BRITISH STANDARD

BS EN
14208:2004

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

The European Standard EN 14208:2004 has the status of a British Standard

ICS 23.020.30

BSi
British Standards

National foreword

This British Standard is the official English language version of EN 14208:2004.

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

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

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English version

Transportable gas cylinders - Specification for welded pressure drums up to 1000 litre capacity for the transport of gases - Design and construction

Bouteilles à gaz transportables - Spécification pour les fûts soudés de capacité inférieure ou égale à 1000 litres destinés au transport des gaz - Conception et fabrication

Ortsbewegliche Gasflaschen - Spezifikation für geschweißte Druckfässer mit einem Fassungsraum bis zu 1000 liter für den Transport von Gasen - Gestaltung und Konstruktion

This European Standard was approved by CEN on 4 December 2003.

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 Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Contents

Foreword

This document (EN 14208:2004) 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of an identical text or by endorsement, at the latest by August 2004, and conflicting national standards shall be withdrawn at the latest by August 2004.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.

Annex A is normative and annexes B and C are informative.

This document includes a bibliography.

For relationships with EC directives, RID and ADR see informative annex C, which is an integral part of this document.

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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The purpose of this European Standard is to provide a specification for the design, manufacture, inspection and approval of welded steel pressure drums.

The specifications given are based on knowledge of and experience with, materials, design requirements, manufacturing processes and control during manufacture of steel drums in common use in the countries of the CEN members.

1 Scope

This European Standard specifies the minimum requirements for the material, design, construction and workmanship, inspection and testing at manufacture of refillable welded steel pressure drums, hereafter referred to as drums, of volumes of 150 litres up to 1 000 litres for compressed and liquefied gases. Cylindrical and spherical containers are covered.

2 Normative references

This Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place in the text and 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 287-1, *Approval testing of welders — Fusion welding — Part 1: Steels*

EN ISO 15607, *Specification and qualification of welding procedures for metallic materials - General rules (ISO 15607:2003)*

EN 288-3, *Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for the arc welding of steels*

EN 462-3, *Non-destructive testing — Image quality of radiographs — Part 3: Image quality classes for ferrous metals*

EN 629-1, *Transportable gas cylinders — 25 E taper thread for connection of valves to gas cylinders — Part 1: Specification*

EN 895, *Destructive tests on welds in metallic materials — Transverse tensile test*

EN 910, *Destructive tests on welds in metallic materials — Bend tests*

EN 970, *Non-destructive examination of fusion welds — Visual examination*

EN 1435, *Non-destructive examination of welds — Radiographic examination of welded joints*

EN 1714, *Non destructive examination of welds — Ultrasonic examination of welded joints*

EN 10002-4, *Metallic materials — Tensile test — Part 4: Verification of extensometers used in uniaxial testing*

EN 10028-1, *Flat products made of steels for pressure purposes — Part 1: General requirements*

EN 10028-2, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*

EN 10028-3, *Flat products made of steels for pressure purposes — Part 3: Weldable fine grain steels, normalized*

EN 10028-4, *Flat products made of steels for pressure purposes — Part 4: Nickel alloy steels with specified low temperature properties*

EN 10028-5, *Flat products made of steels for pressure purposes — Part 5: Weldable fine grain steels, thermomechanically rolled*

EN 10028-7, *Flat products made of steels for pressure purposes — Part 7: Stainless steels*

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method*

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*

EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes*

EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods and sections for general purposes*

EN 12517, *Non-destructive examination of welds - Radiographic examination of welded joints - Acceptance levels*

EN 13445-2, *Unfired pressure vessels — Part 2: Materials*

EN 22063, *Metallic and other inorganic coatings — Thermal spraying — Zinc, aluminium and their alloys (ISO 2063:1991, modified)*

EN ISO 5817:2003, *Welding - Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) - Quality levels for imperfections (ISO 5817:2003*

EN ISO 8501-1, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings (ISO 8501-1:1988)*

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 11116-1, *Gas cylinders — 17E taper thread for connection of valves to gas cylinders — Part 1: Specifications (ISO 11116-1:1999)*

3 Terms, definitions and symbols

For the purposes of this standard, the following terms, definitions and symbols apply:

3.1 Terms and definitions

3.1.1
yield stress
value corresponding to the lower yield stress or, for steels that do not exhibit a defined yield point, the 0,2 % proof stress (1% proof stress for austenitic stainless steel)

3.1.2
normalizing
heat treatment given to the steel by heating to a uniform temperature above the upper critical point (AC_3) of the steel and then cooled in a controlled atmosphere

3.1.3
stress relieving
heat treatment given to reduce the residual stresses of the steel

3.1.4
batch
quantity of finished drums made consecutively during the same or consecutive working days to the same design, size and material specifications; using the same welding procedures; and heat-treated under the same conditions of temperature and duration

3.1.5
test pressure
pressure applied to the drum after completion of all fabrication; it is the parameter used to design the drum

3.1.6
finished drum
drum which is fully assembled and appropriately stampmarked, but without any external coatings

3.2 Symbols

a_1 Minimum thickness of the cylindrical part of the drum based on pressure criteria, in mm

a_2 Minimum thickness of cylindrical shell or dished end based on handling criterion, in mm

B Area to be compensated, in mm^2

b_1 Calculated minimum thickness of dished ends, in mm

c_1 Calculated minimum thickness of a spherical shell or hemispherical dished ends, in mm

D_d Diameter of valve protection dome, in mm

D_o Maximum outside diameter of the drum, in mm

D_i Internal diameter

f_c Maximum allowable stress for the cylindrical section of the drum, in MPa

f_e Maximum allowable stress for the dished ends of the drum, in MPa

f_p Maximum allowable stress for the pad material of the drum, in MPa

f_s Maximum allowable stress for the spherical section of the drum, in MPa

H Height of the dished end

H_0 External height of the domed part of the end, in mm

H_e Equivalent height of a dished end for determining the shape factor, in mm

k Minimum length of the edge on the shroud or of the drum, in the case of dished ends convex to pressure, to ensure compatibility with hooks (see Figure 5)

K Shape factor of the dished ends

L The dimension between the external surface of the shroud or of the drum, in the case of dished ends convex to pressure, and the internal surface of the edge (see Figure 5)

N Largest dimensioning of an opening, in mm

P Maximum dimension of pads that can be considered as compensation, in mm

p_h Test pressure, in bar [1)] above atmospheric pressure

Q Radius of equivalent sphere when calculating compensation, in mm

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1) 1 bar = 10^5 Pa = 0,1 MPa = 0,1 N/mm^2

R_0 External radius of the crown of a torispherical dished end, in mm

r_0 External radius of the knuckle of a torispherical dished end, in mm

R_m Actual value of tensile strength, in MPa

S Thickness of shell in area to be compensated, in mm

S_f Length of straight flange on a torispherical or ellipsoidal dished end, in mm

s_1 Minimum thickness of spherical section, in mm

S_f Length of a straight flange on a torispherical or ellipsoidal dished end, in mm

T Minimum value of tensile strength, in MPa

t_e Thickness of un-pierced end in location of opening, in mm

Y Minimum guaranteed value of yield stress of the material in the relevant part of the finished drum, in MPa

4 Materials

4.1 General provisions

4.1.1 Materials for the pressure envelope shall conform to EN 10028-1 to –5 for carbon steels and for austenitic stainless steels either EN 10028-7 or EN 10088-1 to –3.

4.1.2 The materials used for the drum shall be compatible with the intended gas service e.g. corrosive or embrittling gases. See EN ISO 11114-1 and EN ISO 11114-2.

NOTE Particular attention should be paid to the specification for bolts, studs and other components, which are in contact with the gas where the use of high strength materials may be incompatible with embrittling gases.

4.1.3 All parts welded to the drum shall be made of material that is compatible with respect to weldability and strength.

4.1.4 The welding consumables shall be such that they are capable of giving consistent welds with minimum tensile strength at least equal to that specified for the parent material in the finished drum.

4.1.5 The manufacturer shall obtain and provide certificates proving conformance to the material specifications for the steel used for the construction of pressure retaining parts of the drum. If the minimum values of the yield stress of the material guaranteed by the steel manufacturer is greater than the minimum specified in the material standard, then this higher figure may be used in the design calculations, up to a maximum enhancement of 15 %. It shall be ensured that the heat treatment (if any) will not affect this minimum guaranteed value.

The manufacturer shall be able to identify all pressure bearing parts of the drum with the cast(s) of steel from which it is made.

4.2 Heat treatment

If the steel used, or the steel specification requires it, the drums shall be heat treated or stress relieved. The manufacturer shall produce certificates for the applied heat treatment. The temperature and process time shall be continuously recorded during the heat treatment. Localized heat treatment is not permitted.

5 Design

5.1 Design stress

The design stress *f*c, *f*e, *f*p and *f*s at the test pressure shall not exceed 0,77 *Y*.

5.2 Calculation of thickness

5.2.1 Cylindrical wall

The minimum thickness a_1 of a wall of cylindrical section shall be not less than the thickness calculated using the equation:

$$a_1 = \frac{Ph \times Do}{20\,fc + Ph} \qquad (1)$$

5.2.2 Spherical shell

The minimum thickness s_1 of a wall of spherical section shall be not less than the thickness calculated using the equation:

$$s_1 = \frac{Ph \times Do}{40\,fs + Ph} \qquad (2)$$

5.2.3 Dished ends concave to pressure

5.2.3.1 General

For a drum with ends concave to pressure, the minimum thickness b_1 of the wall of a torispherical sphere or ellipsoidal dished end shall be not less than $b_1 = K.a_1$ where the value of K varies with the shape of the ends, as shown in Figure 1. The value of K shall not be taken as less than 1,0. If a drum is made of two dished ends, the thickness of the straight cylindrical part shall be not less than a_1 as calculated according to **5.2.1**. If a drum is made of two hemispherical ends, their thickness shall be calculated according to **5.2.2**.

5.2.3.2 Shape factor

The shape factor K is determined and taken from Figure 1, using the appropriate values of H_e/D_0 and b_1/D_o. The value for H_e is determined as follows:

— for an ellipsoidal end $H_e = H_0$,

— for a torispherical end H_e = the least of : H_0, or $D_0^2 / 4R_0$, or $(D_0 r_0/2)^{0,5}$.

NOTE The external height of the domed end for a torispherical end may be calculated as

$$H_0 = R_0 - \{(R_0 - D_0/2)(R_0 + D_0/2 - 2\,r_0)\}^{0,5}$$

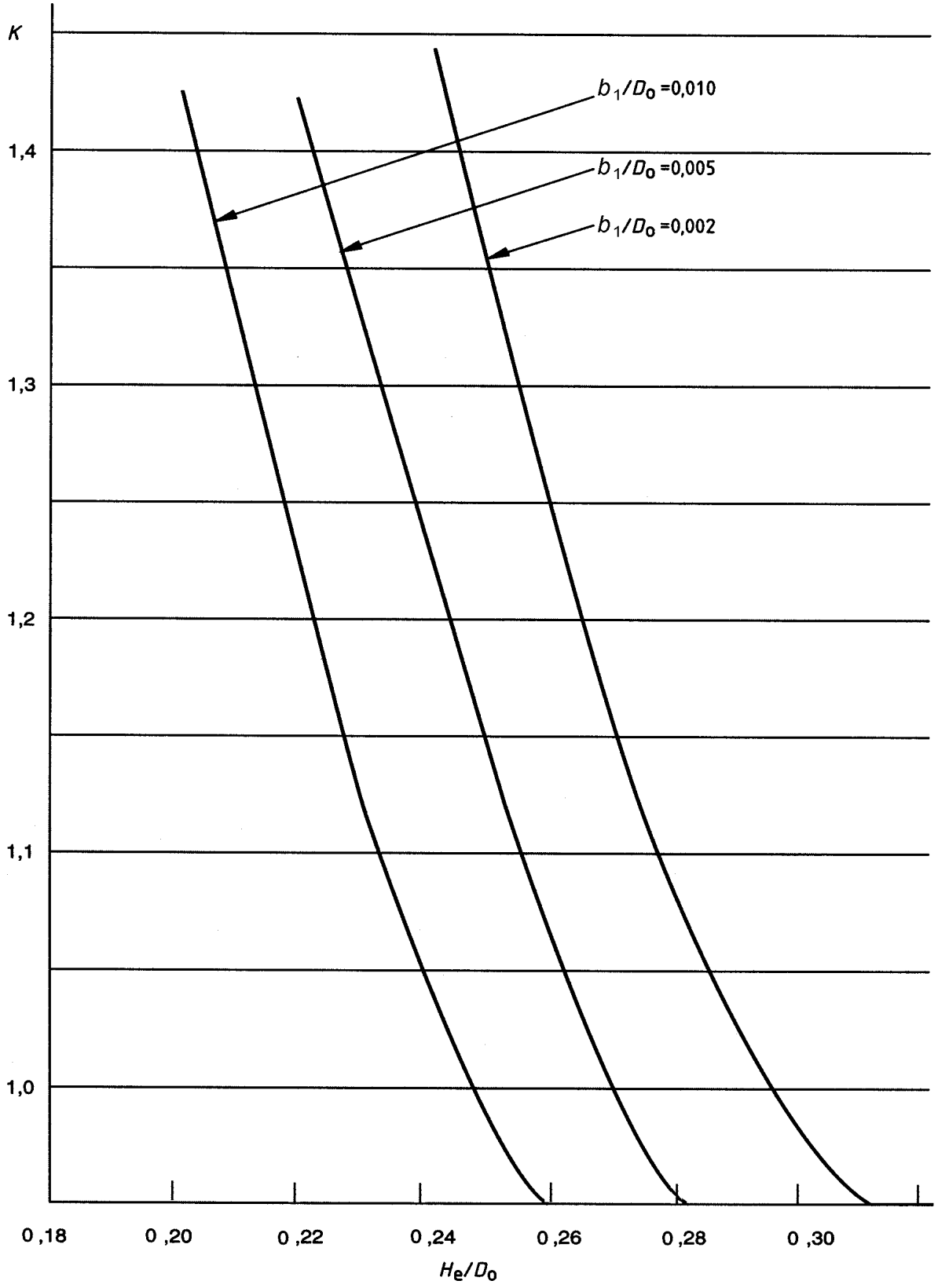


Figure 1 — Shape factor *K*

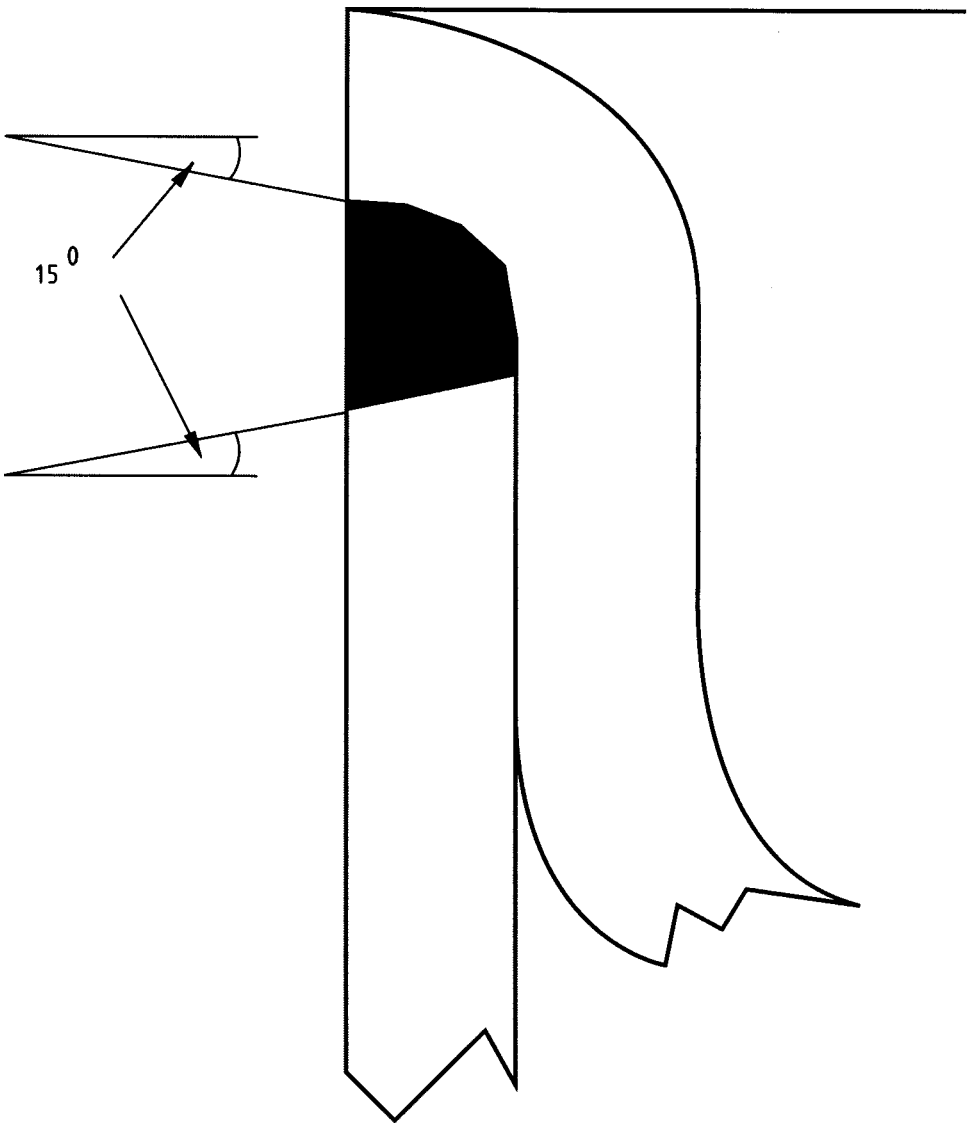


Figure 2 — Weld detail for dished-in ends

5.2.3.3 Limitations of shape

a) In a torispherical end R_0 shall not be greater than D_0;

b) In a torispherical end r_0 shall not be less than 0,1 D_0 nor less than four times the thickness of the dished end as manufactured;

c) In an ellipsoidal end the ratio H_e/D_O shall be not less than 0,192;

d) S_f shall be not less than 0,3 $(D_o t_e)^{0.5}$

5.2.4 Dished ends convex to pressure

In the case of dished ends convex to pressure, the design shall be confirmed by a burst test and a pressure cycling test (see clause **15**). The arrangement of the end weld shall be such that it can be inspected by radiography or an equivalent NDT method. Figure 2 gives one example.

Dished ends convex to pressure shall not be used for vessels designed to contained corrosive substances.

5.3 Minimum thickness for handling

5.3.1 The thicknesses of the shell and ends calculated from the pressure conditions (see **5.2**) shall be increased if they are less than the value calculated from the formula $a_2 = 2{,}5\ (D_o/T)^{0,5}$, with a minimum thickness of 2,5 mm. If the materials used for shell and ends are different, the calculation shall be carried out for each component using the appropriate properties.

5.3.2 When the thickness of a drum has to be increased in accordance with **5.3.1**, the test pressure may optionally be increased to take account of this increased thickness, provided the other parts of the drum conform to the design requirements of the higher test pressure.

5.4 Fittings

5.4.1 General

Fittings (valves for filling, emptying, pressure relief, level devices etc.) shall be attached as defined below. While there is no restriction on the number of apertures, their number shall be kept to the minimum.

NOTE It is recommended that no more than two apertures per end should be used.

Fittings shall be located only in the dished ends or spherical sections. They shall be attached to parts of the container that are reinforced locally by a pad, or to a flange or access plate bolted to a flange, except when the thickness of the shell is greater than 15 mm. Openings shall be compensated (see **5.4.6**).

5.4.2 Screwed fittings

5.4.2.1 Screwed fittings up to 80 mm thread diameter may be used. If a tapered thread is used, with sealing of the pressure on the threads, then a sealant, such as PTFE tape, PTFE spray, a lead ferrule or an aluminium ferrule, shall be inserted between the threaded components to effect a seal. If parallel threads are used, the torques used for assembly shall be set both to ensure a seal on the gasket, and to prevent loosening in transit.

5.4.2.2 For standard valves with taper and parallel threads, EN 629-1 and EN ISO 11116-1 respectively define the dimensions and mode of connection.

NOTE EN 629-2 and EN ISO 11116-2 respectively define the methods of controlling the thread gauges.

5.4.3 Bolted connections

Bolted connections shall be made with at least three bolts or studs. Studs shall be threaded to their ends, so that they lock upon insertion. Joining surfaces shall be flat and true, in accordance with the flatness, parallelism and perpendicularity tolerances specified on the design drawings (e.g. to EN ISO 1392), and if necessary shall be machined after heat treatment if they have become distorted.

5.4.4 Protection of fittings

5.4.4.1 General

Drums shall be such that all fittings are situated inside the contour of the end shrouds or support structure, or the end of the drum in the case of those with dished ends convex to pressure.

5.4.4.2 End shrouds

End shrouds shall have minimum thickness of 10 mm, or 7 mm if fitted with a reinforcing ring. They shall be attached to the drum by welding for at least 50 % of their circumference. Shrouds shall have holes or cutaways, to allow for drainage.

5.4.4.3 Frame protection

Drums designed to be carried vertically may alternatively have a frame structure rather than shrouds. Bottom outlets and their external pipework shall be protected from impact by a steel structural member of second moment of area not less than $3,5 \times 10^6$ mm^4.

5.4.5 Local protection

5.4.5.1 In addition to the general protection specified in **5.4.4**, fittings shall be provided with local protection.

5.4.5.2 Where the gas is toxic, the valves shall be covered by metal domes or individual caps, of thickness not less than $(D_d/15)^{0,5}$ where D_d is the diameter of the dome in mm, but in any case not less than 2,5 mm. A dome shall be capable of being hinged or moved to allow access for filling or emptying, and secured for transport. There shall also be a facility within the dome to allow venting of any gas within, in case of leakage.

5.4.5.3 Where the gas carried is not toxic, the local protection may take the form of a fixed steel cage mounted local to the fittings. The cage shall allow access to the valves and fittings. In the case of a container that is designed to remain vertical, additional protection is not required where the clearance between the fittings and the edge of the shroud or frame is at least 100 mm.

5.4.5.4 Blank plugs, fusible plugs and pressure relief valves do not require additional local protection provided that they are mounted at a diameter at least 75 % of that of the shroud, and are of low profile protruding not more than 30 mm from the surface of the drum.

5.4.6 Compensation of openings

5.4.6.1 Openings shall have their largest dimension N less than $0,5\ D_o$. (See Figure 3).

5.4.6.2 The total cross-sectional area to be compensated, B, required in any given plane shall not be less than $B = N \times S$ where S is the thickness of an un-pierced dished end or spherical section calculated from the formulae in **5.2.2** or **5.2.3**.

The area of compensation in the parts available for replacement shall be not less than B (see Figure 3). In calculating this area, only material up to a distance P from the actual surface of the shell may be considered, where $P = (N.t_e)^{0,5}$.

Where the pad is made from a material strength different from the part to be compensated, the area available to be considered as compensation shall be multiplied by the ratio of the allowable stresses (f_p/f_s or f_p/f_e) as appropriate.

5.4.6.3 S shall not be less than b_1 or s_1, except that:

a) when the opening and its compensation are located entirely within the spherical portion of a torispherical dished end, then S shall not be less than the thickness required for a sphere equal to the spherical portion of a dished end.

b) when the opening and its compensation are located in an ellipsoidal end and are entirely within a circle having the radius measured from the centre of $0,40D_o$, S is the thickness required for a sphere having the equivalent radius Q taken from Table 1. Intermediate values may be taken from Figure 4.

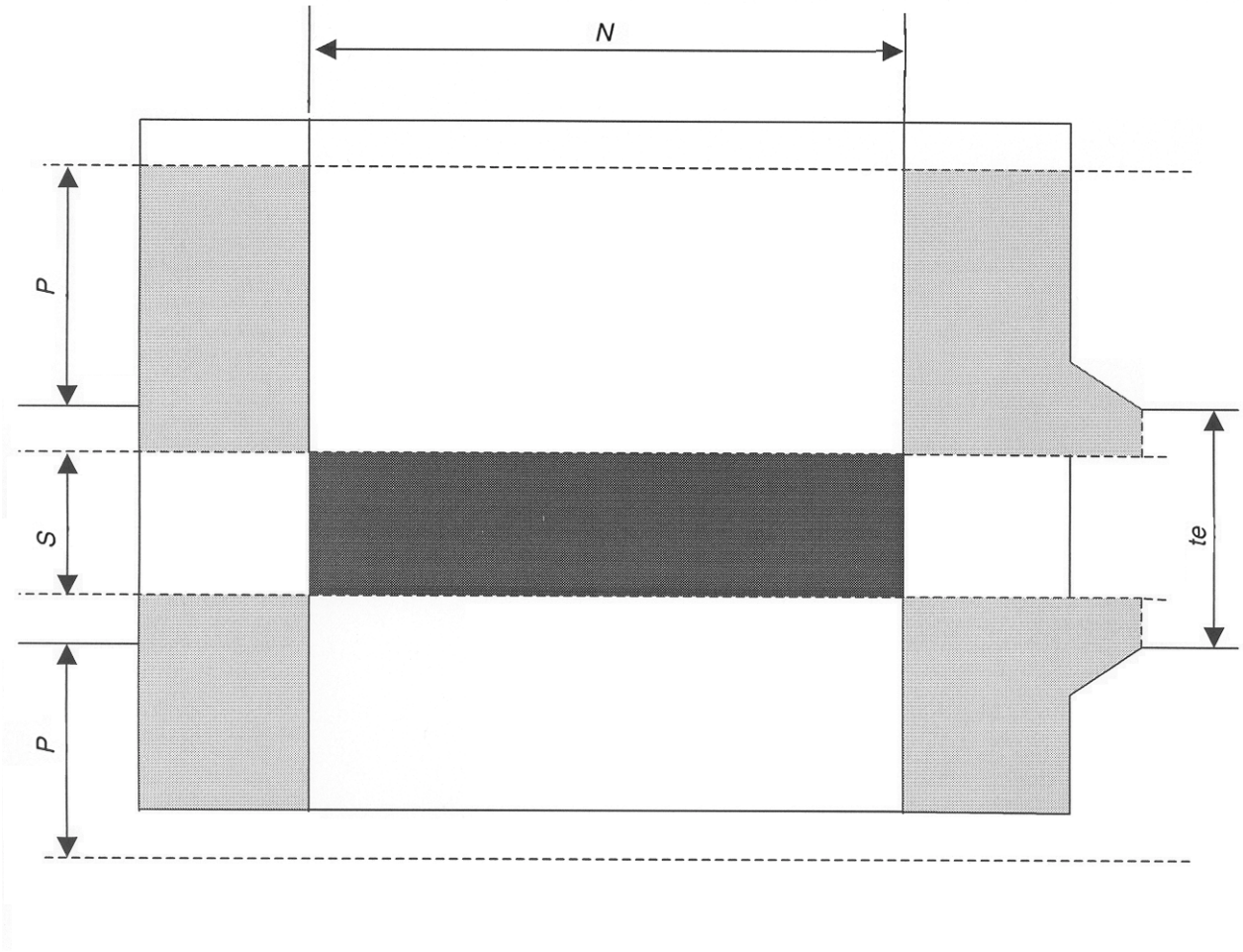


Figure 3 — Compensation of openings

Table 1 — Radius, *Q*, of equivalent sphere

H/D_i	0,17	0,18	0,19	0,21	0,23	0,25	0,28	0,31	0,36	0,4	0,45	0,5
Q/D_i	1,36	1,27	1,18	1,08	0,99	0,9	0,81	0,73	0,65	0,59	0,54	0,5

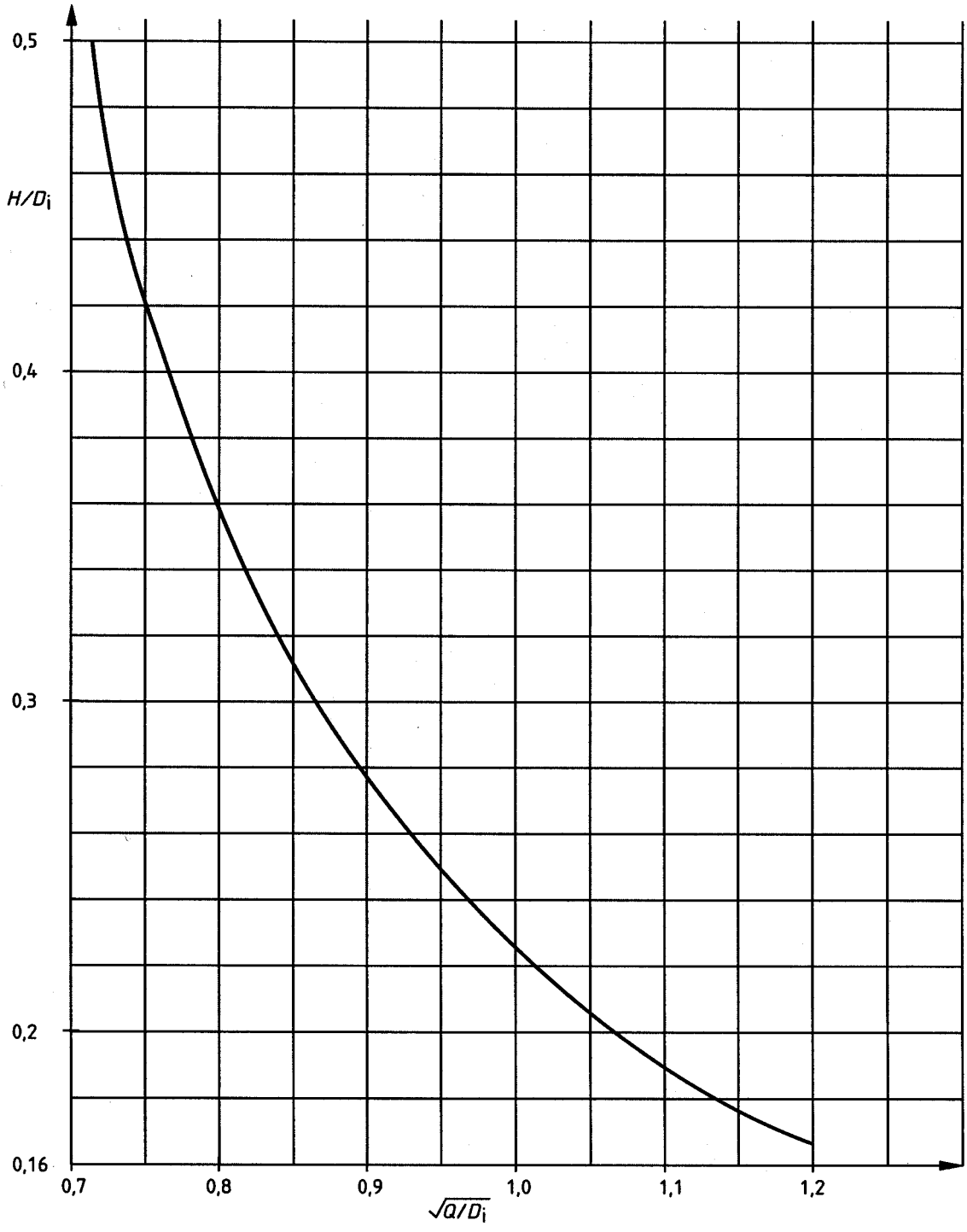


Figure 4 — Radius, *Q*, of equivalent sphere

6 Lifting attachments

6.1 Vertical and spherical drums

6.1.1 Drums designed to be carried in the vertical plane shall have structural members of minimum thickness 5 mm of steel to take the forks of a fork-lift inserted into the bottom structure. The configuration of these pockets/structure shall protect the drum from being impacted during normal handling. The fork apertures shall be positioned symmetrically about the centre of gravity and their size shall be appropriate to the forks which are to be used to move the drum. The fork apertures shall be designed such that the drum cannot accidentally disengage from the forks.

6.1.2 If lifting lugs are fitted, they shall be designed to withstand a design load of 2 x maximum gross weight. Drums with more than one lifting eye shall be designed such that a minimum sling leg angle of 45° to the horizontal can be achieved during lifting using the lifting eyes.

Where four lifting eyes are used their design shall be such that they are strong enough to allow the drum to be lifted by only two. Where two or four lifting eyes are used, diametrically opposite lifting eyes shall be aligned with each other to allow for correct lifting using shackle pins.

6.2 Horizontal drums

When drums are designed to be carried in the horizontal position, the edge of the shrouds shall be reinforced. The profile of the edge of the shroud, or the edge of the drum in the case of dished ends convex to pressure, shall conform to the dimensions given in Figure 5. Dimension k is to be not less than 50 mm, and the angle ϕ not greater than 45 °.

NOTE This is to ensure compatibility with the shape of the hooks used.

Requirements for lifting lugs shall be as specified in **6.1.2**.

6.3 Attachment of rolling bands

For carbon steel vessels to be used in the horizontal position, external rolling bands are not required if the external surface is shot blasted and covered with a zinc or aluminium spray before painting in accordance with EN 22063.

In the case where rolling bands are fitted to the pressure containing part of the shell, they shall be attached by continuous fillet welds on either side of the band.

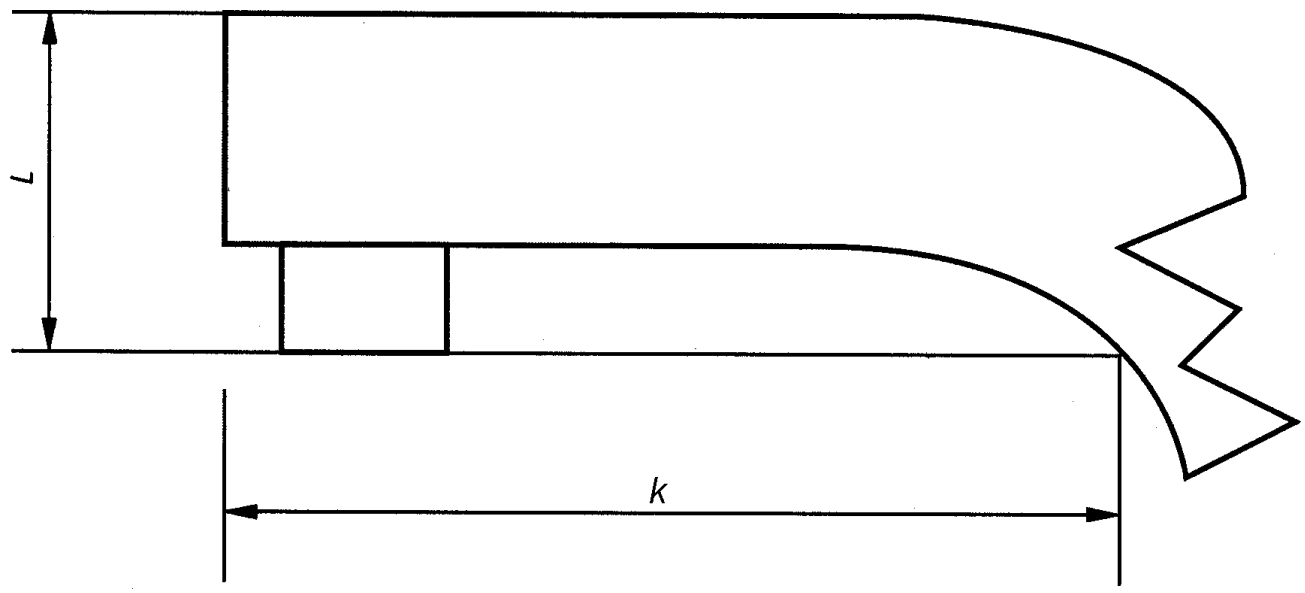
If fitted to a non-pressure part (e.g. a shroud) then intermittent welds of not less than 50 % of the circumference are permissible. The leg length of these fillet welds shall be not less than 5 mm.

7 Manufacturing process - Welding procedures

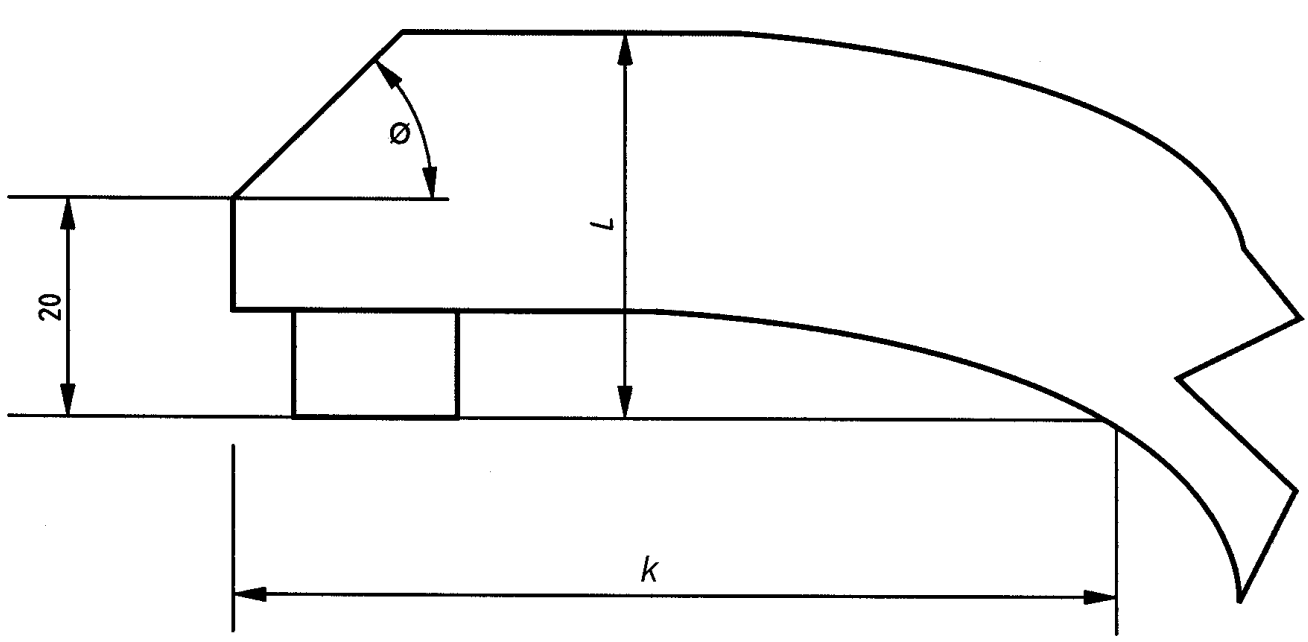
The manufacturer shall qualify the specific welding procedures and welders to EN 288 and EN 287 respectively. Records of such qualification shall be kept on file by the manufacturer for a period of at least 10 years.

Procedural qualification tests shall be performed in such a manner that the welds shall be representative of those made in production.

Re-qualifying of the procedure, as well as the welder, shall be required if there is a change in any of the essential variables as detailed in EN 287-1, EN ISO 15607 and EN 288-3.



a) $L < 20$ mm



b) $L > 20$ mm

Figure 5 — Limits on vessel or shroud edge dimensions

8 Fabrication

8.1 Shell sections

The cylindrical shell shall be made from a single plate.

8.2 Dished ends

The dished ends shall each be pressed from a single plate. All forming shall be done by machine; local heating or hammering is not permissible.

8.3 Cold pressed dished ends

Where material properties require, cold-formed dished ends shall be normalized after pressing. Ends distorted in this heat treatment beyond the allowable limits shall be re-aligned by cold deformation in the press.

8.4 Hot pressed dished ends

Dished ends pressed with plates heated to above 500 °C, do not require heat treatment after forming

9 Welded joints

The welding of the longitudinal and circumferential seams shall be by an automatic or a semi-automatic process. The longitudinal weld, of which there shall be no more than one in a cylindrical section, shall be a full penetration butt weld, and any backing bars shall be removed after welding.

The circumferential welds shall be a butt weld or a joggle joint weld. Vessels designed for corrosive gases shall not use joggle joints.

10 Surface finish of material

The external surface finish shall be at least equal to level SA 2.5 in accordance with EN ISO 8501-1.

The internal surface finish shall be agreed by the parties. Any scale or corrosion shall be removed by an appropriate method such as shot blasting. The pressure containing parts of the drums shall be examined for uniform quality and freedom from unacceptable defects (in accordance with annex A).

Any surface defects such as pits, scrapes, rolled-in scale or pressing marks, shall be ground out so that the reduced thickness is blended in to the rest of the plate at an angle not greater than 1:20.

The depths of the defects shall be limited to 1,5 mm. The thickness at all such locations shall be measured and proved to be greater than the minimum specified.

11 Assembly

11.1 Temporary attachments

Tacking strips, cleats, or any other attachments temporarily welded to the drum to facilitate manufacture shall be of the same material as the vessel and shall be completely and carefully removed so as not to damage the drum. Any surface imperfections remaining after removal shall be made good by repair welding.

The repaired areas shall be dressed to a smooth finish level with the surface of the adjacent parent material and be subjected to a check for surface cracks using appropriate non destructive testing e.g. Dye penetrant test in accordance with ISO 3879 or a magnetic particle examination in accordance with EN 1290 or EN 10246.

11.2 Alignment of joints

The edges of plates at all butt seams shall at no place be out of alignment by more than the limits specified in EN ISO 5817 level C.

Where joggle joints are used, the fit of the mating parts shall be such that there is no gap greater than 0,5 mm before welding. When a joggling operation is performed on a cylindrical section, those lengths of weld that are deformed by the joggle shall be ground flush with the parent plate before the joggling operation, and shall be crack detected before welding them into circumferential seams.

11.3 Attachments and fittings

Any external attachments such as shrouds or skirts shall fit the contour of the part of the drum. Any local gaps shall not exceed 2,5 mm and any change in the gap shall be gradual.

Shrouds, skirts and other attachments to the pressure envelope shall, prior to fitting to the pressure drum, have their welds inspected visually 100 % and 10 % by NDT testing e.g. Dye penetrant test in accordance with ISO 3879 with or a magnetic particle examination in accordance with EN 1290 or EN 10246.

If any defects are detected by the NDT, then 100 % of the attachment welds shall be inspected by NDT.

12 Repair of weld defects

Defects shall be repaired by chipping, grinding or machining out to sound metal and re-welding. Care shall be taken to ensure proper penetration and complete fusion of the fresh weld deposit with the plates and previously deposited weld metal. Flame gouging may be used as an alternative method for cutting out defects provided the edges are subsequently machined or ground back to sound material. All repairs in main seam welds shall be tested non-destructively as specified in **14.5**.

13 Construction and workmanship

13.1 Thickness measurement

The finished drum shall be checked ultrasonically on a grid basis in accordance with EN 1714, to ensure maintenance of the minimum thickness as specified on the drawing.

13.2 Out of roundness

The out-of-roundness of the cylindrical shell shall be limited so that the difference between the maximum and the minimum outside diameter in the same cross-section is not more than 1 % of the mean of these diameters for two piece drums and 1,5 % for three piece drums and for spheres.

13.3 Straightness

The maximum deviation of the cylindrical part of the shell from a straight line shall not exceed 0,3 % of the cylindrical length.

14 Testing and examination

14.1 Test plates

Test plates for mechanical tests shall be provided as specified in **14.2** on one drum in every fifty drums manufactured, except that for the first 40 of a new design, test plates shall be provided for 1 in every 10 drums.

14.2 Provision of welded test plates

14.2.1 Test plates shall be provided at the end of a longitudinal seam, except in the case of spherical vessels where separate flat test plates shall be provided.

14.2.2 The combined length of weld in each set of test plates shall be sufficient to provide material for the tests required together with any re-tests which may be necessary and with suitable allowances for discards and cutting.

14.2.3 The material used for the test plates shall be from the same cast or to the same specification as the shell plates of the drum and shall be of the same thickness and welding procedure as that of the shell plates represented. The test plates shall be securely attached at the end of the longitudinal seam to be welded and shall be suitably clamped or reinforced to prevent excessive distortion or warping. Alternatively they may be made by making an overlong cylindrical section, and cutting off a complete ring, or made separately in the case of spherical vessels.

14.2.4 For the bend test, the welds in the test plates shall be dressed smooth and flush with, but not below, the surface of the adjacent plates.

14.2.5 Straightening of the test plates that have warped during fabrication shall be carried out cold.

14.2.6 The test plates shall be subjected to non-destructive examination to the same standard as the main seams. If the non-destructive examination of a test plate reveals the presence of flaws, which in a main seam would normally require repair, these flaws shall be avoided in the selection of the test pieces. Repairs of welded test plates shall not be permitted.

14.2.7 If a production drum requires a repair to a pressure bearing weld, such a repair shall also be tested.

14.3 Number of test specimens

The number of specimens required from each set of test plates shall be in accordance with Table 2. When more than one specimen of a particular type is required, the specimens shall be taken as far apart as possible.

Table 2 — Number of test specimens required

Test specimen	Thickness of plate at weld	
	10 mm or less	over 10 mm
Macro examination	1	1
Transverse tensile	1	1
Root bend	2	— [1)]
Face bend	1	—
Impact	3	3

[1)] For a butt joint made from only one side, one root bend test specimen is required.

14.4 Mechanical tests

14.4.1 Transverse tensile test

Each specimen shall be of a shape in accordance with EN 895. The yield stress and tensile strength shall be not less than the specified minimum value for the parent metal.

Tensile specimens T1 and T2 shall be made from strips cut from test plates as described in 14.2, with the axis of strips, where possible, parallel to the axis of the drum. Figure 6 shows the orientation of the test pieces compared to the drum. Where necessary, test specimen T1 shall be cut transverse to the axis of the drum as shown. The form and dimensions shall be as specified in EN 895. The face and back of the test specimen shall not be machined, but shall represent the surface of the drum as manufactured.

Tensile testing shall be carried out as specified in EN 10002-4.

14.4.2 Bend tests

The bend test specimens and the conditions and the method of carrying out the tests shall be in accordance with EN 910.

The un-machined surfaces of bend specimens representing the outside or inside of the vessel shall be dressed only lightly so that the rolled surface of the parent metal is not wholly removed, except that where the rolled surface of the abutting plates are not level with one another, one plate may be machined at each face to a depth not exceeding 1 mm.

The bend test specimens shall be cut transversely to the welded seam. They shall be the full thickness of plates and shall have a width not less than 1,5 times the plate thickness. The edges shall be rounded to a radius not exceeding 10 % of the thickness tested.

Two transverse bend tests shall be made. One test piece shall be tested with the surface corresponding with the outer surface of the vessel in tension, and the other with the surface corresponding with the inner surface of the vessel in tension. The diameter of the former, around which the test specimens shall be bent, shall not be more than 3 times the thickness of the test specimens, and the test is to be continued until the two limbs are parallel.

On completion of the test there shall be no cracks or defects at the outer surface of the specimen.

14.4.3 Impact test

14.4.3.1 Except for the requirements set out below, the impact test (Charpy V-notch) shall be carried out in accordance with EN 10045-1.

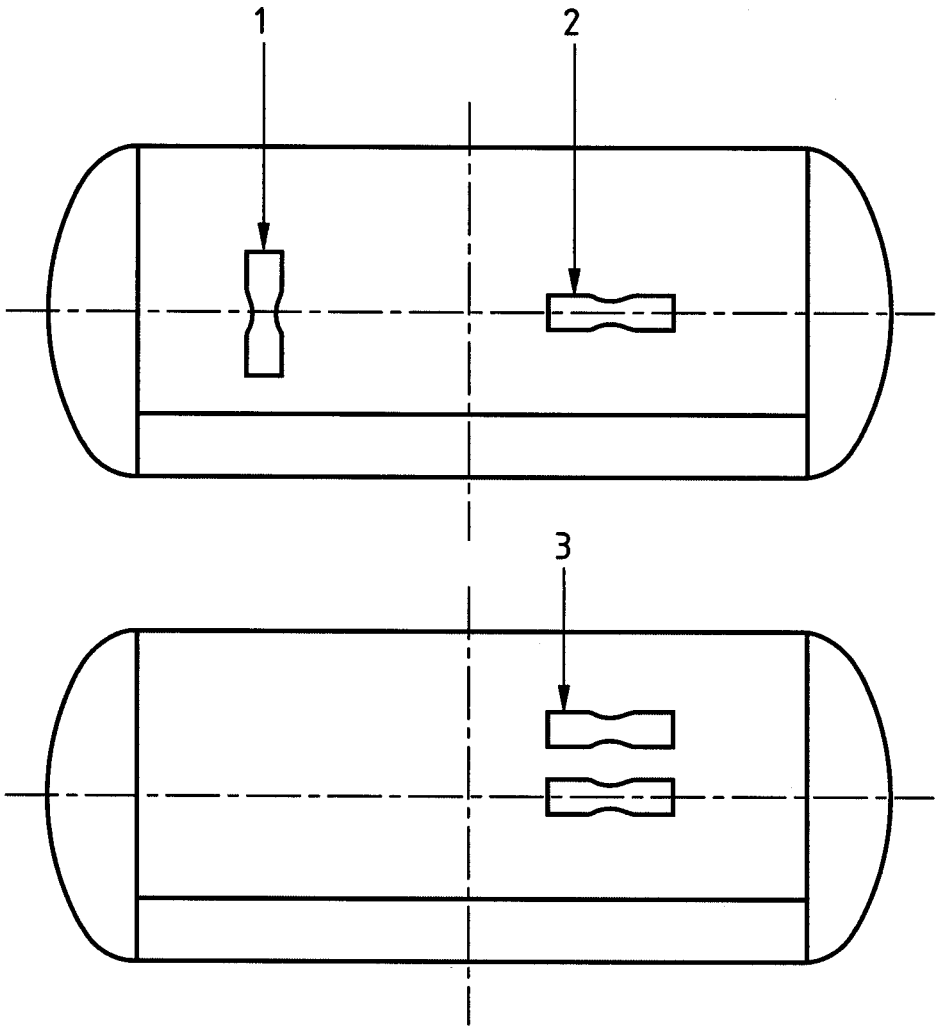
14.4.3.2 The test temperature shall be at least that specified in EN 13445-2, with a minimum design reference temperature of – 50 °C. For deciding the test temperature, the actual drum wall thickness shall be used.

14.4.3.3 The following impact test samples shall be taken (see Figure 7):

— Three impact test samples from each parent material;

— Three impact test samples from the longitudinal welds;

— Three impact test samples from one of the circumferential welds.



Key

1 T1 transverse to axis

2 T2 parallel to axis

3 T1 and T2 parallel to axis

Figure 6 — Location of test specimens for tensile testing

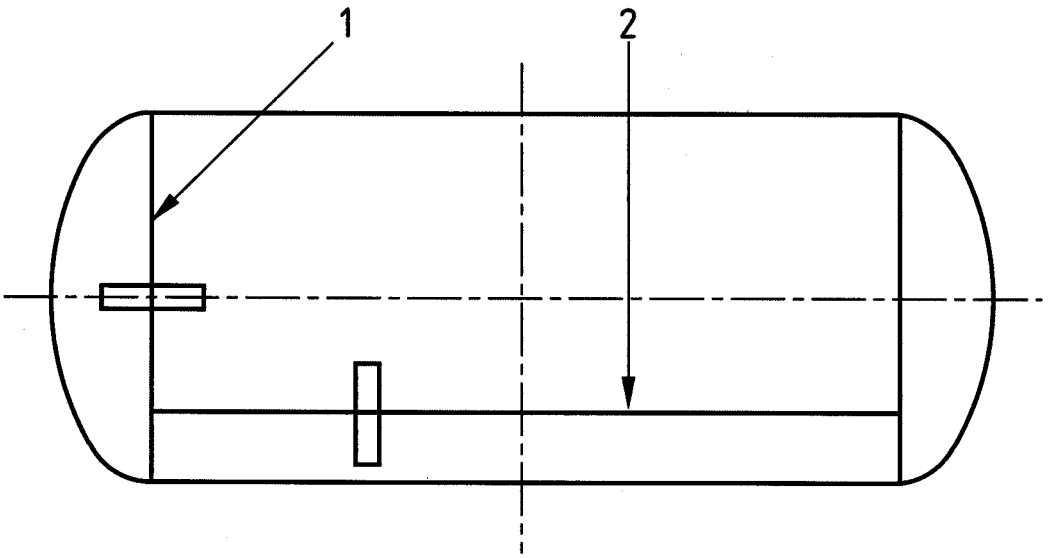
14.4.3.4 For the parent material samples, the transverse impact test pieces shall be taken from the wall of the drum. The notch shall be perpendicular to the face of the wall. The test pieces shall be machined on four faces only, with the inner and outer face of the drum wall un-machined. For outside diameters equal to or less than 140 mm, longitudinal impact tests may be performed instead of transverse tests.

14.4.3.5 For the welds, impact test pieces transverse to the weld shall be taken. The notch shall be in the centre of the weld and shall be perpendicular to the face of the drum. The test pieces shall be machined on all six faces. If the wall thickness does not permit a final test piece width of 10 mm, the width shall be as near as practicable to the nominal thickness of the wall of the drum.

The average of three specimens shall meet the value specified in Table 3. No specimen shall show a value less than 70 % of the average value.

Table 3 — Minimum value for impact test pieces

Tensile strength	≤ 750 MPa		> 750 MPa	
Material	**Parent**	**Weld**	**Parent**	**Weld**
Impact energy, (J/cm^2) for Do > 140 mm. Transverse test	20	20	35	35
Impact energy (J/cm^2) for Do ≤ 140 mm. Longitudinal test	16	16	28	28



Key

1 Circumferential weld

2 Longitudinal weld

Figure 7 — Location of test specimens for Charpy V-notch test

14.4.4 Macro examination

The macrocospic examination shall show complete fusion and shall be free of any assembly faults or unacceptable defects as defined in annex A.

14.5 Non-destructive examination of completed welds

14.5.1 General

Following a full external visual examination all welded seams shall be examined by radiography/radioscopy or other method if the method is proved to be as sensitive as radiography.

14.5.2 Radiography/radioscopy

Radiographs shall be taken of the entire length of each weld seam, together with the seams in the corresponding test plates. Sufficient overlap shall be ensured to cover the whole of the welded seam. The welds shall be radiographed in accordance with the general principles for X-ray radiography as specified in EN 1435.

The image quality shall be in accordance with Class B of EN 462-3. Images shall be retained.

14.5.3 Acceptance criteria

Acceptance criteria shall be as specified to level C in EN ISO 5817 or level 2 in EN 12517.

14.6 Lifting points

Where lifting points are fitted, the design shall be proved by a test in which a sample lifting point is tested to 2 times the maximum gross weight without failure. In production each lifting point shall be subjected to a lift test at the maximum gross weight. These tests may be carried out by attaching external weights to the drum.

Lifting eyes shall be tested for crack defects on 10% of a batch in accordance with EN 1290 and EN 1291. If a defect is detected, then the whole of the batch shall be tested.

Structural welded joints shall be tested for defects, on 10% of a batch. If a defect is detected, then the whole of the batch shall be tested.

It is not necessary to carry out lifting tests on drums which are to be lifted via fork lift pockets.

14.7 Re-tests

If any test fails to meet the requirements, two re-tests of the same type as that which failed shall be taken from the same test plate and both of these shall conform to the requirements. If one or both of these re-tests fail to conform, the drums represented by these tests shall be rejected.

14.8 Pressure test

14.8.1 Proof pressure test

Each drum shall be subjected to a hydraulic proof pressure test (unless a pneumatic test in accordance with **14.8.2** is used) at the test pressure after all welding operations and heat treatment of the drum have been completed, but before any lining or internal or external coating processes.

The joint rings used on all pads, bosses and other attachments for the test shall be of the same material and to the same dimensions as specified for the operating duty.

During the test the outside of the drum shall be dry, and it shall be possible (with good access and illumination) to examine the welded seams. There shall be no leakage and no visible permanent deformation.

If bolted connections leak they shall be dis-assembled, the cause identified and corrected and the drum re-tested. It is not permissible to apply excess torque to cure a leak.

14.8.2 Pneumatic test

Alternatively, provided adequate safety precautions are taken, the hydraulic pressure test may be carried out using a gaseous medium. Measures shall be taken to ensure safe operation and to contain any release of stored energy, which is considerably more than that in the hydraulic test. The pressure source shall be isolated and vented; the settled test pressure shall not decline by more than 1,0 % in 10 min.

The pressure shall then be reduced to 6 bar, and all seams and joints examined for leaks by an appropriate detection method, e.g. soap solution testing.

14.9 Leak tightness test

Each drum shall be subjected to a leak test at a minimum pressure of 6 bar (using e.g. dry air or nitrogen) when fitted as for use with studs, nuts, joints and valves. The joints shall be tested for leaks with soap solution, or by a method of equal sensitivity.

14.10 Final checks

14.10.1 Volume

The minimum volume (water capacity) of the drum shall be guaranteed by the manufacturer. This can be done, for example, by weighing empty and full of water or other liquid.

14.10.2 Tare weight

Each drum shall be weighed to an accuracy of 1 %, and the value inscribed on the name plate. The tare weight shall include all non-removable fittings and internal and external coatings, consistent with normal filling procedures.

14.10.3 Visual inspection

Each drum shall have a final internal and external examination. If a drum fails to meet the specification, it shall be rectified or rejected.

15 New design tests

15.1 General

New design tests are not required for drums which meet the limitations on shape and thickness based on the design calculation of **5.2.3**. Drums with ends convex to pressure shall have their design proved by carrying out a pressure cycling test and a burst test.

15.2 Pressure cycling test

A finished drum representative of the design shall be subjected to 12 000 cycles, the upper pressure being the test pressure p_h, the lower pressure not exceeding 10 % of p_h. The design shall pass if there is no leakage of pressure at the end of the test.

15.3 Hydraulic burst test

A drum representative of the design including the nameplate (which may be the drum used for the pressure cycling test) shall be subjected to a burst test. The pressure shall be raised at a rate not exceeding 5 bar/min. The design shall pass if reversal of an end, or other plastic deformation does not occur at a pressure less than 20 % above p_h. The final burst shall be without fragmentation.

The minimum burst pressure shall be:

— 2,25 p_h for $p_h \leq 60$ bar;

— 2,0 p_h for p_h > 60 bar and ≤ 120 bar;
— 1,6 p_h for p_h > 120 bar.

16 Information to be marked

16.1 Marking

Drums shall be marked clearly and legibly with certification and gas or pressure receptacle specific marks. These marks shall be permanently affixed (e.g. stamped, engraved, or etched) on the drum.

a) The following certification marks shall be applied:

— The number of this technical standard i.e. EN 14208;

— The character(s) identifying the country of approval as indicated by the distinguishing signs of motor vehicles in international traffic;

— The identity mark or stamp of the inspection body that is registered with the competent authority of the country authorizing the marking;

— The date of the initial inspection, the year (four digits) followed by the month (two digits) separated by a slash (i.e. "/").

b) The following operational marks shall be applied:

— The test pressure in bar, preceded by the letters "PH" and followed by the letters "BAR";

— The tare weight (empty mass) of the drum, including all permanently attached integral parts in kg, followed by the letters "KG". With the exception of pressure receptacles of UN No. 1965 hydrocarbon gas mixture, liquefied, n.o.s., this weight shall not include the mass of valve, valve cap or valve guard, or any coating. The tare weight shall be expressed to three significant figures rounded up to the last digit;

— The minimum guaranteed wall thickness of the drum in millimetres followed by the letters "MM". This mark is not required for pressure receptacles of UN No. 1965 hydrocarbon gas mixture, liquefied, n.o.s.;

— In the case of liquefied gases, the water capacity in litres expressed to three significant digits rounded down to the last digit, followed by the letter "L". If the value of the minimum or nominal water capacity is an integer, the digits after the decimal point may be neglected;

c) The following manufacturing marks shall be applied:

— Identification of the thread for any valves (e.g. 25E). This mark is not required for drums for UN No. 1965 hydrocarbon gas mixture, liquefied, n.o.s.;

— The manufacturer's mark registered by the competent authority. When the country of manufacture is not the same as the country of approval, then the manufacturer's mark shall be preceded by the character(s) identifying the country of manufacture as indicated by the distinguishing signs of motor vehicles in international traffic. The country mark and the manufacturer's mark shall be separated by a space or slash;

— The serial number assigned by the manufacturer;

— In the case of drums intended for the carriage of gases with a risk of hydrogen embrittlement, the letter "H" showing compatibility of the steel (see EN ISO 11114-1).

d) The above marks shall be placed in three groups.

— Manufacturing marks shall be the top grouping and shall appear consecutively in the sequence given above.

— The middle grouping shall include the test pressure which shall be immediately preceded by the working pressure when the latter is required.

— Certification marks shall be the bottom grouping and shall appear in the sequence given above.

— Other marks are allowed in areas other than the side wall, provided they are made in low stress areas and are not of a size and depth that will create harmful stress concentrations. Such marks shall not conflict with required marks.

— In addition to the preceding marks, each drum shall be marked indicating the date (year (two digits) followed by the month (two digits) separated by a slash (i.e."/")) of the last periodic inspection and the registered mark of the inspection body authorized by the competent authority of the country of use.

The permanent marking of the following information is optional:

— gases for which the drum is suitable, and in the case of liquefied gases, the filling weight.

16.2 Position and size of marking

The obligatory markings shall be made on a plate either welded to the head of the drum, or on a plate securely fixed to a shroud, support or other part that is a permanent part of the drum. The plate shall have space to mark re-test dates. It shall be positioned so that it is accessible for re-stamping, but is not damaged under normal handling.

For the optional marking, it could be achieved marking on a separate plate.

The serial number shall be in characters at least 10 mm high, other markings at least 5 mm high.

17 Records

For each batch of drums a record of the results of the tests specified in clause **14** and **15** shall be made. Satisfactory batch tests may be recorded on a batch test certificate, a typical example of which is given in annex B.

Annex A
(normative)
Description, evaluation of manufacturing defects and conditions for rejection of welded steel pressure drums at time of visual inspection

A.1 Introduction

Several types of defects can occur during the manufacturing of a welded steel drum. Such defects can be mechanical or material. They can be due to the basic material used, the manufacturing process, heat treatments, marking operations and other occurrences during manufacture.

The aim of this annex is to identify the manufacturing defects most commonly met and to provide rejection criteria to the inspectors who shall perform the visual inspection. Nevertheless extensive field experience and good judgement are necessary by the inspector to detect and to be able to evaluate and judge a defect at the time of the visual inspection (see EN ISO 5817).

A.2 General

A.2.1 Visual examination shall be carried out in accordance with EN 970. It is essential to perform the visual internal and external inspection in good conditions. Appropriate sources of illumination with sufficient intensity shall be used e.g. 50 lux.

The surface of the metal and particularly of the inner wall shall be clean, dry and free from oxidation products, corrosion and scale since these could obscure more serious defects. Where necessary, the surface shall be cleaned under closely controlled conditions by suitable methods before further inspection.

When this visual inspection is carried out after the circumferential welding, the internal neck area shall be examined by means of an introscope, dental mirror or other suitable appliance.

A.2.2 Defects may be repaired in accordance with Table A.1. It shall be ensured that any repair method used will not impair the safety of the drums. Great care shall be taken to avoid introducing new defects. After such repair the drum shall be re-examined, and, if necessary, the wall thickness shall be rechecked.

A.3 Manufacturing defects

The most commonly found manufacturing defects and their definitions are listed in Table A.1. Rejection limits for repair or reject are included in this table. These rejection limits have been established following considerable field experience. They apply to all sizes and types of drums and service conditions. Nevertheless some customer specifications, some types of drum or some special service conditions may require more stringent criteria. Rejection limits for repair or reject of weld defects shall be in accordance with EN ISO 5817 level C.

A.4 Rejected drums

All rejected drums shall be rendered unserviceable.

Table A.1 — Manufacturing defects in welded steel pressure drums and rejection criteria

Defect	Description	Conditions and/or actions	Repair or scrap
Bulge	Visible swelling of the drum	All drums with such a defect	Scrap
Dent	A depression in the drum that has neither penetrated nor removed metal (see Figure A.1) and is greater in depth than 1 % of the outside diameter of the drum	- When the depth of the dent exceeds 3 % of the external diameter of the drum - When the diameter of the dent is less than 15 times its depth	Repair if possible followed by heat treatment of the drum, or scrap Repair if possible followed by heat treatment of the drum, or scrap
Cut or gouge	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 when the length exceeds 25 % of the outside diameter of the drum.	Repair if possible by grinding (see Note 1), or scrap.
Lamination	Layering of the material within the drum wall and sometimes appearing as a discontinuity or crack (see Figure A.2)	- Inside defect: all drums with such defect - Outside defect: all drums with such defect	Repair if possible by grinding (see Note 1), or scrap Repair if possible. by grinding (see Note 1), or scrap
Crack	A split or rift in the metal	- All drums with such defects	Scrap
Internal valve boss threads damaged	Threads damaged, with dents, cuts, burrs or out of tolerance	- When the design permits it, threads may be re-tapped and re-checked by the appropriate thread gauge and carefully visually re-examined. The appropriate number of effective threads shall be achieved. - If not repairable	Repair Scrap

Table A.1 — Manufacturing defects in welded steel pressure drums and rejection criteria (cont.)

Defect	Description	Conditions and/or actions	Repair or scrap
Non conformity with design drawing	Non-conformity with design drawing (e.g. form and dimensions, out of straightness, stability, lack of thickness)	All drums presenting such a defect	Repair if possible or scrap
Illegible, modified or incorrect stamping	Marking by means of a metal punch	All drums presenting such a defect	Repair if possible or scrap
Note 1. After any repair by grinding, it shall be checked that the remaining wall thickness is above the guaranteed minimum wall thickness. Note 2. The manufacturer shall ensure that the axial load required to remove a valve boss is greater than 10 times the weight of the empty drum and not less than 1 000 N, also that the minimum torque required to turn the valve-ring is greater than 100 Nm.			

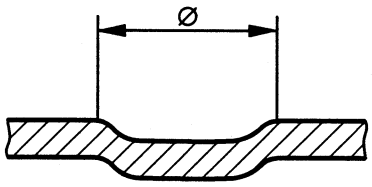


Figure A.1 — Dent

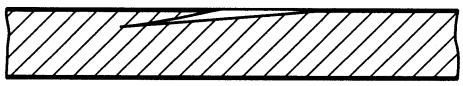


Figure A.2 — Lamination

Annex B
(informative)

Examples of design test and batch test certificates

B.1 Design test certificate

Issued by ....on behalf of

....

applying EN 14208 ....

concerning WELDED PRESSURE DRUMS

Certificate No. .... Date ....

Type of drum ....

(*Description of the family of drums to which the certificate applies)*

p_h ....D_0......………….......a_1 ....……………….b_1.....………………

Manufacturer or agent ....

(*Name and address of manufacturer or its agent*)

....

....

....

Details of the results of design testing of the drum

and the main features of the design are annexed.

All information may be obtained from ....

(Name and address of the certificate issuer)

....

....

Date ....   Place ....

....*(Signature)*

B.2 Comments for use with design test certificate

a) Results of design testing with drum design details should be attached.

b) Main features of the drum design should be shown, in particular:

— longitudinal cross-section of the drum which has been design tested, showing:

  — the maximum external diameter, D_o with an indication of the design tolerances laid down by the manufacturer;

  — the guaranteed minimum thickness of the drum wall (a_1);

  — the calculated minimum thickness of the dished end (b_1) with an indication of the design tolerances laid down by the manufacturer.

  — the water capacity or capacities;

  — the hydraulic test pressure, p_h;

  — the name of the manufacturer/No. of the drawing and date;

  — the name of the drum design;

  — the material in accordance with clause 4 (nature/chemical composition/method of manufacturer/heat treatment/guaranteed mechanical characteristics (tensile strength - yield stress)).

B.3 Batch test certificate

Application of EN 14208 .....

Issuer.....

.....

Date .....

Design certificate No. .....

Description of drum ....

Manufacturing serial No. ..... to .....

Manufacturer .....

(*Name and address*)

.....

Country.....Mark .....

Owner .....

(*Name and address*)

.....

.....

Customer .....

(*Name and address*)

.....

.....

Table B.1 — Batch tests - Measurements of sample drums

Test No.	Batch covering Nos..... to Nos.....	Water capacity l	Mass (empty) kg	Minimum measured thickness	
				of the wall mm	of the dished ends mm

Table B.2 —Chemical composition

Table B.3 — Mechanical tests carried out on sample drums

Test No.	Heat treat-ment No.	Tensile test				Bend test	Hydraulic burst test bar	
		Test piece in accordance with EN 10 002-1	Yield point R_{ea} MPa	Tensile strength R_m MPa				
Minimum values specified								

I, the undersigned hereby declare that I have checked that requirements of clauses 14 and 15 of EN 14208 have been carried out successfully.

Special remarks .....

.....

General remarks .....

.....

Certified on (date) .....Place.....

……..

(*Signature of Issuer*)

On behalf of .....

Annex C
(informative)

Guidance on the application of conformity assessment modules when using this standard

Table C.1 has been drawn up for use when assessing conformity of the product in accordance with the RID/ADR clause 6.2.1.4.4 (b) and the Council Directive 99/36/EC concerning transportable pressure equipment. It shows how some of the requirements listed in the modules are met by the standard. The table is compiled on the basis that all requirements of EN 14208 are satisfied, so that all parts of the standard are available for reference in support of the modules. There is a strict link between the tests and examinations listed in the standard and those required by the modules, i.e. the tests and examinations are sufficient for ensuring conformity of the transportable gas drums. Where a link is made between documentation and the standard, the standard cannot fulfil the requirement completely, but provides some or most of the information required.

The full text of the modules is given in Annex IV, Part I of the Council Directive 99/35/EC which can be found in the Official Journal of the European Communities, No. L 138 of 1999-06-01. Additionally, the Directive requires the application of particular, specified modules, either singly or in combination, according to categories of transportable pressure equipment, as prescribed in Annex V.

Conformity with this standard requires all tests and verifications to be carried out. The table is designed to enable those tests and verifications to be linked to the relevant requirement in each module or combination of modules as foreseen in the Directive 99/36/EC.

Table C.1 — Detailed application of EN 14208 to the directive conformity assessment modules

Module	Clause of Module	Requirement	Clause(s) of this Standard
A (as included in A1)	3	General description	1
	3	Conceptual design	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	3	Description of solutions adopted	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	3	Results of design calculations Results of examinations carried out	5 10, 14, 15, 17
	3	Test reports	17, Annex B
A1		Final assessment by manufacturer	14
		Final assessment during unexpected visits of notified body	Selected from 14, 15
B	3	General description	1
	3	Conceptual design	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	3	Description of solutions adopted	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16

(Cont.)

Table C.1 — Detailed application of EN 14208 to the directive conformity assessment modules *(continued)*

Module	Clause of Module	Requirement	Clause(s) of this Standard
	3	Results of design calculations Results of examinations carried out	5 10, 14, 15, 17
	3	Test reports	17
	3	Information concerning tests	14, 15
	4.1	Technical documentation with respect to design and manufacturing	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	4.1	Materials	4
	4.2	Solutions meet the requirements of the Directive	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16 Check that standard is listed in RID/ADR
	4.3	Examinations and tests	10, 14, 15
	5	Issue an EC type-examination certificate	B.1
B1	3	General description	1
		Conceptual design Manufacturing drawings	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
		Description of solutions adopted	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
		Supporting evidence, results of test	10, 14, 15, 17
		Results of design calculations	5
	4.1	Technical documentation	This EN
	4.2	Solutions meet the requirements of the Directive	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16; Check that standard is listed in RID/ADR
	4.3	Establish that the provisions of the Directive have been applied	Conformity to 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, tests of 14, 15 passed
	5	Issue an EC design-examination certificate	B.1, omitting the design tests and results
C1	1	EC type examination certificate	B.1, omitting the design tests and results
	2	Ensuring product complies to type	10, 14
	4	Final assessment	10, 14

Table C.1 — Detailed application of EN 14208 to the directive conformity assessment modules *(continued)*

Module	Clause of Module	Requirement	Clause(s) of this Standard
D	1	EC type or design examination certificate	B.1
	3.1	Technical documentation EC type or design examination certificate	This EN B.1
	3.2	Examinations and tests	10, 14
	3.2	Inspection reports and test data	17
	4.2	Inspection reports and test data	17
	4.4	Test during visits	Selected from 14
D1	2	General description	1
	2	Conceptual design and manufacturing drawings	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	2	Description of solutions adopted	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	2	Results of design calculations Examinations carried out, etc. Results of examinations	5 10, 14, 15 17, annex B
	2	Test reports	17, Annex B
	4.2	Examinations and tests	14, 15
	4.2	Inspection reports and test data	17, annex B
	5.2	Inspection reports and test data	17, annex B
	5.4	Tests during visits	Selected from 14, 15
E	1	EC type examination certificate	Annex B.1
	3.1	Technical documentation EC type examination certificate	This EN B.1
	3.2	Examinations and tests	10, 14
	3.2	Inspection reports and test data	17, annex B
	4.2	Technical documentation	This EN
	4.2	Inspection reports and test data	17, annex B
	4.4	Test during visits	Selected from 14

Table C.1 — Detailed application of EN 14208 to the directive conformity assessment modules *(continued)*

Module	Clause of Module	Requirement	Clause(s) of this Standard
E1	2	General description	1
	2	Conceptual design and manufacturing drawings	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	2	Description of solutions adopted	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16
	2	Results of design calculations Results of examinations carried out	5 10, 14, 15, 17
	2	Test reports	17, annex B
	4.2	Examinations and tests	14, 15
	4.2	Inspection reports and test data	14, 15, 17, B.1, B.3
	5.2	Technical documentation	This EN
	5.2	Inspection reports and test data	14, 15, 17, B.1, B.3
	5.4	Test during visits	Selected from 14, 15
F	1	EC type/design examination certificates	B.1
	2	EC type/design examination certificates	B.1
	3	Appropriate examinations and tests	14
	4.1	Final inspections and proof tests	14
	4.2, 4.3	Certificate of conformity	17, B.3
G	2	Technical documentation	This EN
	3	General description	1
	3	Conceptual design	4, 5, 6, 7, 8, 9, 10, 11, 12, 13
	3	Description of solutions adopted	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15
	4	Examine design and construction	4, 5, 6, 7, 8, 9, 10, 11, 12, 13
	4 4.2	Appropriate tests Examine technical documentation	14, 15 This EN
	4.2	Assess materials used	4
	4.2	Final Inspection	14
	4.2	Proof tests	14

Table C.1 — Detailed application of EN 14208 to the directive conformity assessment modules *(continued)*

Module	Clause of Module	Requirement	Clause(s) of this Standard
H	3.1	Information on transportable pressure equipment	1
	3.2	Technical design specifications including standards	This EN
	3.2	Examinations and test to be carried out before, during and after manufacture	14, 15
	3.2	Inspection reports and test data	17, annex B
	4.2	Results of analyses, calculations, Results of tests	5 10, 14, 15, 17
	4.2	Quality records in manufacturing, inspection reports and test data	17, annex B
	4.4	Tests during visits	Selected from 14, 15
H1	1(b)	Technical design specifications	This EN
	1(b)	Necessary supporting evidence for adequacy of technical specifications	4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 17; check that standard is listed in RID/ADR
	1(b)	Results of tests	10, 14, 15, 17
	1(c)	Design meets the requirements of the Directive	Conformity with 4, 5, 6 7, 8, 9, 10, 11, 12, 13
	2	Tests during visits	Selected from 14, 15

Bibliography

[1] EN 444, Non-destructive testing — General principles for radiographic examination of metallic materials by X and gamma-rays

[2] EN 629-2, Transportable gas cylinders — 25E taper thread for connection of valves to gas cylinders — Part 2: Gauge inspection

[3] EN 875, Destructive tests on welds in metallic materials - Impact tests - Test specimen location, notch orientation and examination

[4] EN 1290, Non-destructive examination of welds — Magnetic particle examination of welds

[5] EN 1712, Non destructive examination of welds - Ultrasonic examination of welded joints - Acceptance levels

[6] EN 1713, Non-destructive examination of welds - Ultrasonic examination - Characterization of indications in welds

[7] EN 10002-1, Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature

[8] EN 10002-2, Metallic materials — Tensile testing — Part 2: Verification of the force measuring system of the tensile testing machines

[9] EN 10045-2, Metallic materials — Charpy impact test — Part 2: Verification of the testing machine (pendulum impact)

[10] EN 10120, Steel sheet and strip for welded gas cylinders

[11] EN 10246, Non-destructive testing of steel tubes — Magnetic particle inspection of seamless and welded ferromagnetic steel tubes for the detection of surface imperfections

[12] EN ISO 11116-2, Gas cylinders — 17E taper thread for connection of valves to gas cylinders — Part 2: Inspection gauges (ISO 11116-2:1999)

[13] EN ISO 13920, Welding — General tolerances for welded constructions — Dimensions for lengths and angles — Shape and position (ISO 13920:1996)

[14] ISO 3879, Welded joints — Recommended practice for liquid penetrant testing

[15] 99/36/EC, Council Directive 1999/36/EC of 29 April 1999 on transportable pressure equipment

[16] RID, Regulations concerning the International Carriage of Dangerous Goods

[17] ADR, European agreement on the International Carriage of Dangerous Goods by Road

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