SLOVENSKI STANDARD
SIST-TP CEN/TR 15444:2007

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Premiļ ne plinske jeklenke ï Plinske jeklenke, ki so izdelane v skladu z direktivo za premiļ no tlaļ no opremo in se uporabljajo v podroļ ju direktive za tlaļ no opremo ï Pogoji uporabe in dokazovanje ustreznosti

Transportable gas cylinders - Gas cylinders conforming to the TPED to be used for PED applications - Applicability and justifications

Ortsbewegliche Gasflaschen - Gasflaschen entsprechend der TPED für PED Anwendungen — Anwendbarkeit und Begründung

Bouteilles a gaz transportables - Bouteilles a gaz conformes a la Directive sur les équipements sous pression transportables (TPED), a utiliser pour des applications relevant de la Directive sur les équipements sous pression (PED) - Applicabilité et justifications

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23.020.30	Tlaļ ne posode, plinske jeklenke	Pressure vessels, gas cylinders

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English Version

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Foreword

This document (CEN/TR 15444:2006) has been prepared by Technical Committee CEN/TC 23 “Transportable gas cylinders”, the secretariat of which is held by BSI.

Introduction

This CEN technical report has been prepared to address the essential requirements of the Pressure Equipment Directive (PED) 97/23/EC with regard to European Standards prepared originally for transportable gas cylinders, which address the essential safety requirements of the Transportable Pressure Equipment Directive (TPED) 99/36/EC.

1 Scope

This Technical Report provides a rationale and technical justification for certain European Standards for transportable gas cylinders, produced in accordance with the requirements of the Transportable Pressure Equipment Directive (TPED), to be used for applications currently listed in the Pressure Equipment Directive (PED). Its purpose is to prove equivalence of approach in the two directives and demonstrate equivalence to the overall level of safety in the Essential Safety Requirements (ESRs) of the PED, thereby allowing European Standards and EEC directives listed in this Technical Report to be used to fulfil the requirements of the PED, provided that their filling conditions fulfil the requirements of ADR/RID (P200, 4.1.4.1), in respect of portable fire extinguishers and breathing apparatus.

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.

EN 1964-1, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 1: Cylinders made from seamless steel with an R_m value of less than 1 100 MPa*

EN 1964-2, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 2: Cylinders made from seamless steel with an R_m value of 1 100 MPa and above*

EN 1964-3, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless steel gas cylinders of water capacities from 0,5 litre up to and including 150 litres — Part 3: Cylinders made of seamless stainless steel with an R_m value of less than 1 100 MPa*

EN 1975, *Transportable gas cylinders — Specification for the design and construction of refillable transportable seamless aluminium and aluminium alloy gas cylinders of capacity from 0,5 litre up to 150 litre*

EN 12245, *Transportable gas cylinders — Fully wrapped composite cylinders*

EN 12257, *Transportable gas cylinders — Seamless, hoop wrapped composite cylinders*

EN 13322-1, *Transportable gas cylinders — Refillable welded steel gas cylinders — Design and construction — Part 1: Carbon steel*

prEN ISO 10286:2006, *Gas cylinders — Terminology (ISO/FDIS 10286: 2006)*

EN ISO 13769 Gas Cylinders, Stampmarking

3 Terms and definitions

For the purposes of this document the terms and definitions in prEN ISO 10286 apply.

4 Technical justification

4.1 General

The following standards, together with those referred to in the Bibliography, have been produced to support the essential requirements of the TPED.

— EN 1964-1, -2 and -3 for seamless steel cylinders;

— EN 1975 for seamless aluminium alloy cylinders;

— EN 12245 for fully wrapped, composite cylinders;

— EN 12257 for hoop wrapped, composite cylinders;

— EN 13322-1 for welded steel cylinders.

They have been adjudged by the experts to conform to the requirements of the TPED, the Regulations concerning the International Carriage of Dangerous Goods (RID) and the European Agreement on the International Carriage of Dangerous Goods by Road (ADR). Gas cylinders are manufactured using stock materials which are transformed to their final shape, then carefully heat treated and finally tested to well defined criteria. Hence the manufacture of gas cylinders follows a different approach from that of conventional pressure vessels. In the case of gas cylinders, the mechanical properties of the final product are significantly altered during the manufacturing process from those of the stock materials. Consequently the mechanical properties of the stock materials, guaranteed by material standards, are of little relevance.

4.2 Application

4.2.1 General

It is proposed by this Technical Report that cylinders manufactured in accordance with the design and manufacturing standards quoted in **4.1** are suitable for the design and construction of seamless or welded portable fire extinguishers and breathing apparatus (see clause 1.1 (a) of Article 3, PED). The dimensions of these cylinders should reflect the limits in the various standards.

4.2.2 Materials

a) Steels

Materials used in the steel cylinder design standards and EEC Directive 84/525 need to meet stringent mechanical properties. Hence their composition is defined according to a narrow specification, as is the manufacturing process e.g. non-ageing, non-rimming quality steel is stipulated. Additionally full materials' compatibility with the gas contained is an essential, normative requirement in gas cylinder manufacturing standards (EN ISO 11114-1 refers).

b) Aluminium alloys

Materials used in the aluminium alloy cylinder design standards and EEC Directive 84/526 are referred back to recognised and registered compositions within the International Aluminium Federation (IAF), for most commonly used materials. These materials and other permitted alloys shall meet stringent mechanical properties. Hence their composition is defined according to a narrow specification. Additionally full materials' compatibility with the gas contained is an essential, normative requirement in gas cylinder manufacturing standards (EN ISO 11114-1 refers).

c) Composites

— Liner materials

When steel or aluminium alloy is used, conditions in **4.2.2** a) and **4.2.2** b) above apply. In the case of non-metallic liners, the latter are non-load sharing but shall be both chemically compatible (EN ISO 11114-2 and EN ISO 11114-3, where applicable, refer) with the gas contained and be leak-tight. . Additionally full materials' compatibility of the liner, with the gas contained is an essential, normative requirement in gas cylinder manufacturing standards (EN ISO 11114-1 refers).

— Overwrap materials

These are closely specified by the manufacturer and subsequently verified, as required in the manufacturing/design standard, by various stringent tests on the starting materials and completed cylinders.

4.2.3 Safety considerations

4.2.3.1 General

The PED requires a proof test at the final assessment which will normally take the form of a hydrostatic pressure test at a pressure (PT) at least equal, where appropriate, to the maximum allowable pressure (PS) x $1{,}43$. For gas cylinders this factor may be lower and depends on the gas used and the maximum expected allowable temperature, TS. However, in no case shall the maximum allowable pressure PS ever exceed PT. Furthermore in order to compensate for this possible lower ratio, gas cylinders produced and tested according to the standards listed in **4.1** are subjected to stringent experimental tests at various stages of their design and production.

One way of illustrating the pressure considerations of the two Directives (PED/TPED) is shown in Figure 1. Here it can be seen that the wall stress at maximum allowable pressure at maximum temperature for gas cylinders designed under TPED, does not exceed the maximum allowable stress as per the PED.

Figure 1 shows an example of the pressures relating to cylinders used for breathing apparatus applied in accordance with the PED and the TPED for a case where $PT = 1{,}43$ x PS.

The only pressure they have in common is the maximum allowable pressure (PS) at the maximum allowable temperature for the PED on the left and the maximum developed pressure at elevated temperature for the TPED on the right.

The PED requires a proof test at the final assessment which will normally take the form of a hydrostatic pressure test at a pressure (PT) at least equal, where appropriate, to the maximum allowable pressure (PS) multiplied by 1.43 i.e. $PT \geq 1{,}43$ x PS.

TPED cylinders have a test pressure (PH) based on the working pressure (PW) at 15 °C, i.e. $PH \geq 1{,}5$ x PW. Additionally TPED cylinders are required to pass the minimum yield pressure (P_y) and minimum burst pressure (P_b) requirements.

If all these requirements are plotted together, as in Figure 1, it is evident that the maximum wall stress at test pressure for a TPED cylinder is 77% of yield stress which would result in a maximum wall stress at test pressure for an equivalently designed PED cylinder of less than 95% of yield stress.

This example thus proves that the safety factors for TPED cylinders are comparable with those of PED.