# COUNCIL DIRECTIVE

## of 17 September 1984

## on the approximation of the laws of the Member States relating to welded unalloyed steel gas cylinders

(84/527/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 in the Member States the construction and the inspection of gas cylinders are subject to mandatory provisions varying from one Member State to another and consequently hinder trade in such cylinders; whereas it is therefore necessary to approximate these provisions;

Whereas Council Directive 76/767/EEC of 27 July 1976 on the approximation of the laws of the Member States relating to common provisions for pressure vessels and methods of inspecting them (4), lays down in particular the procedures of EEC pattern approval and verification for these vessels; whereas according to this Directive it is advisable to lay down the technical requirements to be complied with by EEC-type welded unalloyed steel gas cylinders with a capacity of 0,5 to 150 litres in order to be put into circulation, commercialized and used without restraint after having undergone inspection and bearing accordingly a mark and a symbol,

HAS ADOPTED THIS DIRECTIVE:

*Article 1*

This Directive shall apply to welded unalloyed steel gas cylinders formed from several pieces, of an actual thickness of 5 mm or less, capable of being refilled several times, with a capacity ranging from 0,5 to 150 litres inclusive and designed to contain and transport compressed, liquefied or dissolved gases except liquefied gases at very low temperatures and acetylene. The design pressure ($P_h$) of these cylinders shall not exceed 60 bars. These gas cylinders are hereinafter referred to as 'cylinders'.

*Article 2*

For the purposes of this Directive, 'EEC-type cylinder' shall mean any cylinder designed and manufactured in such a way that it satisfies the requirements of this Directive and of Directive 76/767/EEC.

*Article 3*

No Member State may, on grounds relating to the construction or inspection of a cylinder within the meaning of Directive 76/767/EEC and this Directive refuse, prohibit or restrict the placing on the market and putting into service of an EEC-type cylinder.

*Article 4*

All EEC-type cylinders shall be subject to EEC pattern approval.

All EEC-type cylinders shall be subject to EEC verification with the exception of cylinders with a capacity of not more than 1 litre.

*Article 5*

Any amendments necessary to adapt sections 1, 2.1.1, 2.3 except for 2.3.3, 2.4 except for 2.4.1 and 2.4.2.1, 3.1.1, 3.1.2, 3.3, 3.4, 3.5, 5 except for 5.2.2 and 5.3, and 6 of Annex I and Annexes II and III to this Directive to technical progress shall be adopted in accordance with the procedure laid down in Article 20 of Directive 76/767/EEC.

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(1) OJ No C 104, 13. 9. 1974, p. 59.
(2) OJ No C 5, 8. 1. 1975, p. 52.
(3) OJ No C 62, 15. 3. 1975, p. 31.
(4) OJ No L 262, 27. 9. 1976, p. 153.

*Article 6*

The procedure laid down in Article 17 of Directive 76/767/EEC may apply to sections 2.2, 2.3.2 and 3.4.1.1 of Annex I to this Directive.

*Article 7*

1. Member States shall bring into force the laws, regulations and administrative provisions needed in order to comply with this Directive within 18 months of its notification (1) and shall forthwith inform the Commission thereof.

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

*Article 8*

This Directive is addressed to the Member States.

Done at Brussels, 17 September 1984.

*For the Council*

*The President*

P. BARRY

(1) This Directive was notified to the Member States on 26 September 1984.

*ANNEX I*

## 1. SYMBOLS AND TERMS USED IN THIS ANNEX

1.1. The symbols used in this Annex have the following meanings:

$P_h$ = hydraulic test pressure (design pressure), in bars;

$P_r$ = cylinder bursting pressure measured during the bursting test, in bars,

$P_{rt}$ = calculated minimum theoretical bursting pressure, in bars;

$R_e$ = minimum value of yield stress guaranteed by the cylinder manufacturer for the finished cylinder, in $N/mm^2$;

$R_m$ = minimum tensile strength guaranteed by the material standard, in $N/mm^2$;

$R_{mt}$ = actual tensile strength, in $N/mm^2$;

a = calculated minimum thickness of the cylindrical shell wall, in mm;

b = calculated minimum thickness of barrelled ends, in mm;

D = nominal outside diameter of the cylinder, in mm;

R = inside radius of curvature of convex base, in mm;

r = inside radius of junction of convex base, in mm;

H = outside height of dished part of cylinder end, in mm;

h = height of cylindrical part of dished end, in mm;

L = length of cylinder's stress-resistant shell, in mm;

A = elongation value of parent metal, in %;

$V_o$ = initial volume of the cylinder at the moment when the pressure is increased in the bursting test, in litres;

V = final volume of the cylinder on bursting, in litres;

Z = stress reduction factor.

1.2. For the purposes of this Directive, 'bursting pressure' means the pressure at plastic instability, i.e. the maximum pressure obtained during a burst test.

1.3. NORMALIZATION

The term 'normalization' is used in this Directive as defined in paragraph 68 of EURONORM 52-83.

1.4. STRESS RELIEVING

The term 'stress relieving' relates to the heat treatment to which a completed cylinder is subjected, during which the cylinder is heated to a temperature below the steel's lowest critical point ($A_{c1}$) in order to reduce the residual stresses.

## 2. TECHNICAL REQUIREMENTS

2.1. MATERIALS

2.1.1. The material used for the manufacture of the stress-resistant cylinder shells must be steel as specified in EURONORM 120-83.

2.1.2. All components of the cylinder body and all the parts welded thereto must be made of mutually compatible materials.

2.1.3. The filler materials must be compatible with the steel so as to form welds with properties equivalent to those specified for the parent metal.

2.1.4. The cylinder manufacturer must obtain and provide chemical cast analysis certificates in respect of the steels supplied for the manufacture of the pressure parts.

2.1.5. It must be possible for independent analyses to be made. These analyses must be carried out either on specimens taken from the materials as supplied to the cylinder manufacturer or on the finished cylinders.

2.1.6. The manufacturer must make available to the inspection body the results of metallurgical and mechanical tests and analyses carried out on welds and must also provide it with a description of the welding methods and processes adopted which can be regarded as representative of the welds made during production.

2.2. HEAT TREATMENT

Cylinders shall be delivered in either the normalized or the stress-relieved condition. The cylinder manufacturer shall certify that the cylinders have been heat treated after completion of all welding and shall certify the process of heat treatment applied. Localized heat treatment is not permitted.

2.3. CALCULATIONS FOR THE PRESSURE PARTS

2.3.1. The thickness of the cylindrical shell wall at any point on the stress-resistant shell of the gas cylinders must not be less than that calculated by the formula:

2.3.1.1. for cylinders without longitudinal welds:

$$a = \frac{P_h \cdot D}{20 \frac{R_e}{4/3} + P_h}$$

2.3.1.2. for cylinders with longitudinal welds:

$$a = \frac{P_h \cdot D}{20 \frac{R_e}{4/3} Z + P_h}$$

Z being equal to:

— 0,85 where the manufacturer radiographs the intersection of the welds for a distance of 100 mm beyond the intersection in the case of the longitudinal weld and of 50 mm (25 mm on each side) in the case of the circumferential welds. One cylinder selected at the beginning and one at the end of each shift period and per machine is to be radiographed,

— 1 where the manufacturer spot radiographs the intersection of the welds for a distance of 100 mm beyond the intersection in the case of the longitudinal weld and of 50 mm (25 mm on each side) in the case of the circumferential welds.

This examination shall be carried out on 10 % of cylinders manufactured, chosen at random.

Should these radiograph tests reveal unacceptable defects, as defined in 3.4.1.4, all the necessary steps must be taken to examine the production run in question and eliminate the defects.

2.3.2. **Dimensions and calculation of ends** (see figures in Appendix 1)

2.3.2.1. The cylinder ends must fulfil the following conditions:

— *torispherical ends*

simultaneous limits: $0{,}003\ D \leq b \leq 0{,}08\ D$
$r \geq 0{,}1\ D$
$R \leq D$
$H \geq 0{,}18\ D$
$r \geq 2\ b$
$h \geq 4\ b$

— *elliptical ends*

simultaneous limits: $0{,}003\ D \leq b \leq 0{,}08\ D$
$H \geq 0{,}18\ D$
$h \geq 4\ b$

— *hemispherical ends*

limits: $0{,}003\ D \leq b \leq 0{,}16\ D$

2.3.2.2. The thickness of these dished ends must not at any point be less than the figure calculated by means of the following formula:

$$b = \frac{P_h \cdot D}{20 \frac{R_e}{4/3}} C$$

The coefficient of form C to be used for full ends is given in the table in Appendix 1.

However, the nominal thickness of the cylindrical edge of the ends must not be less than the nominal thickness of the cylindrical part.

2.3.3. The nominal wall thickness of the cylindrical part and of the dished end may not, under any circumstances, be less than:

$$- \frac{D}{250} + 0{,}7 \text{ mm where } P_h < 30 \text{ bar}$$

$$- \frac{D}{250} + 1 \text{ mm} \quad \text{where } P_h \geq 30 \text{ bar}$$

with a minimum of 1,5 mm in both cases.

2.3.4. The cylinder body, excluding the valve seat, may be made up of two or three parts. The ends must be in one piece and convex.

## 2.4. CONSTRUCTION AND WORKMANSHIP

### 2.4.1. General requirements

2.4.1.1. The manufacturer guarantees on his own responsibility that he has the manufacturing facilities and processes to ensure that cylinders produced satisfy the requirements of this Directive.

2.4.1.2. The manufacturer must ensure through adequate supervision that the parent plates and pressed parts used to manufacture the cylinders are free from any defects likely to adversely affect the operating safety of the cylinder.

### 2.4.2. Pressure parts

2.4.2.1. The manufacturer must describe the welding methods and processes used and indicate the inspections carried out during production.

2.4.2.2. *Technical welding requirements*

The butt welds must be executed by an automatic welding process.

The butt welds ons the stress-resistant shell may not be located in any area where there are changes of profile.