BRITISH STANDARD

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Transportable gas cylinders — Periodic inspection and testing of welded steel pressure drums

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National foreword

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Ortsbewegliche Gasflaschen - Wiederkehrende Prüfung von geschweißten Fässern aus Stahl

This European Standard was approved by CEN on 11 November 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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Contents

Foreword

This document (EN 14876:2007) 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of an identical text or by endorsement, at the latest by July 2007, and conflicting national standards shall be withdrawn at the latest by July 2007.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The principal aim of a periodic inspection and testing procedure is that, at the completion of the test, the pressure drums may be reintroduced into service for a further period of time.

Experience of the inspection and testing of pressure drums which is specified in this European Standard is an important factor when determining whether a pressure drum should be returned into service.

1 Scope

This European Standard deals with welded steel transportable pressure drums intended for compressed and liquefied gases under pressure of water capacity from 150 litres up to 1 000 litres.

This European Standard specifies the requirements for periodic inspection and testing to verify the integrity of such pressure drums to be re-introduced into service for a further period of time. It also defines a procedure to qualify existing pressure drums for free movement between member states of the European Union (see Annex A).

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 14208, *Transportable gas cylinders — Specification for welded pressure drums up to 1 000 litre capacity for the transport of gases — Design and construction*

EN ISO 11114-1, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 1: Metallic materials (ISO 11114-1:1997)*

EN ISO 11114-2, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 2: Non-metallic materials (ISO 11114-2:2000)*

EN ISO 11621, *Gas cylinders — Procedures for change of gas service (ISO 11621:1997)*

EN ISO 13341, *Transportable gas cylinders — Fitting of valves to gas cylinders (ISO 13341:1997)*

EN ISO 13769, G*as cylinders — Stamp marking (ISO 13769:2002)*

3 Intervals between periodic inspection and test

In order to ensure continued safe operation, pressure drums shall be subjected periodically to inspection and test in accordance with Annex B. A pressure drum shall fall due for periodic inspection and test on its first receipt by filler after expiry of the interval in Annex B.

NOTE 1 Table B.1 gives a list of the intervals between periodic inspections for some gases which conforms to the current RID/ADR regulations and also gives recommendations which can be subsequently adopted by the RID/ADR regulations.

Provided that the pressure drum has been subjected to normal conditions of use and has not been subjected to abusive and abnormal conditions making the pressure drum unsafe, there is no requirement for the user to return a pressure drum before the contents have been used even though the test interval may have been exceeded. However, it is suggested that pressure drums are re-tested at a period not exceeding twice the normative time interval specified in Table B.1.

NOTE 2 Certain products such as hydrogen fluoride require an intermediate check of wall thickness as well as the contents to be checked for pressure rise due to the generation of gases such as hydrogen. Other products such as hydrogen bromide should not be allowed to exceed one and a half times the time interval for the normative test interval in Table B.1.

4 List of procedures for periodic inspection and test

Each pressure drum shall be submitted to a periodic inspection and test. The following procedures form the requirements for such inspection and test, and are explained more fully in later clauses:

— identification of pressure drum and preparation for inspection and test;

— depressurization and de-valving operation;

— external visual inspection;

— visual inspection of welds;

— internal visual inspection;

— supplementary tests;

— inspection of valve connections;

— repair of pressure drums;

— inspection of openings;

— inspection of valves;

— proof pressure test;

— final operations, including drying;

— rejection and rendering pressure drums unserviceable.

Where pressure drums are manufactured according to National Regulations and are intended to be qualified under the Transportable Pressure Equipment Directive (TPED) for free movement and use between member states of the European Union, additional requirements are specified in Annex A.

It is recommended that the above listed tests are performed in the suggested sequence. For most gases, the internal visual examination (Clause 8) should be carried out before the pressure test (Clause 11). In some cases, e.g. HCl, performing the hydraulic test first can dissolve residual product thus making the internal inspection less hazardous.

Pressure drums which fail the inspection or tests shall be rejected. When after the above tests, doubts still exist as to the extent of a defect or the condition of a pressure drum, additional tests may be performed in accordance with Clause 9, until such doubts are positively resolved, or the pressure drum shall be rendered unserviceable.

5 Identification of pressure drum and preparation for inspection and test

Before any work is carried out, details of the design, contents and ownership shall be identified. If it is intended to change the service of the drum, procedures in EN ISO 11621 shall be followed.

6 Depressurization and de-valving procedures

The pressure drum shall be depressurised and emptied in a safe and controlled manner before proceeding. Particular attention shall be paid to pressure drums that have contained flammable, oxidising or toxic gases to eliminate risks at the internal visual inspection. Additionally, as some liquefied products may not be removed from the pressure drum by venting, an additional check such as check weighing or check of the atmosphere of the pressure drum may be required. It is recommended that pressure drums containing a hazardous product are purged in a safe manner.

Pressure drums with incorrect markings, unknown product contents, or those which cannot be safely emptied of product shall be set aside for special handling.

Before removing any pressure retaining accessory e.g. valve, flange, a positive check shall be performed to ensure that the pressure drum does not contain any gas under pressure. This can be performed as described in Annex D using the device such as shown in Figure D.1.

NOTE If the above procedure is not performed, a violent reaction can occur e.g. projection of the valve, release of toxic gas, fire etc.

Pressure drums with inoperative or blocked valves shall be treated as outlined in Annex D. Provided the requirements above have been complied with, and the pressure drum has been safely depressurised, the valves and/or flanges, as applicable, may be removed.

7 External visual inspection

7.1 Preparation for external visual inspection

Each pressure drum shall be cleaned and have all labels, loose coatings, corrosion products, tar, oil or other foreign matter removed from its external surface, e.g. by brushing, shot-blasting, (under controlled conditions), water jet abrasive cleaning, chemical cleaning or other methods. Care shall be taken at all times to ensure that the pressure drum is not damaged or excess amounts of the wall of the pressure drum are not removed by the cleaning application.

If a fused nylon, polythene or a similar coating has been applied and is seen to be damaged, or prevents a proper inspection, then the coating shall be removed. If the coating is removed by the application of heat the temperature of the pressure drum shall not exceed 300 °C.

7.2 Inspection procedure

The external surface of each pressure drum shall undergo a thorough visual inspection for:

— dents, cuts, gouges, bulges, cracks, laminations or excessive wear;

— heat damage, torch or electric arc burns, (as identified in Table C.1);

— corrosion (as defined in Table C.2). Special attention shall be given to areas where water may be trapped;

— all welds and welded attachments and the areas adjacent to them shall be checked for defects;

— other defects such as illegible or unauthorized stamp markings, unauthorized additions or modifications;

— integrity of all permanent attachments e.g. shrouds, lifting points, lifting pockets, rolling bands;

— damage to rolling bands.

Occasionally, it may be necessary to use non destructive techniques (NDT) such as dye-penetrant, to investigate potential cracks.

For rejection criteria see Annex C. Pressure drums no longer suitable for continued service shall be rendered unserviceable (as defined in Clause 15).

8 Internal visual inspection

Once the requirements of Clause 6 have been met, each pressure drum shall be inspected internally to identify any defects such as those listed in 7.2. Precautions shall be taken to ensure that the method of illumination presents no hazard to the person carrying out the inspection. Any internal lining or coating which may prevent a thorough examination shall be removed. Any pressure drum showing presence of foreign matter or signs of more than light surface corrosion shall be cleaned under closely controlled conditions by shot blasting, water jet abrasive cleaning, flailing, steam jet, hot water jet, rumbling, chemical cleaning or other method. Care shall be taken to avoid damage to the pressure drum. If cleaning is required the pressure drum shall be re-inspected after the cleaning operation.

9 Supplementary tests

Where there is doubt concerning the type/severity of a defect found on visual inspection (see Clauses 7 and 8), or when the cleaning processes might have reduced the wall thickness, additional tests or methods of examination may be applied, e.g. ultrasonic techniques, check weighing or other non-destructive tests. Only when all doubts are eliminated may the drum be further processed (see Annex C).

10 Inspection of openings

10.1 Internal neck threads

The internal threaded openings shall be visually examined, and using gauges relevant to the threads in the drum, to ensure they are:

— clean and of full form;

— free of damage;

— free of burrs;

— free of cracks;

— free of other imperfections.

Where there is any doubt as to the thread condition, the thread shall be checked using a threaded gauge by a person trained in gauging threads.

10.2 Damaged internal neck threads

Where necessary and where the manufacturer or the competent person confirms that the design of the neck thread permits, threads may be re-tapped or re-machined to provide the required number of effective threads. After re-making, the threads shall be checked by a thread gauge. Damaged retaining assemblies shall be replaced ensuring compatibility with the intended gas service (see EN ISO 11114-1 or EN ISO 11114-2 as relevant).

10.3 Flanged openings and retaining assemblies

Where the pressure drum is fitted with flanged openings, these shall be inspected to ensure that they are:

— clean faced;

— free of damage to the mating surfaces;

— free of cuts or gouges.

For retaining assemblies e.g. bolts/studs etc. it shall be ensured that:

— the profile conforms to the required specification;

— is free from all surface defects;

— the materials are compatible with the intended gas service even though they might not be in the gas stream (see EN ISO 11114-1).

10.4 Damaged flanged openings and/or retaining assemblies

Where necessary, and where the manufacturer or a competent person confirms that the design permits, damaged flange faces, both on the drum and the flange, may be re-machined to enable a pressure seal to be made on re-assembly.

Damaged retaining assemblies shall be replaced ensuring compatibility with the intended gas service (see EN ISO 11114-1 or EN ISO 11114-2 as relevant).

11 Pressure test

11.1 General

Each pressure drum shall be subjected to a hydraulic or pneumatic pressure test (see 11.2).

11.2 Proof pressure test

When carrying out a pressure test, a fluid, normally water, shall be used as the test medium. The test shall be a proof pressure test (see 11.3) as appropriate to the design of the drum. The test pressure shall be in accordance with the stamping on the pressure drum.

NOTE A pneumatic pressure test may be substituted provided that a risk assessment has been carried out. Those using pneumatic testing need to ensure, that precautions are taken to contain any energy released if a pressure drum fails. The energy required to conduct a pneumatic pressure test is considerably more than required for a hydraulic pressure test and can cause extensive damage in the event of failure if adequate precautions have not been taken.

11.3 Procedure and acceptance criteria

11.3.1 Hydraulic test

11.3.1.1 General

The pressure in the pressure drum shall be increased gradually until the test pressure is reached. The pressure shall be held for a minimum of 10 min with the pressure drum isolated from the pressure source. During the test period there shall be no decrease in the recorded pressure or evidence of any leakage. Safety precautions shall be taken, even for a hydraulic test in view of the considerable stored energy in a pressure drum.

11.3.1.2 Test equipment

11.3.1.2.1 All rigid pipe work, flexible tubing, valve, fittings and components forming the pressure system of the test equipment shall be designed to withstand a pressure 1,5 times the maximum test pressure of any pressure drum that may be tested. Flexible tubing shall have sufficient wall thickness to prevent kinking.

11.3.1.2.2 There shall be two pressure gauges to at least an accuracy of Class 2,5 as defined in EN 837-1 or EN 837-3, with a scale appropriate to the test pressure. They shall be checked for accuracy against a calibrated gauge at regular intervals, and in any case not less than once a month. The pressure gauges shall be chosen such that the test pressure is approximately between 1/3 and 2/3 of the value capable of being measured on the pressure gauge and the readings are clearly visible to the test personnel.

11.3.1.2.3 The design and installation of the equipment, the connection of the drums and the operating procedures, shall be such as to avoid trapping air in the system when a liquid medium is used.

11.3.1.2.4 All joints within the system shall be leak tight.

11.3.1.2.5 A pressure relief device shall be fitted to the test equipment to ensure that no pressure drum is subjected to a pressure in excess of the tolerances in 11.3.1.3.3.

11.3.1.3 Test method

11.3.1.3.1 Only one pressure drum may be tested at a time.

11.3.1.3.2 Before applying pressure the external surface of the pressure drum shall be dry.

11.3.1.3.3 The pressure applied shall not be below the test pressure and shall not exceed the test pressure by 10 % or 10 bar, whichever is the lower.

11.3.1.3.4 On attaining the test pressure the pressure drum shall be isolated from the pump and pressure held for a minimum period of 10 min.

11.3.1.3.5 If there is a leakage in the pressure system it shall be corrected and the pressure drum retested.

11.3.1.3.6 During the 10 min period that the pressure is held, the pressure registered on the pressure gauge shall remain constant.

11.3.1.3.7 There shall be no visible leakage or visible permanent deformation on the entire surface of the pressure drum. This check may be made during the 10 min the pressure is held or immediately after the pressure has been released.

11.3.1.3.8 Any pressure drum failing to conform to the requirements of this test from the pressure bearing body shall be rendered unserviceable, in accordance with Clause 15. Leaks from any mechanical joints, e.g. flanges, may be repaired and the pressure drum shall be retested.

11.3.2 Pneumatic test

The pressure in the pressure drum shall be increased gradually until the test pressure is reached. The rise in pressure shall be controlled to minimize the effects of a temperature rise due to the heat of compression. The pressure shall be held for a minimum of 20 min, once a settled pressure has been achieved for at least 10 min, with the pressure drum isolated from the pressure source. During the test period there shall be no decrease in the recorded pressure or any evidence of any leakage. Safety precautions shall be taken.

The pressure source shall be isolated and vented. There shall be no visible leakage (in cases where leak detection fluid has been applied to the weldments) or visible permanent deformation on the entire surface of the pressure drum. This check shall be made immediately after the pressure has been released.

Any pressure drum failing to conform to the requirements of this test shall be rendered unserviceable, in accordance with Clause 15. Leaks from any joints e.g. flanges may be repaired and the pressure drum shall be retested in accordance with 11.3.2.

12 Pressure drum repair

12.1 Detection of pinholes

If during the pressure test or external visual inspection, pinhole leaks are detected in a weld, the pressure drum shall be made unserviceable. No repair to pressure containing welds shall be undertaken.

12.2 Other repairs

Any other repairs including de-denting, replacement of fittings etc. may be carried out, provided this will not impair the integrity of the drum. All corrosion products shall be removed prior to repair. After de-denting, the requirements given in 12.3 shall be followed.

12.3 Requirements for repair

12.3.1 Major repairs as defined in 12.2 shall be performed by a competent repairer following an approved procedure, and taking into account the fabrication and testing requirements of the pressure drum design standard EN 14208. After such repairs, which may involve a high temperature (i.e. greater than 300 °C), a stress relieving or normalizing heat treatment shall be performed. This shall be performed in a controlled manner under the supervision of a competent person.

The drum shall finally be pressure tested in accordance with Clause 11 and inspected as necessary for the intended gas service.

12.3.2 Minor repairs (e.g. reforming damaged fittings) not involving welding or hot-work on pressure containing parts may be carried out provided the integrity of the pressure drum is not impaired. At all times, materials compatibility shall be maintained (see EN ISO 11114-1).

13 Inspection of valves

If valves are to be re-used they shall be inspected/refurbished in accordance with EN 14189.

14 Final operations

14.1 Drying, cleaning and painting

14.1.1 Drying and cleaning

When required, the interior of each pressure drum shall be thoroughly dried, paying particular attention to the areas of any joggle joints, at a temperature not exceeding 300 °C immediately after pressure testing, such that there is no trace of free water. The interior of the pressure drum shall be inspected to ensure that it is dry and free from other contaminants.

14.1.2 Painting

Pressure drums shall be repainted as required such that markings stamped on the pressure drum are legible. Particular attention shall be paid to crevices to ensure that they are fully covered with a layer of paint.

14.2 Fitting valves

Valves shall be fitted to the pressure drum in accordance with EN ISO 13341.

The applied torque shall take into account the size and form of the threads, the materials of the valve and the type of sealing material used according to the manufacturer’s recommendations. Where the use of lubricants/sealing material is permitted, only those approved for the gas service shall be used, taking specific care of pressure drums in oxidising service according to EN ISO 11114-2.

14.3 Fitting of flanges

Flanges shall be refitted to pressure drums using both gasket materials and bolts/studs that are compatible with the gas service according to EN ISO 11114-1 and EN ISO 11114-2.

Each drum shall be subjected to a pneumatic leak test at a minimum pressure of 6 bar when fitted as for use, with studs, nuts, joints and valves. The joints shall be tested for leaks with a leak detection solution, or by a method of equal sensitivity. The leak detection solution shall be compatible with the contained gas and with the valve material, e.g. brass exhibits stress corrosion cracking in ammoniacal solutions.

14.4 Checking of tare weight

This requirement shall only apply to drums for liquefied gases. The tare of the drum shall be obtained by weighing on a machine regularly checked for accuracy. The capacity of the weighing machine shall be suitable for the tare weight of the drum.

The tare shall include the mass of the drum, valve(s) and all permanent fittings. If the tare of the drum differs from the stamped tare by more than ± 2 % and is not due to reasons of damage, e.g. corrosion, the original tare shall be cancelled and the correct tare shall be marked in a permanent and legible fashion in accordance with EN ISO 13769. Particular attention shall be paid to the tare weight when replacing any valves, dip tubes, rolling bands, guards/shrouds and foot rings.

14.5 Stamp marking

After satisfactory completion of the periodic inspection and test, each pressure drum shall be permanently marked, normally on a nameplate, using EN ISO 13769 as a guideline, at least with the symbol of the inspection body or test station followed by the test date.

14.6 Reference to the next date

The next test date shall be shown in a clearly visible manner, such as by a label, or by stencilling, or by a disc fitted between the valve and the pressure drum.

14.7 Records

Details of the present test shall be recorded by the test station and the following information shall be available:

— owner’s name;

— manufacturer’s or owner's serial number;

— pressure drum tare;

— type of test (hydraulic or pneumatic);

— test pressure;

— result of test (pass or fail);

— present test date;

— date of the next test;

— identification of the inspection body or the test station;

— identification of inspector;

— details of any major repairs.

Additionally the following items of information relating to a pressure drum shall be recorded, if possible:

— drum manufacturer;

— manufacturing specification;

— water capacity/size;

— manufacturing test date.

15 Rejection and rendering pressure drum unserviceable

The decision to reject a drum may be taken at any stage during the inspection and test procedure. If it is not possible to recover a rejected drum, it shall, after notifying the owner, be made unserviceable by the testing station for holding gas under pressure so that it is impossible for any part of the drum, especially the shoulder, to be re-issued into service.

In case of any disagreement, ensure that the legal implication of the contemplated action is fully understood.

One or a combination of the following methods may be employed to render the pressure drum unserviceable, after ensuring that the drum is empty and free of product or pressure:

— crush the pressure drum, paying particular attention to crushing both ends;

— burn an irregular hole at least 10 % of the area in each of the ends and in two other locations equally spaced along the parallel section.

The nameplate of the drum, where fitted, shall be removed from the drum and returned to the pressure drum owner.

Annex A
(informative)

Pressure drums manufactured according to National Regulations

A.1 Scope

This annex specifies those checks, inspections and tests which should be performed in order to re-qualify existing pressure drums, manufactured according to national regulations, to ensure their conformance to the TPED for free movement and use between all member states of the European Union.

This annex does not apply to and hence is not necessary for pressure drums manufactured according to EN 14208 (see also Directive 84/527/EEC).

A.2 Definitions and symbols

π
official stamp mark required by the TPED to certify existing pressure drums conforming to the technical requirements of RID/ADR and the requirements of the TPED directive for use throughout the European Union

A.3 General requirements

A.3.1 The owner of the pressure drums should indicate to the inspector the types and the number of drums presented for qualification. For each drum the following information should be made available for documentation and subsequent calculation:

— manufacturer;

— serial number;

— date of manufacture;

— regulation or specification to which the drum was manufactured;

— filling ratio;

— test pressure;

— external diameter;

— minimum wall thickness;

— minimum yield stress;

— water capacity.

The inspection body should verify that this list contains all the necessary information to clearly define the drum.

A.3.2 The inspection body should verify that any drum is not on any relevant national safety related recall list. Additionally if any restrictions of use apply these should be maintained for further use.

A.3.3 The inspection body should verify that the wall thickness of the pressure drum is equal to, or greater than, the minimum wall thickness, as calculated in accordance with EN 14208, for the corresponding yield stress of the drum.

A.3.4 The inspection body should verify that a drum intended for use in hydrogen, or other embrittling gas service, conforms to EN ISO 11114-1.

A.3.5 The inspection body should verify that the manufacturing certificates, or equivalent records, are available. When manufacturing certificates are not available, the inspector should verify that all relevant design tests and manufacturing batch tests have been performed, in accordance with EN 14208.

A.3.6 The inspection body should perform the periodic inspection according to this European Standard.

A.4 Specific requirements

If any of the general requirements in A.3.1 to A.3.5 are not fully met, the drum may be qualified if the inspection body is able to verify the following, as appropriate:

a) the inspector should verify the calculation of the minimum wall and dome thicknesses.

   All the drums should be ultrasonically tested by means of spot checks to verify that the minimum wall and dome thicknesses of each drum are equal to, or greater than, the minimum wall and base thicknesses prescribed by EN 14208;

b) the test pressure of a drum should not be up rated. If data on material of construction are not available, then a representative drum should be subjected to the mechanical tests as described in EN 14208;

c) The drum should be pressure tested in accordance with Clause 11 if not already pressure tested as in A.3.6.

A.5 Special markings

A pressure drum passing the periodic inspection may only be stamped with the π mark, provided that the requirements under A.3 and A.4 as appropriate, have been fully verified.

A.6 Inspection report

The inspection body should prepare a report for each type of drum. All relevant certifications, new tests and inspections performed should be attached to this report.

Annex B
(normative)

Inspection periods

Table B.1 — Intervals between periodic inspections and test [a]

Description	Gas type (examples) [b]	Normative intervals [c] Period years	Informative recommendations for next revision of ADR Period years
Compressed gases	Ar, N_2, He etc.	10	10
	H_2 [d]	10	10
	Air, O_2	10	10
	CO [e]	5	5
Liquefied gases	CO_2, N_2O etc.	10	10 [h]
Corrosive gases [g f]		5	5
Toxic gases	CH_3Br	5	10
Very toxic gases	AsH_3, PH_3 etc.	5	5
Gas mixtures	a) all mixtures except b) below	5 or 10 years according to classification	a) Lowest test period of any component
	b) mixtures completely in the gaseous state containing toxic and/or very toxic components	5 years for groups T, TF, TO, TC, TFC, TOC	b) For such mixtures, if the toxicity of the final mixture is such that $LC_{50} \geq 200 \times 10^{-6}$, a 10 year period shall apply, and if the toxicity of the final mixture is such that $LC_{50} < 200 \times 10^{-6}$, a 5 year period shall apply
		10 years for groups A, O, F	

[a] At all times certain requirements can necessitate a shorter time interval e.g. the dew point of the gas, polymerisation reactions and decomposition reactions, drum design specification, change of gas service.

[b] This list of gases is not exhaustive. A full list of gases can be found in RID/ADR.

[c] These intervals conform to the 2005 edition of RID/ADR.

[d] Pay particular attention to the requirements of Clause 5 and possible additional testing in accordance with EN ISO 11621 for change of service.

[e] This product requires very dry gas (see EN ISO 11114-1).

[f] For gas mixtures shown to be corrosive for the drum material, the time period for single corrosive gases applies.

[g] For RID/ADR purposes, corrosivity is with reference to human tissue and NOT the steel of the drum.

[h] This test period may be used provided the dryness of the product and that of the filled drum are such that there is no free water, and that this condition is proven and documented within a quality system of the filler. If these conditions cannot be fulfilled then alternative, or more frequent, testing may be appropriate.

Annex C
(normative)

Description, evaluation of defects and conditions for rejection of welded steel pressure drums at the time of visual inspection

C.1 General

Pressure drum defects can be physical or material or due to corrosion as a result of environmental or service conditions to which the drum has been subjected during its life. The object of this annex is to give general guidelines to the drum users as to the application of rejection criteria. This annex applies to all drums but those which have contained gases having special characteristics may require modified controls.

Any defect in the form of a sharp notch may be removed by grinding, machining or other approved methods. After such a repair, checking of the wall thickness, e.g. ultrasonically, shall be repeated.

C.2 Physical or material defects

Evaluation of physical or material defects shall be in accordance with Table C.1.

C.3 Corrosion

C.3.1 General

The pressure drum can be subjected to environmental conditions that could cause external corrosion of the metal. Internal corrosion of the metal can also occur owing to service conditions.

There is difficulty in presenting definite rejection limits in tabular form for all sizes and types of drums and their service conditions. The limits of rejection, described in Annex C, have been established following considerable field experience.

Extensive experience and judgement are required in evaluating whether drums that have corroded internally are safe and suitable for return to service. It is important that the surface of the metal is cleaned of corrosion products prior to the inspection of the drum.

C.3.2 Types of corrosion

The types of corrosion possible are classified as described in Table C.2.

Table C.1 — Rejection limits relating to physical and material defects in the drum shell

Type of defect	Definition	Rejection limits in accordance with Clause 6 [a]	Repair or render unserviceable
Bulge	Visible swelling of the drum	All drums with such a defect	Render unserviceable
Dent	A depression in the drum that has neither penetrated nor removed metal and is greater in depth than 1 % of the outside diameter	When the depth of the dent exceeds 3 % of the external diameter of the drum, or	Render unservicable
		when the diameter of the dent is less than 15 times its depth	Render unserviceable
Cut or gouge (Figure C.1)	A sharp impression where metal has been removed or redistributed and whose depth exceeds 5 % of the drum wall thickness	When the depth of the cut or gouge exceeds 10 % of the wall thickness, or	Repair if possible [b]
		when the length exceeds 25 % of the outside diameter of the drum, or	Repair if possible [b]
		when the wall thickness is less than the minimum design (i.e. minimum guaranteed) thickness	Render unserviceable
Crack (Figure C.2)	A rift or split in the pressure retaining area	All drums with such defects	Render unserviceable
Fire damage (Figure C.3)	Excessive general or localized heating of a drum usually indicated by: a) partial melting of the drum; b) distortion of drum; c) charring or burning of paint; d) fire damage to valve, melting of plastic date ring	All drums in categories a) and b) All drums in categories c) and d) may be acceptable after inspection and/or testing	Render unserviceable Repair if possible
Plug or neck inserts	Additional inserts fitted in the drum end, base or wall	All drums unless it can be clearly established that addition is part of approved design	Repair if possible
Damage to rolling bands, shrouds, lifting points etc.		All drums with such a defect	Repair if possible
Stamp marking	Marking by means of a metal punch	All drums with illegible, modified or incorrect or incorrectly modified markings	Render unserviceable [c]
Arc or torch burns (Figure C.4)	Partial melting of the drum, the addition of weld metal or the removal of metal by scarfing or cratering	All drums with such defects	Repair if possible
Suspicious marks	Introduced other than by the drum manufacturing process or approved repair	All drums with such defects	Continued use possible after additional inspection

Table C.1 — Rejection limits relating to physical and material defects in the drum shell (*concluded*)

Vertical stability		Deviation from verticality which may present a risk during service (especially if fitted with support skirt)	Repair if possible or render unserviceable

[a] When applying the rejection criteria given in Table C.1, the conditions of use of the drums, the severity of the defect and safety factors in the design shall be taken into consideration.

[b] Provided that after repair by a suitable metal removal technique, the remaining wall thickness is at least equal to the design (i.e. minimum guaranteed) wall thickness.

[c] If it can be clearly established that the drum fully conforms to the appropriate specifications, altered operational and modified markings may be acceptable and inadequate markings may be corrected, provided there is no possibility of confusion.

Table C.2 — Rejection criteria for corrosion of the drum wall

Type of corrosion	Definition	Rejection limits in accordance with Clause 6 [a]	Repair or render unserviceable
General corrosion (Figure C.5)	Loss of wall thickness over an area of more than 20 % of the total surface area of the drum	If the original surface of the metal is no longer recognizable, or when the wall thickness is less than the minimum design thickness	Repair if possible Render unserviceable
		If the depth of penetration exceeds 10 % of original thickness of wall [b], or if the wall thickness is less than design thickness	Repair if possible (repeat requirements of Clauses 6, 7 and 8)
Local corrosion	Loss of wall thickness over an area of less than 20 % of the total surface area of the drum except for the other types of local corrosion described below	If the depth of penetration exceeds 20 % of the original thickness of the drum wall [b], or if the wall thickness is less than design thickness	Repair if possible (repeat requirements of Clauses 6, 7 and 8)
Chain pitting or line corrosion (Figure C.6)	Corrosion forming a narrow longitudinal or circumferential line or strip, or isolated craters or pits (Figure C.7) which are almost connected	If the total length of corrosion in any direction exceeds the diameter of the drum and the depth exceeds 10 % of the original wall thickness [b]	Repair if possible [c]
Crevice corrosion	Corrosion taking place in, or immediately around, an aperture	If, after thorough cleaning, the depth of penetration exceeds 20 % of the original wall thickness	Repair if possible [c]

[a] If the bottom of the defect cannot be seen and if its extent cannot be determined using appropriate equipment, the drum shall be rendered unserviceable.

[b] If corrosion has reached limits of depth or extent, the remaining wall thickness should be checked with an ultrasonic device. When applying the rejection criteria given in this table, the conditions of use of the drums, the severity of the defect and safety factors in the design shall be taken into consideration.

[c] Provided that after repair by a suitable metal removal technique, the remaining wall thickness is at least equal to the design minimum wall thickness.

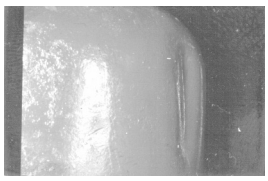


Figure C.1 — Cut or gouge

Figure C.2 — Crack

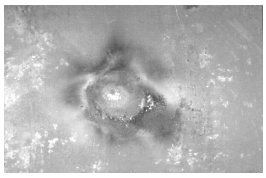


Figure C.3 — Fire damage

Figure C.4 — Arc or torch burns

Figure C.5 — General corrosion

Figure C.6 — Line corrosion

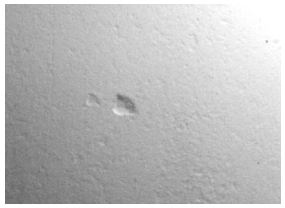


Figure C.7 — Isolated pits

Annex D
(normative)

Procedure to be adopted when de-valving and when a valve is suspected to be obstructed

D.1 The following procedures shall be carried out only by trained personnel. In view of the potential hazards with pressure drums, this operation can lead to injury from stored energy release, fire and toxic hazards, hence the personnel shall take such precautions as deemed necessary for the work to be performed.

As indicated in Clause 7, a systematic check shall be made to establish that the free passage through the valve is not obstructed. The method adopted shall be a recognized procedure such as one of the following or one that provides equivalent safeguards:

a) introduce inert gas at a pressure of up to 5 bar and check its discharge;

b) use the device shown in Figure D.1, to pump air into the drum, by hand.

D.2 Only when it is established that there is no obstruction to gas flow in the valve attached to the drum, the valve may be removed.

D.3 When a drum is found to have an obstructed gas passage in the valve, the drum shall be set aside and handled by specially trained personnel in this task as follows:

a) for drums of liquefied gases, first check to establish that the weight of the drum is the same as the tare weight stamped on the drum. If there is a positive difference, the drum can contain either liquefied gas under pressure or contaminants. Lack of a positive difference does not rule out the presence of a gas under pressure;

b) saw or drill the valve body until interception is made with the gas passage between the valve body stem and valve spindle seat; cooling shall be provided, especially if oxidizing gases are involved, or

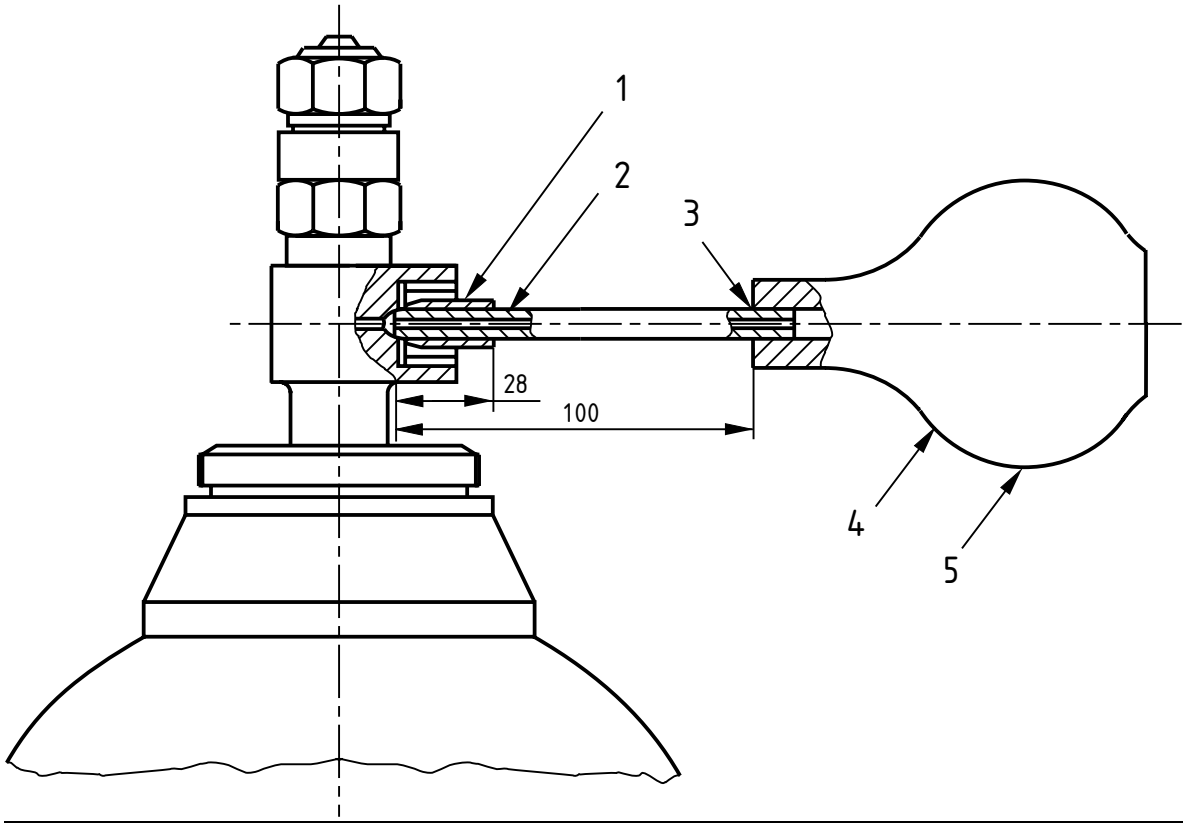
c) loosen or pierce the safety device in a controlled manner.

These methods are applicable to drums of non-toxic, non-flammable, non-oxidizing and non-CFC gases. Safety precautions shall be taken to ensure that no hazard results from the uncontrolled discharge of any residual gas.

Where the contents are toxic, flammable, oxidizing or CFC, the preferred method is to unscrew partially the valve within a glanded cap, secured and joined to the drum and vented to a safe discharge. The principles of a suitable device are illustrated in Figure D.2. This procedure shall be performed in a controlled manner and in such a way as to avoid personal injury.

When the gas, if any, has been released and the pressure within the drum reduced to atmospheric pressure, and, in the case of liquefied gases, when there is no frost or dew on the outside of the drum, the valve may be removed, after an additional check made to establish that there is free passage through the valve.

Dimensions in millimetres



Key

1 rubber tube 8mm internal diameter × 13mm external diameter ground to olive shape and bonded

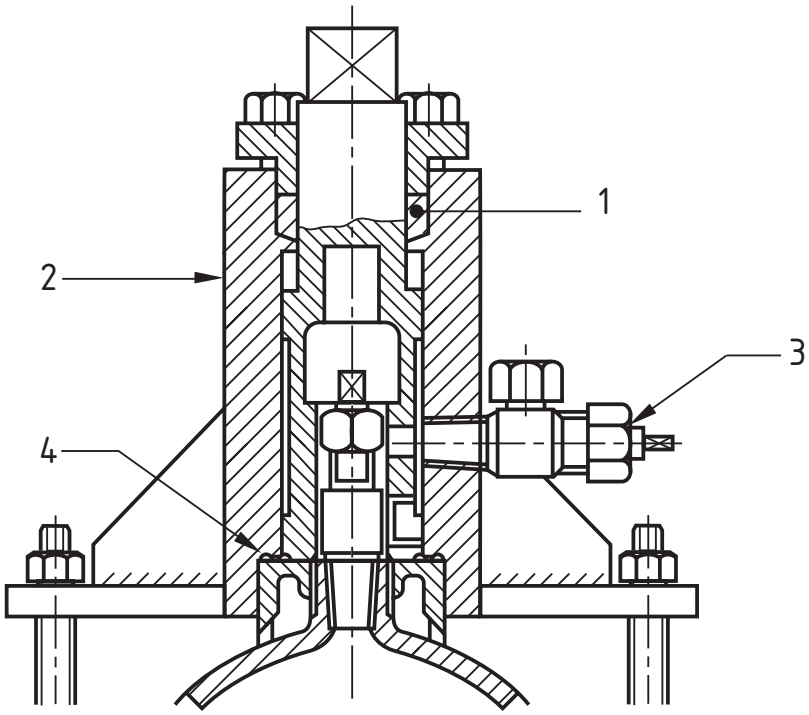
2 copper tube 3mm internal diameter × 8mm external diameter

3 bond

4 rubber bulb

5 hand pressure

Figure D.1 — Device for detecting obstructed drum valve



Key

1 rubber gland packing
2 extractor casing
3 control valve
4 joint ring

Figure D.2 — Typical device for the removal of a damaged drum valve

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[1] EN ISO 10297, Transportable gas cylinders — Cylinder valves — Specification and type testing (ISO 10297:2006)

[2] EN 1089-2, *Transportable gas cylinders — Gas cylinder identification (excluding LPG) — Part 2: Precautionary labels*

[3] EN 1089-3, *Transportable gas cylinders — Gas cylinder identification (excluding LPG) — Part 3: Colour coding*

[4] *Council Directive 1999/36/EC of 29 April 1999 on transportable pressure equipment (TPED)*

[5] 84/527/EEC *Council Directive of 17 September 1984 on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders*

[6] ADR *European agreement on the International Carriage of Dangerous Goods by Road*

[7] RID *Regulations concerning the International Carriage of Dangerous Goods by Rail*

[8] EN 837-1, *Pressure gauges — Part 1: Bourdon tube pressure gauges — Dimensions, metrology, requirements and testing*

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[10] EN 14189, *Transportable gas cylinders — Inspection and maintenance of cylinder valves at time of periodic inspection of gas cylinders*

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