

**Gasflaskor – Villkor för fyllning av gas-  
blandningar i behållare**

**Transportable gas cylinders – Conditions for  
filling gas mixtures into receptacles**

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## Transportable gas cylinders - Conditions for filling gas mixtures into receptacles

Bouteilles à gaz transportables - Conditions de remplissage  
des mélanges de gaz dans des récipients

Orstbewegliche Gasflaschen - Bedingungen für das Füllen  
von Gasgemischen in Gefäße

This European Standard was approved by CEN on 3 November 2003.

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<b>Contents</b>	<b>page</b>
Foreword.....	3
<b>1 Scope .....</b>	<b>4</b>
<b>2 Normative references .....</b>	<b>4</b>
<b>3 Terms and definitions.....</b>	<b>4</b>
<b>4 Principles and requirements for filling gas mixtures into receptacles .....</b>	<b>6</b>
4.1 General requirements (all gas mixtures) .....	6
4.2 For compressed gas mixtures.....	7
4.3 For liquefied gas mixtures .....	7
4.3.1 With a critical temperature up to + 65 °C.....	7
4.3.2 With a critical temperature above + 65 °C .....	8
<b>5 Fitment of pressure relief devices.....</b>	<b>8</b>
<b>6 Gas table.....</b>	<b>8</b>
<b>Annex A (informative) Further informative guidance notes concerning competent persons and the formulation and checking of instructions for filling gas mixtures .....</b>	<b>19</b>
A.1 Introductory note .....	19
A.2 Competent persons (gas mixing instructions) .....	19
A.3 Formulation and checking procedures for instructions for filling gas mixtures .....	19
A.4 Key points requiring special consideration when formulating instructions for filling gas mixtures .....	20
A.5 Content of instructions for filling gas mixtures.....	20
<b>Annex B (informative) Compatibility data for some commonly used gas mixture components .....</b>	<b>22</b>
<b>Annex C (informative) Index of gas mixtures .....</b>	<b>27</b>
<b>Bibliography .....</b>	<b>31</b>

## Foreword

This document (EN 13099:2003) has been prepared by Technical Committee CEN/TC 23 “Transportable gas cylinders”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This European Standard has been submitted for reference into the RID and/or in the technical annexes of the ADR. Therefore in this context 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.

Annexes A, B and C are informative.

This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

**EN 13099:2003 (E)****1 Scope**

This European Standard specifies the general requirements for filling receptacles, manifolded gas cylinders (bundles), tubes and drums with gas mixtures. Gas mixing data for some commonly used gas mixture components and further guidance notes are given in informative annexes.

Filling requirements for the following are excluded from this standard:

- cryogenic gases;
- LPG;
- beverages and other liquid foodstuffs, pressurized with carbon dioxide or other gas or previous blended gas mixture;
- aerosols pressurized with a gas or previously blended gas mixture, used as a propellant;
- single component liquefiable gases and liquids which have been pressurized with a gas for safety reasons or for the purpose of product withdrawal from the liquid phase.

**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).

ISO 3807-1, *Cylinders for acetylene — Basic requirements — Part 1: Cylinders without fusible plugs.*

ISO 3807-2, *Cylinders for acetylene — Basic requirements — Part 2: Cylinders with fusible plugs.*

ISO 7866, *Gas cylinders — Refillable seamless aluminium alloy gas cylinders — Design, construction and testing.*

ISO 11621, *Gas cylinders — Procedures for change of gas service.*

**3 Terms and definitions**

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

**3.1****gas**

substance, which :

- a) at 50 °C has a vapour pressure greater than 300 kPa (3 bar); or
- b) is completely gaseous at 20 °C at the standard pressure of 101,3 kPa

**3.2****gas mixture**

mixture of two or more components, either liquid or gaseous, which have been deliberately filled for use from the receptacle as a blended mixture, which fulfils the criteria for a gas (see 3.1)

**3.3****compressed gas mixture<sup>1)</sup>**

gas mixture which remains as a gas at a temperature of -50 °C

**3.4****liquefied gas mixture<sup>1)</sup>**

gas mixture which will liquefy at a temperature above -50 °C

**3.5****gas receptacles****3.5.1****cylinders**

transportable pressure receptacles of a water capacity not exceeding 150 l

**3.5.2****tubes**

seamless transportable pressure receptacles of a water capacity exceeding 150 l and of not more than 3 000 l

**3.5.3****pressure drums**

welded transportable pressure receptacles of a water capacity exceeding 150 l and of not more than 1 000 l (e.g. cylindrical receptacles equipped with rolling hoops, receptacles on skids and receptacles equipped in frames)

**3.5.4****bundles of cylinders (also known as frames)**

transportable assemblies of cylinders which are interconnected by a manifold and held firmly together

**3.6****filling degree (ADR[1]/RID[2]: filling ratio)**

mass of gas in kg which can be filled into 1 l of cylinder water capacity; normally applied to liquefied gases only

NOTE The water capacity stamped on the cylinder can apply to the minimum designed water capacity without internal fittings, in which case, the net water capacity needs to be ascertained.

**3.7****filling degree reference temperature**

temperature at which the liquid density is to be evaluated for calculating the filling degree (see 4.3)

**3.8****developed pressure**

pressure achieved by the contents of a gas cylinder filled according to the standard when raised to the reference temperature for developed pressure

NOTE All pressures are given in bar gauge unless otherwise stated.

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<sup>1)</sup> Gas mixtures containing condensable components can themselves be classified as "compressed gas mixtures" or "liquefied gas mixtures" depending on the partial pressure(s) of the condensable component(s) in the mixture.

**EN 13099:2003 (E)****3.9****developed pressure reference temperature**

that chosen to represent the expected maximum temperature in normal service

NOTE All pressures are given in bar gauge unless otherwise stated.

**3.10****settled pressure ( $P_{15}$ )**

pressure of the content of the cylinder at +15 °C

NOTE All pressures are given in bar gauge unless otherwise stated.

**3.11****test pressure**

pressure at which the cylinder is hydraulically or pneumatically tested

NOTE 1 The test pressure should not be exceeded under any foreseeable normal conditions (for example during filling).

NOTE 2 All pressures are given in bar gauge unless otherwise stated.

**3.12****critical temperature**

temperature above which the substance cannot exist in the liquid state

**3.13****pressure relief device**

device which is fitted to the cylinder or cylinder valve and designed to relieve gas pressure in the event of abnormal conditions resulting in the development of excessive pressure inside the receptacle

**3.14****compatible**

relates to the interaction of gas and receptacles/cylinder equipment (parts in contact with gas) under the conditions of use. Hence the term 'compatible' implies a satisfactory gas/cylinder/cylinder equipment combination. The components of a gas mixture are called "compatible", if at normal temperatures during transport and storage no dangerous reactions are liable to occur in the blended mixture which endanger the safety of the cylinder. Hence the term 'compatible' implies a satisfactory combination of gas mixture components with each other and with the cylinder/cylinder equipment.

**3.15****tare weight**

sum of the masses of the receptacles and other fittings not removed during the cylinder filling operation, such as valve, dip tube and any permanently or semi permanently fixed valve protection device

**3.16****competent person for gas mixing instructions**

person who has received an appropriate level of formal scientific education to enable him to carry out his work

**4 Principles and requirements for filling gas mixtures into receptacles****4.1 General requirements (all gas mixtures)**

**4.1.1** The gas mixture to be filled shall be compatible with the receptacles, the cylinder valve and other fittings that may be in contact with the gas.

**4.1.2** The gas mixture components shall not react with each other, during or after mixing, in any manner which may affect the integrity of the receptacles or which may be dangerous.



**4.1.3** The receptacles, when presented for filling, shall be within the specified period for periodic inspection and test.

**4.1.4** The receptacles shall be equipped with a suitable valve with the appropriate valve outlet.

**4.1.5** The receptacles and valve shall be in serviceable condition.

**4.1.6** The receptacles shall be correctly identified for the intended gas mixture.

**4.1.7** There shall be written filling instructions – prepared by competent persons – available for each gas mixture (see informative annex A).

## 4.2 For compressed gas mixtures

The maximum settled pressure shall be the lower of the following values:

- a) two thirds of the test pressure (for compressed gases); or
- b) the pressure, which, when the cylinder content is raised to the reference temperature at 65 °C produces a developed pressure that does not exceed the cylinder test pressure.

## 4.3 For liquefied gas mixtures

### 4.3.1 With a critical temperature up to + 65 °C

The maximum filling degree shall be such that the internal pressure at + 65 °C does not exceed the test pressure of the receptacles.

For gases and gas mixtures with insufficient data, the maximum permissible filling degree (*FD*) shall be determined as follows:

$$FD \leq 8,5 \times 10^{-4} \times d_g \times P_h$$

where

*FD* is the max. permissible filling degree (in kg/l)

*d<sub>g</sub>* is the gas density (at + 15 °C, 1 bar) (in kg/m<sup>3</sup>)

*P<sub>h</sub>* is the minimum test pressure (in bar)

If the density of the gas is unknown, the maximum permissible filling degree shall be determined as follows:

$$FD \leq \frac{P_h \times MM \times 10^{-3}}{R \times 338}$$

where

*FD* is the max. permissible filling degree (in kg/l)

*P<sub>h</sub>* is the minimum test pressure (in bar)

*MM* is the molar mass (in g/mol)

*R* is 8,31451 · 10<sup>-2</sup> bar · l · mol<sup>-1</sup> · K<sup>-1</sup> (gas constant)

**EN 13099:2003 (E)****4.3.2 With a critical temperature above + 65 °C**

The maximum permissible mass of contents per litre water capacity (filling factor) equals 0,95 times the density of the liquid phase at + 50 °C. In addition, the vapour phase shall not disappear below 60 °C. The test pressure shall be at least equal to the vapour pressure of the liquid at + 65 °C, minus 100 kPa (1 bar).

**5 Fitment of pressure relief devices**

The filling conditions defined in this standard are designed to give safe operation in normal use without a pressure relief device. If fitted the selection of pressure relief device is at the discretion of the gas supplier/cylinder owner.

Pressure relief devices shall not be fitted to receptacles intended for the conveyance of toxic or pyrophoric gases. These gases are shown in Table 1. It is also recommended that pressure relief devices are not to be used for other gases classified in the Dangerous Preparations Directive (1999/45/EC)[3] as very toxic, toxic, harmful, flammable or corrosive.

Receptacles used for the conveyance of non-toxic or non-pyrophoric gases may be fitted with appropriate pressure relief devices at the discretion of the gas supplier/cylinder owner. The filling of such receptacles shall conform to this standard, whether equipped or not equipped with pressure relief devices.

**6 Gas table**

Explanations for the table:

**Minimum test pressure  $P_h$  (column 3)**

The minimum test pressure ( $P_h$ ) is a function of the settled pressure  $P_{15}$  or the filling degree (column 4), but shall be at least 10 bar.

**Filling degree (column 4)**

The values of the filling degree are the highest values mentioned in ADR. Other filling degrees may be used provided that the requirements are met.

**ADR Item No. (column 6a)**

- A: Asphyxiant;
- O: Oxidizing;
- F: Flammable;
- T: Toxic;
- TF: Toxic, flammable;
- TC: Toxic, corrosive;
- TO: Toxic, oxidizing;
- TFC: Toxic, flammable, corrosive;
- TOC: Toxic, oxidizing, corrosive.

**ADR Special Provisions (column 6b)**

- a: Aluminium alloy pressure receptacles are not authorized.
- b: Copper valves shall not be used.
- c: Metal parts in contact with the contents shall not contain more than 65 % copper.
- d: When steel pressure receptacles are used, only those resistant to hydrogen embrittlement shall be authorized.
- k: Valve outlets shall be fitted with gas tight plugs or caps which shall be made of material not liable to attack by the contents of the pressure receptacle.

Each cylinder within a bundle shall be fitted with an individual valve that shall be closed during carriage. After filling, the manifold shall be evacuated, purged and plugged.

Pressure receptacles shall not be fitted with a pressure relief device.

Cylinders and individual cylinders in a bundle shall be limited to a maximum water capacity of 85 l.

Each valve shall have a taper threaded connection directly to the pressure receptacle and be capable of withstanding the test pressure of the pressure receptacle.

Each valve shall either be of the packless type with non-perforated diaphragm, or be of a type which prevents leakage through or past the packing.

Carriage in capsules shall not be allowed.

Each pressure receptacle shall be tested for leakage after filling.

- l: UN No. 1040 ethylene oxide may also be packed in hermetically sealed glass or metal inner packagings suitably cushioned in fibreboard, wooden or metal boxes meeting the packing group I performance level. The maximum quantity permitted in any glass inner packaging is 30 g, and the maximum quantity permitted in any metal inner packaging is 200 g. After filling, each inner packaging shall be determined to be leak-tight by placing the inner packaging in a hot water bath at a temperature, and for a period of time, sufficient to ensure that an internal pressure equal to the vapour pressure of ethylene oxide at 55 °C is achieved. The total quantity in any outer packaging shall not exceed 2,5 kg.
- m: Pressure receptacles shall be filled to a working pressure not exceeding 5 bar;
- n: A pressure receptacle shall contain not more than 5 kg of the gas.
- o: In no case shall the working pressure or filling ratio shown in the tables be exceeded.
- p: For UN No. 1001 acetylene, dissolved, and UN No. 3374 acetylene, solvent free: cylinders shall be filled with a homogeneous monolithic porous mass; the working pressure and the quantity of acetylene shall not exceed the values prescribed in the approval or in ISO 3807-1 or ISO 3807-2, as applicable.

For UN No. 1001 acetylene, dissolved: cylinders shall contain a quantity of acetone or suitable solvent as specified in the approval (see ISO 3807-1 or ISO 3807-2, as applicable); cylinders fitted with pressure relief devices or manifolded together shall be carried vertically.

Alternatively, for UN No. 1001 acetylene, dissolved: cylinders which are not UN certified pressure receptacles may be filled with a non monolithic porous mass; the working pressure, the quantity of acetylene and the quantity of solvent shall not exceed the values prescribed in the approval. The maximum test period for periodic inspection of the cylinders shall not exceed five years.