manufacturer of the inner vessel;

   2) serial number of the inner vessel;

   3) mark confirming successful final acceptance tests of the inner vessel.

b) On the outer jacket:

   The information marked on the inner vessel shall be repeated on the data plate mounted or permanently attached to the outer jacket.

   1) "EN 1251" to show that the transportable cryogenic vessel is in conformity and the approval number if the design of the vessel is type approved;

   2) name and address, or other means of identification of the manufacturer of the transportable cryogenic vessel;

   3) serial number of the transportable cryogenic vessel;

   4) maximum allowable working pressure (PS in bar) of the transportable cryogenic vessel;

5) test pressure of the transportable cryogenic vessel;

6) volume of the inner vessel (in litres);

7) tare mass (in kilograms) of the transportable cryogenic vessel;

8) date of the final acceptance tests (month, year);

9) final acceptance test mark;

10) date of the next periodic inspection (year);

11) the date of the last periodic inspection (month, year);

12) last periodic inspection mark;

13) a reference to the operating instructions;

14) instructions for transporting the transportable cryogenic vessel (lifting, lashing) (optional marking).

c) Prior to filling:

1) a flow sheet with operation instructions;

2) an unshortened identification of the fluid which is transported in accordance with the transport and substance regulations and its net mass in accordance with the documentation;

3) danger labels in accordance with transport regulations;

4) risk and Safety phrases associated with the gas content;

5) name and address of the fluid producer or supplier.

The marks as described under a1) to b13) shall be permanently affixed, e.g. stamped, either on a reinforced part of the transportable cryogenic vessel, or on a ring, or on permanently affixed attachment(s).

The technique employed for marking and attaching shall not adversely affect the integrity of the transportable cryogenic vessel.

Marks described under c1) to c5) can either be stamped or indicated on a durable information disk or label attached to the transportable cryogenic vessel or indicated in an adherent and clearly visible manner such as painting or by an equivalent process.

Additional markings are permitted, provided that they do not obscure or create confusion with specified markings called for in this standard.

11 Final acceptance test

The marking in accordance with 10 b9) after the final acceptance test on the transportable cryogenic vessel confirms that the marking and that the vessel itself meets the requirements of this standard.

The marking in accordance with 10 b9) also confirms that the transportable cryogenic vessel is ready for putting into service provided that the requirements of EN 1251-3 are met.

12 Periodic inspection

The transportable cryogenic vessel has to be inspected periodically. By affixing the mark of the inspector and the date on the data plate, the inspector confirms the successfully completed periodic inspection.

The periodic inspection shall be in accordance with EN 1251-3.

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