BRITISH STANDARD

BS EN
13458-1:2002

Cryogenic vessels — Static vacuum insulated vessels —

Part 1: Fundamental requirements

The European Standard EN 13458-1:2002 has the status of a British Standard

ICS 23.020.40

National foreword

This British Standard is the official English language version of EN 13458-1:2002.

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 international/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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Cryogenic vessels - Static vacuum insulated vessels - Part 1: Fundamental requirements

Récipients cryogéniques - Récipients fixes, isolés sous vide - Partie 1: Exigences fondamentales

Kryo-Behälter - Ortsfeste, vakuum-isolierte Behälter - Teil 1: Grundanforderungen

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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

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Contents

Foreword

This document EN 13458-1:2002 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of an identical text or by endorsement, at the latest by November 2002, and conflicting national standards shall be withdrawn at the latest by November 2002.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.

EN 13458 consists of the following parts under the general title, *Cryogenic vessels – Static vacuum insulated vessels*:

– Part 1: Fundamental requirements.

– Part 2: Design, fabrication, inspection and testing.– Part 3: Operational requirements.

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 fundamental requirements for static vacuum insulated cryogenic vessels designed for a maximum allowable pressure greater than 0,5 bar.

This European Standard applies to static vacuum insulated cryogenic vessels for fluids as specified in 3.1.

For static vacuum insulated cryogenic vessels designed for a maximum allowable pressure of not more than 0,5 bar, this standard can be used as a guide.

This European Standard is not applicable to vessels built on-site.

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 1252-1, *Cryogenic vessels - Materials - Part 1: Toughness requirements for temperature below – 80 °C*.

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

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

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

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

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

EN 13371, *Cryogenic vessels - Couplings for cryogenic service.*

prEN 13458-2, *Cryogenic vessels - Static vacuum insulated vessels - Part 2: Design, fabrication, inspection and testing.*

prEN 13458-3, *Cryogenic vessels – Static vacuum insulated vessels - Part 3: Operational requirements.*

3 Terms and definitions

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

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

Table 1 — Refrigerated but non toxic gases

classification code	Identification number, name and description[2)]
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.[3)]
3° O	Oxidizing gases
	1003 Air, refrigerated liquid
	1073 Oxygen, refrigerated liquid
	2201 Nitrous oxide, refrigerated liquid, oxidizing
	3311 Gas, refrigerated liquid, oxidizing, N.O.S[3)]
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[3)]

The flammable gases and mixtures of them may be mixed with: Helium, Neon, Nitrogen, Argon, Carbon dioxide.

NOTE Mixtures of oxidizing and flammable gases are not acceptable.

1) This includes totally evaporated liquids and supercritical fluids.
2) Classification code, identification number, name and description according to ADR.
3) N.O.S. = not otherwise specified.

3.2
static cryogenic vessels
thermally insulated vessel intended for use with one or more cryogenic fluids at a stationary place, consisting of an inner vessel, an outer jacket and the piping system. This static cryogenic vessel is not intended to be transported filled. It may be transported empty or containing marginal residues of cryogenic fluid or gas from one static location to another. This static cryogenic vessel represents a complete assembly ready for putting into service

3.3
thermal insulation
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
vessel intended to contain the cryogenic fluid

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

3.6
normal operation
reasonable foreseeable operation of the vessel either up to the maximum allowable pressure (see 3.15) or empty subjected to the handling loads defined in 3.7

3.7
handling loads
loads exerting on the static cryogenic vessel in all expected situations of transport including loading, unloading, installation, etc.

3.8
putting into service
operation by which a vessel is prepared to be used. It applies to either a new vessel used for the first time or a vessel which has been taken out of service and will be brought into service

3.9
documentation
technical documents delivered by the manufacturer:

— the documentation mentioned in the chosen conformity assessment procedure (see annex III of the Directive 97/23/EEC);

— for the user:

  — operating instructions (according to 3.4 of annex I of the Directive 97/23/EEC);

— for the owner:

  — documentation on request of the owner.

3.10
piping system
pipes including their valves, fittings, pressure relief devices, equipment and their supports

3.11
safety accessories
devices which have a safety related function with respect to pressure containment and/or control (e.g. protective or limiting devices, controlling and monitoring devices, valves, indicators)

3.12
manufacturer of the static cryogenic vessel
company which carries out the final assembly and testing of the static cryogenic vessel

3.13
volume of the inner vessel
volume of the shell, excluding nozzles, pipes, etc. determined at minimum design temperature and atmospheric pressure

3.14
pressure
pressure relative to atmospheric pressure, i.e. gauge pressure. As a consequence, vacuum is designated by a negative value. Vapour pressure is always expressed in absolute pressure

3.15
maximum allowable pressure (p_s)
the maximum pressure for which the equipment is designed, as specified by the manufacturer, defined at a location specified by the manufacturer, being the location of connection of protective or limiting devices or the top of the equipment

NOTE $\boldsymbol{p_s}$ is equivalent to *PS* used in article 1, 2.3 of the PED.

3.16
year build
date of the final acceptance test of the final assembled cryogenic vessel at the manufacturer

4 General requirements

The static 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 prEN 13458-3.

5 Mechanical loads

NOTE Throughout this European Standard $\boldsymbol{p_s}$ is equivalent to PS used in article 1, 2.3 of the PED and p_T is equivalent to PT used in annex I of the PED.

The static cryogenic vessel shall resist the mechanical loads mentioned in clause 4 without such deformation which could affect safety and which could lead to leakage.

The mechanical loads to be considered are:

— the loads exerted during the pressure test is:

$p_T \geq 1{,}43\ (p_s + 1)$

where

p_T = test pressure (in bar);

p_s = maximum allowable pressure (= relief device set pressure) (in bar);

+ 1 = allowance for external vacuum (in bar)];

— loads imposed during installation and removal of the vessel;

— dynamic loads during transport of the vessel.

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;

— 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;

— wind loads and other site conditions (e.g. seismic loads, thermal loads) to the vessel when filled to capacity.

6 Chemical effects

Due to the nature of cryogenic fluids, their temperatures and the metallic materials of construction used, and the fact that the inner vessel is inside an evacuated outer jacket, no external or internal degradation mechanisms is reasonable foreseeable on the cryogenic vessel.

Therefore no corrosion allowance on surfaces in contact with the operating fluid or exposed to the vacuum interspace between the inner vessel and the outer jacket as well as no inspection openings are required in the inner vessel or 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 (other equipment than covered by a)):

— the lowest scheduled ambient temperature;

— a maximum working temperature of 50 °C.

8 Material

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

8.1 Selection of materials

8.1.1 Materials which are or might be in contact with cryogenic fluids shall be selected to be compatible with EN 1797.

8.1.2 The toughness requirements of metallic materials used at cryogenic temperatures shall be determined from EN 1252-1 and EN 1252-2 for non-metallic materials low temperature suitability shall be validated by an experimental method, taking into account service conditions.

8.1.3 For suitable material specification see prEN 13458-2. For other materials an "European approval of pressure equipment material" (according to Article 11 of the Directive 97/23/EC) or a particular material appraisal shall be available.

8.2 Inspection certificate

The properties of material according to 8.1 shall be certified by an inspection certificate 3.1 B 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. The requirements of EN 1252-2 may be followed. For suitable material specification see prEN 13458-2. For other materials a "European approval of pressure equipment material" (according to Article 11 of the Directive 97/23/EC) or a particular material appraisal shall be available.

9 Design, fabrication and testing

9.1 Static cryogenic vessels shall be designed, fabricated, inspected and tested in accordance with prEN 13458-2.

9.2 Static cryogenic vessels shall be equipped with valves, a pressure relief system, 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 overpressurisation.

Relief devices shall be in accordance with prEN 13458-2 for outer jackets and for inner vessels.

Valves shall be in accordance with EN 1626.

Couplings shall be in accordance with EN 13371.

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

9.4 The manufacturer shall retain the documentation referred to in 3.9 for a period of ten years. The manufacturer shall retain the necessary documentation from his subcontractors (if any) to permit manifestation and traceability.

10 Marking and labelling

The static 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:

   1) "EN 13548" to show that the static cryogenic vessel is in conformity with this European standard;

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

   3) serial number of the static cryogenic vessel;

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

5) test pressure (PT in bar) of the static cryogenic vessel;

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

7) year of manufacture;

8) date (year followed by the month) of the final test;

9) the identification of those cryogenic fluids for which the static cryogenic vessel is approved (Chemical symbols may be used).

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

c) prior to filling:

1) a flow sheet with operation instructions;

2) an unshortened identification (see 3.1) of the fluid which is stored in the static cryogenic vessel;

3) danger label(s) associated with the fluid;

4) name of the fluid supplier.

The marks as described under a) and b) shall be permanently affixed, e.g. stamped, either on a reinforced part of the static cryogenic vessel, or on a data plate.

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

Marks described under c) can either be stamped or indicated on a durable information disk or label attached to the static 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 assessment

When all necessary tests specified in prEN 13458-2 are carried out successfully and the documentation (see 3.9) is completed the final assessment is terminated.

12 Periodic inspection

Appropriate periodic inspection procedures are described in prEN 13458-3.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European Standard has been prepared [under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of Pressure equipment Directive 97/23/CE.

WARNING : Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The clauses of this standard given in Table ZA.1 are likely to support requirements of Directives.

Table ZA.1 — Comparison between Directive 97/23/EC and this European Standard

Harmonised clauses of prEN 13458-1	Content	Directive 97/23/EC
§ 5	Design for loading	Annex I § 2.2.1
§ 8	Materials	Annex I § 7.5
§ 10	Marking and labelling	Annex I § 3.3

Compliance with the clauses of this standard provides one means of conforming to the specific essential requirements of the Directive concerned and associated EFTA regulations.

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W4 4AL