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COUNCIL DIRECTIVE
of 25 June 1987
on the harmonization of the laws of the Member States relating to simple pressure vessels
(87/404/EEC)
(OJ L 220, 8.8.1987, p. 48)

Amended by:

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| ► <u>M1</u> Council Directive 90/488/EEC of 17 September 1990 | L 270 | 25 | 2.10.1990 |
| ► <u>M2</u> Council Directive 93/68/EEC of 22 July 1993 | L 220 | 1 | 30.8.1993 |

▼B**COUNCIL DIRECTIVE****of 25 June 1987****on the harmonization of the laws of the Member States relating to simple pressure vessels**

(87/404/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the proposal from the Commission⁽¹⁾,

Having regard to the opinion of the European Parliament⁽²⁾,

Having regard to the opinion of the Economic and Social Committee⁽³⁾,

Whereas Member States have the responsibility of ensuring the safety on their territory of persons, domestic animals and property with regard to the hazards resulting from the leakage or bursting of simple pressure vessels;

Whereas, in each Member State, mandatory provisions define in particular the safety level required of simple pressure vessels by specifying design and operating characteristics, conditions of installation and use and inspection procedures before and after placing on the market; whereas these mandatory provisions do not necessarily lead to different safety levels from one Member State to another but do, by their disparity, hinder trade within the Community;

Whereas the national provisions ensuring such safety must be harmonized in order to guarantee the free movement of simple pressure vessels without lowering existing and justified levels of protection in the Member States;

Whereas Community legislation as it stands at present provides that, notwithstanding one of the fundamental rules of the Community, namely the free movement of goods, barriers to intra-Community movement resulting from disparities in national laws on the marketing of products have to be accepted in so far as those provisions may be recognized as necessary to satisfy essential requirements; whereas the harmonization of laws in the present case must therefore be confined to those provisions needed to satisfy the essential safety requirements for simple pressure vessels; whereas, because they are essential, these requirements must replace the corresponding national provisions;

Whereas this Directive therefore contains only mandatory and essential requirements; whereas, to facilitate proof of conformity with the essential requirements, it is necessary to have harmonized standards at European level in particular as to the design, operation and installation of simple pressure vessels so that products complying with them may be assumed to conform to the safety requirements; whereas these standards harmonized at European level are drawn up by private bodies and must remain non-mandatory texts; whereas for that purpose the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) are recognized as the competent bodies for the adoption of harmonized standards in accordance with the general guidelines for cooperation between the Commission and those two bodies signed on 13 November 1984; whereas, for the purposes of this Directive, a harmonized standard is a technical specification (European standard or harmonization document) adopted by one or both of those bodies upon a remit from the Commission in accordance with the provisions of Council Directive 83/189/EEC of 28 March 1983 laying down a procedure for the provision of

⁽¹⁾ OJ No C 89, 15. 4. 1986, p. 2.

⁽²⁾ OJ No C 190, 20. 7. 1987.

⁽³⁾ OJ No C 328, 22. 12. 1986, p. 20.

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information in the field of technical standards and regulations⁽¹⁾ and the abovementioned general guidelines;

Whereas a check on compliance with the relevant technical requirements is necessary to provide effective protection for users and third parties; whereas the existing inspection procedures differ from one Member State to another; whereas, in order to avoid multiple inspections, which are in effect barriers to the free movement of vessels, arrangements should be made for the mutual recognition of inspection procedures by the Member States; whereas, in order to facilitate the mutual recognition of inspection procedures, harmonized Community procedures should be set up and the criteria for appointing the bodies responsible for carrying out tests, surveillance and verification should be harmonized;

Whereas the presence on a simple pressure vessel of the ►**M2** CE marking ◀ indicates that it satisfies the provisions of this Directive and therefore makes it unnecessary, on import and placing into service of the vessel, to repeat the inspections already carried out; whereas nevertheless simple pressure vessels might represent a safety hazard; whereas provision should therefore be made for a procedure to reduce this hazard,

HAS ADOPTED THIS DIRECTIVE:

CHAPTER I

Scope, placing on the market and free movement*Article 1*

1. This Directive applies to simple pressure vessels manufactured in series.

2. For the purposes of this Directive, 'simple pressure vessel' means any welded vessel subjected to an internal gauge pressure greater than 0,5 bar which is intended to contain air or nitrogen and which is not intended to be fired.

Moreover,

- the parts and assemblies contributing to the strength of the vessel under pressure shall be made either of non-alloy quality steel or of non-alloy aluminium or non-age hardening aluminium alloys,
- the vessel shall be made of:
 - either a cylindrical part of circular cross-section closed by outwardly dished and/or flat ends which revolve around the same axis as the cylindrical part,
 - or two dished ends revolving around the same axis,
- the maximum working pressure of the vessel shall not exceed 30 bar and the product of that pressure and the capacity of the vessel (PS.V) shall not exceed 10 000 bar/litre,
- the minimum working temperature must be no lower than - 50 °C and the maximum working temperature shall not be higher than 300 °C for steel and 100 °C for aluminium or aluminium alloy vessels.

3. The following vessels shall be excluded from the scope of the Directive:

- vessels specifically designed for nuclear use, failure of which may cause an emission of radioactivity,
- vessels specifically intended for installation in or the propulsion of ships and aircraft,
- fire extinguishers.

⁽¹⁾ OJ No L 109, 26. 4. 1983, p. 8.

▼ **B***Article 2*

1. Member States shall take all necessary steps to ensure that the vessels referred to in Article 1, hereinafter referred to as 'vessels', may be placed on the market and taken into service only if they do not compromise the safety of persons, domestic animals or property when properly installed and maintained and when used for the purposes for which they are intended.

2. The provisions of this Directive do not affect the right of Member States to specify — with due observance of the Treaty — the requirements they deem necessary to ensure that workers are protected when using vessels, provided it does not mean the vessels are modified in a way unspecified in this Directive.

Article 3

1. Vessels in respect of which the product of PS and V exceeds 50 bar/litre must satisfy the essential safety requirements set out in Annex I.

2. Vessels in respect of which the product of PS and V is 50 bar/litre or less must be manufactured in accordance with sound engineering practice in one of the Member States and bear markings as laid down in section 1 of Annex II, with the exception of the ► **M2** CE marking ◀ referred to in Article 16.

Article 4

Member States shall not impede the placing on the market and the taking into service in their territory of vessels which satisfy the requirements of this Directive.

Article 5▼ **M2**

1. Member States shall presume that vessels bearing the CE marking comply with all the provisions of this Directive, including the conformity assessment procedures referred to in Chapter II.

Conformity of vessels with the national standards which transpose the harmonized standards the reference numbers of which have been published in the *Official Journal of the European Communities* shall result in a presumption of conformity to the essential safety requirements referred to in Article 3. Member States shall publish the reference numbers of such national standards.

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2. Member States shall presume that vessels in respect of which the manufacturer has not applied, or has applied only in part, the standards referred to in paragraph 1, or for which no such standards exist, comply with the essential requirements referred to in Article 3 where, after receipt of an EEC type-examination certificate, their conformity with the approved model has been certified by the affixation of the ► **M2** CE marking ◀.

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3. (a) Where the vessels are subject to other Directives covering other aspects and which also provide for the affixing of the CE marking, the latter shall indicate that the vessels in question are also presumed to conform to the provisions of those other Directives.

(b) However, where one or more of those Directives allow the manufacturer, during a transitional period, to choose which arrangements to apply, the CE marking shall indicate conformity only to the Directives applied by the manufacturer. In this case, particulars of the Directives applied, as published in the *Official Journal of the European Communities*, must be given in the documents, notices or instructions required by the Directives and accompanying such vessels.

▼B*Article 6*

1. Where a Member State or the Commission considers that the harmonized standards referred to in Article 5 (1) do not entirely meet the essential requirements referred to in Article 3, the Commission or the Member State concerned shall bring the matter before the Standing Committee set up under Directive 83/189/EEC, hereinafter referred to as 'the committee', giving the reasons therefor. The committee shall deliver an opinion without delay. In the light of the committee's opinion, the Commission shall inform the Member States whether or not it is necessary to withdraw those standards from the publications referred to in Article 5 (1).

Article 7

1. Where a Member State finds that vessels bearing the ►**M2** CE marking ◀ and used in accordance with their intended purpose might compromise the safety of persons, domestic animals or property, it shall take all appropriate measures to withdraw those products from the market or to prohibit or restrict their being placed on the market.

The Member State concerned shall immediately inform the Commission of any such measure, indicating the reasons for its decision, and in particular whether non-conformity is due to:

- (a) failure to meet the essential requirements referred to in Article 3, where the vessel does not meet the standards referred to in Article 5 (1);
- (b) incorrect application of the standards referred to in Article 5 (1);
- (c) shortcomings in the standards referred to in Article 5 (1) themselves.

2. The Commission shall enter into consultation with the parties concerned as soon as possible. Where, after such consultation, the Commission finds that any measure as referred to in paragraph 1 is justified, it shall immediately so inform the Member State that took the action and the other Member States. Where the decision referred to in paragraph 1 is attributed to shortcomings in the standards, the Commission, after consulting the parties concerned, shall bring the matter before the Committee within two months if the Member State which has taken the measures intends to maintain them and shall initiate the procedures referred to in Article 6.

3. Where a vessel which does not comply bears the ►**M2** CE marking ◀, the competent Member State shall take appropriate action against whomsoever has affixed the ►**M2** marking ◀ and shall inform the Commission and the other Member States thereof.

4. The Commission shall ensure that the Member States are kept informed of the progress and outcome of this procedure.

CHAPTER II

Certification procedures*Article 8*

1. Prior to production of pressure vessels of which the product of PS and V exceeds 50 bar/litre, manufactured:

- (a) in accordance with the standards referred to in Article 5 (1), the manufacturer, or his authorized representative established within the Community, shall at his own choice:
 - either inform an approved inspection body as referred to in Article 9, which after examining the design and manufacturing schedule referred to in Annex II 3, shall draw up a certificate of adequacy attesting that the schedule is satisfactory, or
 - submit a prototype vessel for the EC type-examination referred to in Article 10;
- (b) not, or only partly, in accordance with the standards referred to in Article 5 (1), the manufacturer, or his authorized representative

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established within the Community, must submit a prototype vessel for the EC type-examination referred to in Article 10.

2. Vessels manufactured in accordance with the standards referred to in Article 5 (1) or with the approved prototype shall, prior to their being placed on the market, be subject:

- (a) to the EC verification referred to in Article 11 where the product of PS and V exceeds 3 000 bar/litre;
- (b) at the choice of the manufacturer, where the product of PS and V does not exceed 3 000 bar/litre but exceeds 50 bar/litre:
 - either to the EC declaration of conformity referred to in Article 12, or
 - to the EC verification referred to in Article 11.

3. The records and correspondence relating to the certification procedures referred to in paragraphs 1 and 2 shall be drafted in an official language of the Member State in which the approved body is established or in a language accepted by that body.

*Article 9***▼M2**

1. Member States shall notify the Commission and the other Member States of the approved bodies which they have appointed to carry out the procedures referred to in Article 8 (1) and (2) together with the specific tasks which these bodies have been appointed to carry out and the identification numbers assigned to them beforehand by the Commission.

The Commission shall publish in the *Official Journal of the European Communities* a list of the notified bodies with their identification numbers and the tasks for which they have been notified. The Commission shall ensure that this list is kept up to date.

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2. Annex III sets out the minimum criteria which Member States must meet as regards approval of these bodies.

3. A Member State which has approved a body must withdraw approval if it finds that the body no longer meets the criteria listed in Annex III. It shall immediately inform the Commission and the other Member States accordingly.

EC type-examination*Article 10*

1. EC type-examination is the procedure by which an approved inspection body ascertains and certifies that a prototype vessel satisfies the provisions of this Directive which apply to it.

2. The application for EC type-examination shall be lodged by the manufacturer or by his authorized representative with a single approved inspection body in respect of a prototype vessel or of a prototype representing a family of vessels. That authorized representative must be established in the Community.

The application shall include:

- the name and address of the manufacturer or of his authorized representative and the place of manufacture of the vessels,
- the design and manufacturing schedule referred to in Annex II 3.

It shall be accompanied by a vessel which is representative of the production envisaged.

3. The approved body shall carry out the EC type-examination in the manner described below.

It shall examine not only the design and manufacturing schedule in order to check its conformity, but also the vessel submitted.

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When examining the vessel, the body shall:

- (a) verify that the vessel has been manufactured in conformity with the design and manufacturing schedule and may safely be used under its intended working conditions;
- (b) perform appropriate examinations and tests to check that the vessel complies with the essential requirements applicable to it.

4. If the prototype complies with the provisions applicable to it the body shall draw up an EC type-examination certificate which shall be forwarded to the applicant. That certificate shall state the conclusions of the examination, indicate any conditions to which its issue may be subject and be accompanied by the descriptions and drawings necessary for identification of the approved prototype.

The Commission, the other approved bodies and the other Member States may obtain a copy of the certificate and, on a reasoned request, a copy of the design and manufacturing schedule and the reports on the examinations and tests carried out.

5. A body which refuses to issue an EC type-examination certificate shall so inform the other approved bodies. A body which withdraws an EC type-examination certificate shall so inform the Member State which approved it. The latter shall inform the other Member States and the Commission thereof, giving the reasons for the decision.

▼M2**EC verification***Article 11*

1. EC verification is the procedure whereby a manufacturer or his authorized representative established within the Community ensures and declares that the vessels which have been checked in accordance with paragraph 3 are in conformity to the type described in the EC type-examination certificate or with the design and manufacturing schedule referred to in Annex II section 3 having received a certificate of adequacy.

2. The manufacturer shall take all the necessary measures for the manufacturing process to ensure that the vessels conform to the type described in the EC type-examination certificate or to the design and manufacturing schedule referred to in Annex II section 3. The manufacturer or his authorized representative established within the Community shall affix the CE marking to each vessel and draw up a declaration of conformity.

3. The approved body shall carry out the appropriate examinations and tests in order to check the conformity of the vessels with the requirements of this Directive by examination and testing of vessels in accordance with the following paragraphs:

- 3.1. The manufacturer shall present his vessels in the form of uniform batches and shall take all necessary measures in order that the manufacturing process ensures the uniformity of each batch produced.
- 3.2. These batches shall be accompanied by the EC type-examination certificate referred to in Article 10, or, where the vessels are not manufactured in accordance with an approved prototype, by the design and manufacturing schedule referred to in Annex II section 3. In this case the approved body shall, prior to EC verification, examine the schedule in order to certify its conformity.
- 3.3. When a batch is examined, the inspection body shall ensure that the vessels have been manufactured and checked in accordance with the design and manufacturing schedule and perform a hydrostatic test or a pneumatic test of equivalent effect on each vessel in the batch at a pressure P_h equal to 1,5 times the vessel's design pressure in order to check its soundness. The pneumatic test shall be subject to acceptance of the test safety procedures by the Member State in which the test is performed.

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Moreover, the inspection body shall carry out tests on test-pieces taken from a representative production test-piece or from a vessel, as the manufacturer chooses, in order to examine the weld quality. The tests shall be carried out on longitudinal welds. However, where differing weld techniques are used for longitudinal and circular welds, the tests shall be repeated on the circular welds.

For the vessels referred to in Annex I, section 2.1.2 these tests on test-pieces shall be replaced by a hydrostatic test on five vessels taken at random from each batch in order to check that they conform to the requirements of Annex I, section 2.1.2.

- 3.4. In the case of accepted batches, the approved body shall affix, or cause to be affixed, its identification number to each recipient and draw up a written certificate of conformity relating to the tests carried out. All recipients in the batch may be placed on the market except for those which have not successfully undergone a hydrostatic test or a pneumatic test.

If a batch is rejected, the notified body or the competent authority shall take appropriate measures to prevent the putting on the market of that batch. In the event of frequent rejection of batches, the notified body may suspend the statistical verification.

The manufacturer may, under the responsibility of the notified body, affix the latter's identification number during the manufacturing process.

- 3.5. The manufacturer or his authorized representative must be able to supply on request the approved body's certificates of conformity referred to in subparagraph 3.4.

▼B**EC declaration of conformity***Article 12***▼M2**

1. A manufacturer fulfilling the obligations arising out of Article 13 shall affix the CE marking provided for in Article 16 to vessels which he declares to be in conformity:

- to the design and manufacturing schedule referred to in Annex II section 3, and on which a certificate of adequacy has been drawn up, or
- an approved prototype.

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By this EC declaration of conformity procedure the manufacturer becomes subject to EC surveillance, in cases where the product of PS and V exceeds 200 bar/litre.

2. The purpose of EC surveillance is to ensure, as required by Article 14 (2), that the manufacturer duly fulfils the obligations arising out of Article 13 (2). Surveillance shall be performed by the approved body which issued the EC type-examination certificate referred to in Article 10 where the vessels have been manufactured in accordance with an approved prototype or, if this is not the case, by the approved body to which the design and manufacturing schedule was sent in accordance with Article 8 (1) (a), first indent.

Article 13

1. Where a manufacturer makes use of the procedure referred to in Article 12, he must, before commencing manufacture, send the approved body which issued the EC type-examination certificate or the certificate of adequacy a document describing the manufacturing processes and all of the pre-determined systematic measures taken to ensure conformity of the pressure vessels to the standards referred to in Article 5 (1) or the approved prototype.

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This document shall include:

- (a) a description of the means of manufacture and checking appropriate to the construction of the vessels;
- (b) an inspection document describing the appropriate examinations and tests to be carried out during manufacture, together with the procedures therefor and the frequency with which they are to be performed;
- (c) an undertaking to carry out the examinations and tests in accordance with the inspection document referred to above and to have a hydrostatic test or, subject to the agreement of the Member State, a pneumatic test carried out on each vessel manufactured at a test pressure equal to 1,5 times the design pressure.

These examinations and tests shall be carried out under the responsibility of qualified staff who are sufficiently independent from production personnel, and shall be covered by a report;

- (d) the addresses of the places of manufacture and storage and the date on which manufacture is to commence.

2. In addition, when the product of PS and V exceeds 200 bar/litre, manufacturers shall authorize access to the said places of manufacture and storage by the body responsible for EC surveillance, for inspection purposes, and shall allow that body to select sample vessels and shall provide it with all necessary information, and in particular:

- the design and manufacturing schedule,
- the inspection report,
- the EC type-examination certificate or certificate of adequacy, where appropriate,
- a report on the examinations and tests carried out.

Article 14

1. The approved body which issued the EC type-examination certificate or certificate of adequacy must, before the date on which any manufacture begins, examine both the document referred to in Article 13 (1) and the design and manufacturing schedule referred to in Annex II, section 3, in order to certify their conformity where vessels are not manufactured in accordance with an approved prototype.

2. In addition, where the product of PS and V exceeds 200 bar/litre, that body must during manufacture:

- ensure that the manufacturer actually checks series-produced vessels in accordance with Article 13 (1) (c),
- take random samples at the places of manufacture or at the place of storage of vessels for inspection purposes.

The body shall supply the Member State which approved it, and, on request, the other approved bodies, the other Member States and the Commission, with a copy of the inspection report.

CHAPTER III

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CE marking

Article 15

Without prejudice to Article 7:

- (a) where a Member State establishes that the CE marking has been affixed unduly, the manufacturer or his authorized representative established within the Community shall be obliged to make the product conform as regards the provisions concerning the CE marking and to end the infringement under the conditions imposed by the Member State;
- (b) where non-conformity continues, the Member State must take all appropriate measures to restrict or prohibit the placing on the market of the product in question or to ensure that it is withdrawn

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from the market in accordance with the procedures laid down in Article 7.

▼B*Article 16*

1. The ►M2 CE marking ◀ and the inscriptions provided for in Annex II, section 1, shall be affixed in a visible, easily legible and indelible form to the vessel or to a data plate attached to the vessel in such a way that it cannot be removed.

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The CE conformity marking shall consist of the initials 'CE' in the form shown in the specimen in Annex II. The CE marking shall be followed by the distinguishing number referred to in Article 9 (1) of the approved inspection body responsible for EC verifications or EC surveillance.

2. The affixing of markings on the vessels which are likely to deceive third parties as to the meaning and form of the CE marking shall be prohibited. Any other marking may be affixed to the vessels or the data plate provided that the visibility and legibility of the CE marking is not thereby reduced.

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CHAPTER IV

Final provisions*Article 17*

Any decision taken pursuant to this Directive and resulting in restrictions on the placing on the market and/or taking into service of a vessel shall state the exact grounds on which it is based. Such a decision shall be notified without delay to the party concerned, who shall at the same time be informed of the judicial remedies available to him under the laws in force in the Member State in question and of the time limits to which such remedies are subject.

Article 18

1. Before 1 January 1990, Member States shall adopt and publish the laws, regulations and administrative provisions necessary in order to comply with this Directive. They shall forthwith inform the Commission thereof.

They shall apply such provisions from 1 July 1990.

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Member States shall, for the period up to 1 July 1992, permit the placing on the market and/or in service of vessels conforming to the rules in force in their territories before the date of application of this Directive.

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2. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the field covered by this Directive.

Article 19

This Directive is addressed to the Member States.

▼**B***ANNEX I*

The essential safety requirements for the vessels are set out below:

1. MATERIALS

Materials must be selected according to the intended use of the vessels and in accordance with 1.1 to 1.4.

1.1. Pressurized parts

The materials referred to in Article 1 used for manufacturing the pressurized parts must be:

- capable of being welded,
- ductile and tough, so that a rupture at minimum working temperature does not give rise to either fragmentation or brittle-type fracture,
- not adversely affected by ageing.

For steel vessels, the materials must in addition meet the requirements set out in section 1.1.1 and, for aluminium or aluminium alloy vessels, those set out in section 1.1.2.

They must be accompanied by an inspection slip drawn up by the producer of the materials as described in Annex II.

1.1.1. *Steel vessels*

Non-alloy quality steels meet the following requirements:

- (a) they must be non-effervescent and be supplied after normalization treatment, or in an equivalent state;
- (b) the content per product of carbon must be less than 0,25 % and that of sulphur and phosphorus must each be less than 0,05 %.
- (c) they must have the following mechanical properties per product:
 - the maximum tensile strength $R_{m,max}$ must be less than 580 N/mm²,
 - the elongation after rupture must be:
 - if test pieces are taken parallel to the direction of rolling:

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| thickness \geq 3 mm: | A | \geq 22 %, |
| thickness < 3 mm: | $A_{80\text{ mm}}$ | \geq 17 %, |
 - if test pieces are taken perpendicular to the direction of rolling:

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| thickness \geq 3 mm: | A | \geq 20 %, |
| thickness < 3 mm: | $A_{80\text{ mm}}$ | \geq 15 %, |
 - the average failure energy KCV for three longitudinal test pieces at minimum working temperature must not be less than 35 J/cm². Not more than one of the three figures may be less than 35 J/cm², with a minimum of 25 J/cm².

In the case of steels used in the manufacture of vessels whose minimum working temperature is lower than - 10 °C and whose wall thickness exceeds five mm, this property must be checked.

1.1.2. *Aluminium vessels*

Non-alloy aluminium must have an aluminium content of at least 99,5 % and those alloys described in Article 1 (2) must display adequate resistance to intercrystalline corrosion at maximum working temperature.

Moreover these materials must satisfy the following requirements:

- (a) they must be supplied in an annealed state; and
- (b) must have the following mechanical characteristics per product:
 - the maximum tensile strength $R_{m,max}$ must be no more than 350 N/mm²,
 - the elongation after rupture must be:
 - $A \geq 16$ % if the test piece is taken parallel to the direction of rolling,
 - $A \geq 14$ % if the test piece is taken perpendicular to the direction of rolling,

▼B**1.2. Welding materials**

The welding materials used to manufacture the welds on or of the vessel must be appropriate to and compatible with the materials to be welded.

1.3. Accessories contributing towards the strength of the vessel

These accessories (e. g. bolts and nuts) must be made of a material specified in 1.1 or of other kinds of steel, aluminium or an appropriate aluminium alloy compatible with materials used for the manufacture of pressurized parts.

The latter materials must at minimum working temperature have an appropriate elongation after rupture and toughness.

1.4. Non-pressurized parts

All unpressurized parts of welded vessels must be of materials which are compatible with that of the components to which they are welded.

2. VESSEL DESIGN

The manufacturer must, when designing the vessel, define the use to which it will be put, and select:

- the minimum working temperature T_{\min} ,
- the maximum working temperature T_{\max} ,
- the maximum working pressure PS.

However, should a minimum working temperature exceeding $-10\text{ }^{\circ}\text{C}$ be selected, the qualities required of the materials must be satisfied at $-10\text{ }^{\circ}\text{C}$.

The manufacturer must also take account of the following provisions:

- it must be possible to inspect the inside of vessels,
- it must be possible to drain the vessels,
- the mechanical qualities shall be maintained throughout the period of use of the vessel for the intended purpose,
- the vessels shall, bearing in mind their prescribed use, be adequately protected against corrosion,

and the fact that under the conditions of use envisaged

- the vessels will not be subjected to stresses likely to impair their safety in use,
- internal pressure will not permanently exceed the maximum working pressure PS; however, it may momentarily do so by up to 10 %.

Circular and longitudinal seams must be made using full penetration welds or welds of equivalent effectiveness. Convex ends other than hemispherical ones shall have a cylindrical edge.

2.1. Wall thickness

If the product PS.V is not more than 3 000 bar/litre, the manufacturer must select one of the methods described in 2.1.1 and 2.1.2 for determining vessel wall thickness; if the product of PS and V is more than 3 000 bar/litre, or if the maximum working temperature exceeds $100\text{ }^{\circ}\text{C}$, such thickness must be determined by the method described in 2.1.1.

The actual wall thickness of the cylindrical section and ends shall, however, be not less than 2 mm in the case of steel vessels and not less than 3 mm in the case of aluminium or aluminium alloy vessels.

2.1.1. Calculation method

The minimum thickness of pressurized parts must be calculated having regard to the intensity of the stresses and to the following provisions:

- the calculation pressure to be taken into account must not be less than the maximum working pressure selected,
- the permissible general membrane stress must not exceed the lower of the values $0,6 R_{\text{ET}}$ or $0,3 R_{\text{m}}$. The manufacturer must use the R_{ET} and R_{m} minimum values guaranteed by the material manufacturer in order to determine the permissible stress.

However, where the cylindrical portion of the vessel has one or more longitudinal welds made using a non-automatic welding process, the thickness calculated as above must be multiplied by the coefficient 1,15.

▼B2.1.2. *Experimental method*

Wall thickness must be so determined as to enable the vessels to resist at ambient temperature a pressure equal to at least five times the maximum working pressure, with a permanent circumferential deformation factor of no more than 1 %.

3. MANUFACTURING PROCESSES

Vessels shall be constructed and subjected to production checks in accordance with the design and manufacturing record referred to in Annex II, section 3.

3.1. **Preparation of the component parts**

Preparation of the component parts (e.g. forming and chamfering) must not give rise to surface defects or cracks or changes in the mechanical characteristics likely to be detrimental to the safety of the vessels.

3.2. **Welds on pressurized parts**

The characteristics of welds and adjacent zones must be similar to those of the welded materials and shall be free of any surface or internal defects detrimental to the safety of the vessels.

Welds must be performed by qualified welders or operators possessing the appropriate level of competence, in accordance with approved welding processes. Such approval and qualification tests must be carried out by approved inspection bodies.

The manufacturer must also, during manufacture, ensure consistent weld quality by conducting appropriate tests using adequate procedures. These tests must be the subject of a report.

4. PLACING IN SERVICES OF THE VESSELS

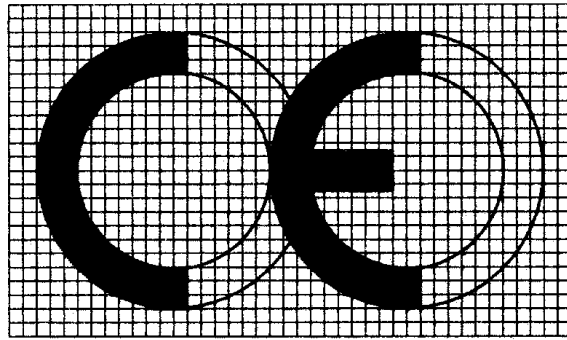
Vessels must be accompanied by the instructions drawn up by the manufacturer, as referred to in Annex II, section 2.

▼B*ANNEX II***▼M2**

1. CE MARKING AND INSCRIPTIONS

1. (a) **CE conformity marking**

- The CE conformity marking shall consist of the initials 'CE' in the following form:



- If the CE marking is reduced or enlarged the proportions given in the above graduated drawing must be respected.
- The various components of the CE marking must have substantially the same vertical dimension, which may not be less than 5 mm.

1. (b) **Inscriptions**

The vessel or data plate must bear at least the following information:

- the maximum working pressure (PS in bar),
- the maximum working temperature (T_{\max} in °C),
- the minimum working temperature (T_{\min} in °C),
- the capacity of the vessel (V in l),
- the name or mark of the manufacturer,
- the type and serial or batch identification of the vessel,
- the last two digits of the year in which the CE marking was affixed.

Where the data plate is used, it must be so designed that it cannot be re-used and must include a vacant space to enable other information to be provided.

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2. INSTRUCTIONS

The instructions must provide the following information:

- the particulars given in 1 above except for the vessel's serial identification,
- the intended use of the vessel,
- the maintenance and installation requirements for vessel safety.

They must be in the official language or languages of the country of destination.

3. DESIGN AND MANUFACTURING SCHEDULES

The design and manufacturing schedules must contain a description of the techniques and operations employed in order to meet the essential requirements referred to in Article 3 or the standards referred to in article 5 (1) and in particular:

- (a) a detailed manufacturing drawing of the vessel type;
- (b) the instructions;
- (c) a document describing:
 - the materials selected,
 - the welding processes selected,
 - the checks selected,

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— any pertinent details as to the vessel design.

When the procedures laid down in Articles 11 to 14 are used, the schedule must also include:

- (i) the certificates relating to the suitable qualification of the welding operations and of the welders or operators;
- (ii) the inspection slip for the materials used in the manufacture of parts and assemblies contributing to the strength of the pressure vessel;
- (iii) a report on the examinations and tests performed or a description of the proposed checks.

4. DEFINITIONS AND SYMBOLS

4.1. Definitions

- (a) The design pressure 'P' is the gauge pressure chosen by the manufacturer and used to determine the thickness of the pressurized parts.
- (b) The maximum working pressure 'PS' is the maximum gauge pressure which may be exerted under normal conditions of use.
- (c) The minimum working temperature T_{\min} is the lowest stabilized temperature in the wall of the vessel under normal conditions of use.
- (d) The maximum working temperature T_{\max} is the highest stabilized temperature which the wall of the vessel may attain under normal conditions of use.
- (e) The yield strength ' R_{ET} ' is the value at the maximum working temperature T_{\max}
 - of the upper yield point R_{eH} , for a material with both a lower and an upper yield point,
 - or of the proof stress $R_{p0,2}$,
 - or of the proof stress $R_{p1,0}$ in the case of non-alloy aluminium.
- (f) Families of vessels:

Vessels form part of the same family if they differ from the prototype only in diameter, provided that the permissible requirements referred to in sections 2.1.1 or 2.1.2 of Annex I are complied with and/or in the length of their cylindrical portion within the following limits:

 - where a prototype has one or more shell rings in addition to the ends, variants in the family must have at least one shell ring,
 - where a prototype has just two dished ends, variants in the family must have no shell rings.

Variations in length causing the apertures and/or penetrations to be modified must be shown in the drawing for each variant.
- (g) A batch of vessels consists at the most of 3 000 vessels of the model of the same type.
- (h) There is series manufacture within the meaning of this Directive if more than one vessel of the same type is manufactured during a given period by a continuous manufacturing process, in accordance with a common design and using the same manufacturing processes.
- (i) Inspection slip: document by which the producer certifies that the products delivered meet the requirements of the order and in which he sets out the results of the routine in-plant inspection test, in particular chemical composition and mechanical characteristics performed on products made by the same production process as the supply, but not necessarily on the products delivered.

4.2. Symbols

| | | |
|------------|--|-------------------|
| A | elongation after rupture ($L_o = 5,65 \sqrt{S_o}$) | % |
| A 80 mm | elongation after rupture ($L_o = 80$ mm) | % |
| KCV | rupture energy | J/cm ² |
| P | design pressure | bar |
| PS | working pressure | bar |
| P_h | hydrostatic or pneumatic test pressure | bar |
| $R_{p0,2}$ | proof stress at 0,2 % | N/mm ² |
| R_{ET} | yield strength at maximum working temperature | N/mm ² |

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| | | |
|-------------|-----------------------------|-------------------|
| R_{eH} | upper yield point | N/mm ² |
| R_m | tensile strength | N/mm ² |
| T_{max} | maximum working temperature | °C |
| T_{min} | minimum working temperature | °C |
| V | capacity of the vessel | L |
| $R_{m,max}$ | maximum tensile strength | N/mm ² |
| $R_{p1,0}$ | proof stress at 1,0 % | N/mm ² |



ANNEX III

MINIMUM CRITERIA TO BE TAKEN INTO ACCOUNT BY MEMBER STATES WHEN APPOINTING INSPECTION BODIES

1. The inspection body, its director and the staff responsible for carrying out the verification tests shall not be the designer, manufacturer, supplier or installer of vessels which they inspect, nor the authorized representative of any of those parties. They shall not become directly involved in the design, construction, marketing or maintenance of the vessels, nor represent the parties engaged in these activities. This does not preclude the possibility of exchanges of technical information between the manufacturer and the inspection body.
2. The inspection body and its staff must carry out the verification tests with the highest degree of professional integrity and technical competence and must be free from all pressures and inducements, particularly financial, which might influence their judgment or the results of the inspection, especially from persons or groups of persons with an interest in the result of verifications.
3. The inspection body must have at its disposal the necessary staff and possess the necessary facilities to enable it to perform properly the administrative and technical tasks connected with verification; it must also have access to the equipment required for special verification.
4. The staff responsible for inspection must have:
 - sound technical and professional training,
 - satisfactory knowledge of the requirements of the tests they carry out and adequate experience of such tests.
 - the ability to draw up the certificates, records and reports required to authenticate the performance of the tests.
5. The impartiality of inspection staff must be guaranteed. Their remuneration must not depend on the number of tests carried out nor on the results of such tests.
6. The inspection body must take out liability insurance unless its liability is assumed by the State in accordance with national law, or the Member State itself is directly responsible for the tests.
7. The staff of the inspection body is bound to observe professional secrecy with regard to all information gained in carrying out its tasks (except *vis-à-vis* the competent administrative authorities of the State in which its activities are carried out) under this Directive or any provision of national law giving effect to it.