BS EN 16119:2013

BSI Standards Publication

LPG equipment and accessories — Sealing caps and plugs for LPG cylinder and pressure vessel valves — Specification and testing

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National foreword

This British Standard is the UK implementation of EN 16119:2013.

The UK participation in its preparation was entrusted to Technical Committee PVE/19, LPG containers and their associated fittings.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Flüssiggas-Geräte und Ausrüstungsteile - Dichtkappen und Dichtstopfen für Flaschen und Behälter für Flüssiggas (LPG) - Spezifikation und Prüfungen

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Contents

Page

Foreword

This document (EN 16119:2013) has been prepared by Technical Committee CEN/TC 286 “Liquefied petroleum gas equipment and accessories”, the secretariat of which is held by NSAI.

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of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.

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Introduction

This European Standard calls for the use of substances and procedures that may be injurious to health and/or the environment if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations at any stage.

Protection of the environment is a key political issue in Europe and elsewhere. Protection of the environment is taken in a very broad sense. What is meant is the total life cycle aspects of, e.g., a product on the environment, including expenditure of energy and during all phases from mining of raw materials, fabrication, packaging, distribution, use, scrapping, recycling of materials, etc.

NOTE Annex C indicates the clauses in this European Standard that address environmental issues.

Provisions need to be restricted to a general guidance. Limit values are specified in national laws.

It is recommended that manufacturers develop an environmental management policy. For guidance, see the EN ISO 14000 series.

It has been assumed in the drafting of this European Standard that the execution of its provisions is entrusted to appropriately qualified and experienced people.

All pressures are gauge pressures unless otherwise stated.

This European Standard requires measurement of material properties, dimensions and pressures. All such measurements are subject to a degree of uncertainty due to tolerances in measuring equipment etc. It may be beneficial to refer to the leaflet "measurement uncertainty leaflet SP INFO 2000 27 [3].

1 Scope

This European Standard specifies the design, testing and marking requirements for caps and plugs used to form a pressure tight seal with liquefied petroleum gas (LPG) cylinder valves and pressure vessel valves. Sealing caps and plugs provide an additional seal for self-closing and manually operated valves.

Dust caps or plugs and tamper evident seals that do not form an additional seal as part of their design are excluded from the scope of this European Standard.

Cylinder valve caps and plugs may be used with valves for liquid and vapour manufactured in accordance with EN ISO 14245 and EN ISO 15995.

Pressure vessel valve caps and plugs may be used with valves for liquid and vapour manufactured in accordance with EN 13175. Occasional liquid withdrawal valve caps and plugs are excluded from the scope of this European Standard.

Reusable and single use sealing caps and plugs are included in this European Standard.

This European Standard does not exclude the use of other designs that provide an equivalent level of safety.

NOTE The term “pressure vessel” does not include LPG tank vehicles, also called “road tankers”, in CEN/TC 286 standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 549, *Rubber materials for seals and diaphragms for gas appliances and gas equipment*

EN 751-1, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 1: Anaerobic jointing compounds*

EN 751-2, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 2: Non-hardening jointing compounds*

EN 751-3, *Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water — Part 3: Unsintered PTFE tapes*

EN 12164, *Copper and copper alloys — Rod for free machining purposes*

EN 12165, *Copper and copper alloys — Wrought and unwrought forging stock*

EN 12420, *Copper and copper alloys — Forgings*

EN 13175:2003+A1, *LPG equipment and accessories — Specification and testing for Liquefied Petroleum Gas (LPG) tank valves and fittings*

EN 15202, *LPG equipment and accessories — Essential operational dimensions for LPG cylinder valve outlet and associated equipment connections*

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

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

EN ISO 14021, *Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling) (ISO 14021)*

EN ISO 14024, *Environmental labels and declarations — Type I environmental labelling — Principles and procedures (ISO 14024)*

EN ISO 14025, *Environmental labels and declarations — Type III environmental declarations — Principles and procedures (ISO 14025)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
liquefied petroleum gas
LPG
low pressure liquefied gas composed of one or more light hydrocarbons which are assigned to UN 1011, UN 1075, UN 1965, UN 1969 or UN 1978 only and which consists mainly of propane, propene, butane, butane isomers, butene with traces of other hydrocarbon gases

Note 1 to entry: In some countries, UN numbers 1011 and 1978 may also be designated LPG.

3.2
plug
component which seals a female connection

3.3
cap
component which seals a male connection

3.4
cylinder valve
primary shutoff device intended for liquid filling and liquid or vapour service fitted to LPG cylinders

Note 1 to entry: The valve can also include additional devices e.g. liquid level indicator, excess flow device, pressure relief valve, sediment tube, non-return valve and eduction tube.

3.5
leak tightness
resistance to gas leakage under a specified pressure differential

3.6
sealing cap or plug
device which is intended to seal the inlet and or outlet connection of a valve

Note 1 to entry: It may also provide protection to the valve connection. The device may provide protection against the ingress of dust, dirt or other contamination. The device may also be used to provide tamper evidence.

3.7
dust cap or plug
device which is intended to protect the inlet or outlet of a valve against the ingress of dust, dirt or other contamination

3.8
reusable sealing caps and plugs
sealing caps and plugs that are designed for reuse and have a means of attachment to the valve

3.9
single use sealing caps and plugs
sealing caps or plugs that are rendered incapable of reuse in their original condition by their removal from the valve

3.10
tamper evidence
visible indication that interference has taken place with the cap or plug of the cylinder or pressure vessel

Note 1 to entry: This also includes sealing caps or plugs where a tamper evident strip is destroyed by their removal from the valve.

3.11
Standard Temperature and Pressure
STP
15,6 °C (288,7 K), 1,013 bar absolute (0,1013 MPa absolute)

4 Operating temperatures

Caps and plugs designed in accordance with this European Standard shall be suitable for the following conditions:

a) a minimum operating temperature of -20 °C;

b) a minimum operating temperature of -40 °C for those parts of Europe where caps or plugs are subject to more severe temperature conditions; the material and design shall be shown to be satisfactory for operations under these conditions and shall meet the requirements of Annex A;

c) a maximum operating temperature of 65 °C.

5 Materials

5.1 Environmental

The manufacturer shall endeavour to acquire materials and components from suppliers who have a declared environmental policy; see EN ISO 14021, EN ISO 14024 and EN ISO 14025.

5.2 General

5.2.1 Materials in contact with LPG shall be physically and chemically compatible with LPG under all normal operating conditions for which the cap or plug is intended and shall meet the requirements for propane and butane in accordance with EN ISO 11114-1 and EN ISO 11114-2.

5.2.2 Metallic and non metallic materials used for the cap or plug shall be selected to give adequate strength in service. Material shall be selected to resist failure due to atmospheric corrosion, ultraviolet rays, brass dezincification, stress corrosion or material failure. The cap or plug material shall be compatible with the valve body material.

5.3 Metallic materials

5.3.1 Metallic materials shall be stainless steel, copper alloys, aluminium alloys, zinc alloys, or other suitable materials.

5.3.2 Hot stamped brass shall be non-porous and shall be suitable for machining or other processes. Sand-cast brass shall not be used.

Leaded brass shall be CW614N or CW617N in accordance with EN 12164 or EN 12165 and forged brass in accordance with EN 12420.

Cold drawn brass rods up to 45 mm in diameter shall only be used after heat treatment and testing for internal cracking. Cold drawn brass rods greater than 45 mm in diameter shall not be used.

Components produced from stamping brass shall not exhibit cold shuts, also known as folds, or surface defects.

5.3.3 Stainless steels shall contain not less than 16 % chromium and not less than 7 % nickel.

5.3.4 Castings shall be free from inclusions and surface defects, which adversely affect the strength, leak tightness or performance of the cap or plug.

5.4 Non-metallic materials

5.4.1 All non-metallic materials for caps and plugs shall not distort, harden or adhere to the body of the valve.

5.4.2 All rubber materials shall also comply with the requirements of EN 549.

5.4.3 Where used on operating threads and seals, lubricants, sealants and adhesives shall be compatible with LPG and not interfere with the operation of the plug or cap. Sealants shall comply with EN 751-1, EN 751-2 or EN 751-3.

6 Design

6.1 General

6.1.1 The cap or plug components shall be designed with adequate strength and adequate clearances to ensure correct operation under normal conditions of service, handling and carriage.

6.1.2 The cap or plug sealing element shall be secured to prevent it becoming lost during the intended period of service. Where a cap or plug is intended to be attached to the valve, the connection element shall be designed to ensure that it is retained for the intended period of service.

6.1.3 Reusable caps or plugs shall be designed for the strength appropriate to the maximum allowable pressure of the contents at 65 °C. This shall ensure that the caps or plugs do not permanently deform or rupture to the extent that it impairs use.

6.1.4 The cap or plug shall be designed to ensure leak tightness appropriate to the maximum allowable pressure of the contents at 50 °C.

6.1.5 The design should take account of the following:

— minimising the use of raw materials;

— minimising the environmental impact of in-service maintenance and end of life disposal; and

— efficient packaging of finished product.

6.2 Threads

The threads (if present) used for the caps or plugs shall be designed in accordance with EN 15202 for the respective valve connection or EN 13175.

6.3 Leak tightness

The leakage shall not exceed 15 cm^3/h at STP.

7 Testing and inspection of the design

7.1 General

7.1.1 A minimum of five samples shall be submitted for each test. All sample caps or plugs shall initially be subject to visual inspection and dimensional checks.

7.1.2 The test medium shall be air or nitrogen for all tests unless otherwise stated.

7.2 LPG resistance

7.2.1 Each sample shall be immersed in n-Pentane for 72 h at ambient temperature. After immersion the weight and volume of the samples shall meet the following requirements:

a) The weight shall be between 95 % and 110 % of the original weight of the sample(s);

b) The volume shall be between 100 % and 120 % of the volume of the original sample(s).

7.2.2 The samples shall then be dried at 40 °C for 168 h.

7.2.3 After drying the weight and volume of the sample(s) shall meet the following requirements:

a) The weight shall be between 92 % and 105 % of the original weight of the sample(s);

b) The volume shall be between 100 % and 110 % of the volume of the original sample(s).

7.3 Water resistance

7.3.1 Each sample shall be immersed in water for 72 h at ambient temperature. After immersion the weight and volume of the samples shall meet the following requirements:

a) The weight shall be between 95 % and 110 % of the original weight of the sample(s);

b) The volume shall be between 100 % and 120 % of the volume of the original sample(s).

7.3.2 The samples shall then be dried at 50 °C for 12 h.

7.3.3 After drying the weight and volume of the sample(s) shall meet the following requirements:

a) The weight shall be between 92 % and 105 % of the original weight of the sample(s);

b) The volume shall be between 100 % and 110 % of the volume of the original sample(s).

7.4 Climatic ageing during 168 hours

7.4.1 Climatic ageing shall be carried out on each of the samples for 168 h following the cycle described in Annex B.

7.4.2 The samples shall subsequently be checked to ensure that there are no visible cracks.

7.4.3 The cap or plug shall also be capable of application to and removal from the valve.

7.4.4 The cap or plug shall be pressure tested at 19 bar and ambient temperature and shall meet the requirements for leak tightness given in 6.3.

7.5 Hydraulic strength test

7.5.1 Reusable sealing caps or plugs

7.5.1.1 Each sample reusable sealing caps or plugs shall be hydraulically tested at a pressure of 30 bar.

7.5.1.2 After the test the sample(s) shall be examined to ensure that the caps or plugs are not permanently deformed or ruptured to the extent that it impairs repeated use.

7.5.2 Single use sealing caps or plugs

7.5.2.1 Each sample single use sealing caps or plugs shall be hydraulically tested at a pressure of 25 bar.

7.5.2.2 After the test the sample(s) shall be examined to ensure that the caps or plugs are not permanently deformed or ruptured to the extent that it impairs use.

7.6 Tightness test

7.6.1 Sample caps or plugs shall be fitted to a fixture representing the valve in the fully open position.

7.6.2 Hand applied threaded caps or plugs shall be tightened with a torque (in Newton metres) of one tenth the outside diameter (in millimetres).

EXAMPLE 50 mm diameter cap tightened to a torque of 5 Nm.

7.6.3 Spanner applied threaded caps or plugs shall be screwed with a torque of 10 Nm.

7.6.4 Sample caps or plugs shall be submitted to a cycle test of:

a) 9 bar at 20 ºC for 2 h;

b) 19 bar for 50 ºC for 12 h; and

c) for the remainder of the 24 h period at 9 bar and 20 °C.

7.6.5 In total five cycles (120 h) shall be carried out on each sample.

7.6.6 The cap or plug shall be pressure tested throughout the cycle and shall meet the requirements for leak tightness given in 6.3.

7.7 Torque Test

7.7.1 Sample threaded caps or plugs, at ambient temperature, shall be fitted to a fixture representing the intended use.

7.7.2 The torque applied shall be at two times the value in 7.6.2 or 7.6.3 as appropriate.

7.7.3 After testing the cap or plug shall meet the requirements for leak tightness given in 6.3.

8 Marking

The following minimum information shall be marked on the body of all caps or plugs:

a) number of this European Standard;

b) date (code) indicating year and month of manufacture or date of expiry (for reusable non-metallic caps or plugs);

c) “-40 °C”, for caps or plugs fulfilling the requirements of Annex A.

9 Documentation

The following information shall be supplied with caps and plugs:

— user/installation instructions;

— tightening torque requirements (if appropriate);

— manufacturers details and name;

— reconditioning or lifetime recommendations (for non metallic caps or plugs); and

— declaration of conformity with this European Standard.

10 Packaging

Any packaging and protection used during storage/transport of the finished products should be selected to have the minimum environmental impact, i.e. use of recyclable or bio-degradable materials, minimum use of energy.

Recycling instructions and/or recycling symbols for each packaging material should be printed on the packaging.

Annex A
(normative)

Special low temperature requirements for caps or plugs

A.1 In some parts of Europe where caps or plugs are subject to more severe temperature conditions, the design temperature range shall be extended to -40 °C. The material and design shall be shown to be satisfactory for operations under these conditions.

A.2 The cap or plug shall be fitted to the valve, before being subjected to a temperature of -40 °C for 24 h. The temperature shall then raised to -30 °C.

A.3 The cap or plug and valve assembly shall then be tested for leak tightness at 0,1 bar and 25 bar and shall meet the requirements for leak tightness given in 6.3.

A.4 The minimum operating temperature "-40 °C" shall be marked in accordance with the requirements of Clause 8.

Annex B
(normative)

Combined aging test

B.1 General

B.1.1 The plugs and caps shall be subjected to an ageing test.

B.1.2 Sample caps or plugs shall be placed in a climatic chamber and shall be subject to artificial ageing.

B.1.3 Ageing shall be carried out on a cyclic basis as described in Table B.1 which shows the different phases throughout a 24 h period. This cycle is also shown graphically in Figure B.1.

B.1.4 These phases include different combinations of heat, cold humidity, rain and UV conditions. UV light shall be provided in accordance with B.2 for the phase numbers shown in Table B.1. Rain shall be provided in accordance with B.3 for the phases as shown in Table B.1.

B.1.5 The ageing test shall be continued for a total of 168 h.

B.1.6 At the end of 168 h, the samples shall be stabilized for 48 h at 20 °C ± 5 °C and at 50 % humidity ± 5 %.

B.2 Ultraviolet light

Ultraviolet (UV) light shall be applied in the following condition:

— energy to be received by samples is (65 ± 10) W/m^2; and

— the wavelength range shall be (360 ± 40) nm.

B.3 Rain

Rain shall be applied in the following condition:

a) Demineralised water with a high resistivity more than 250 Ω.m

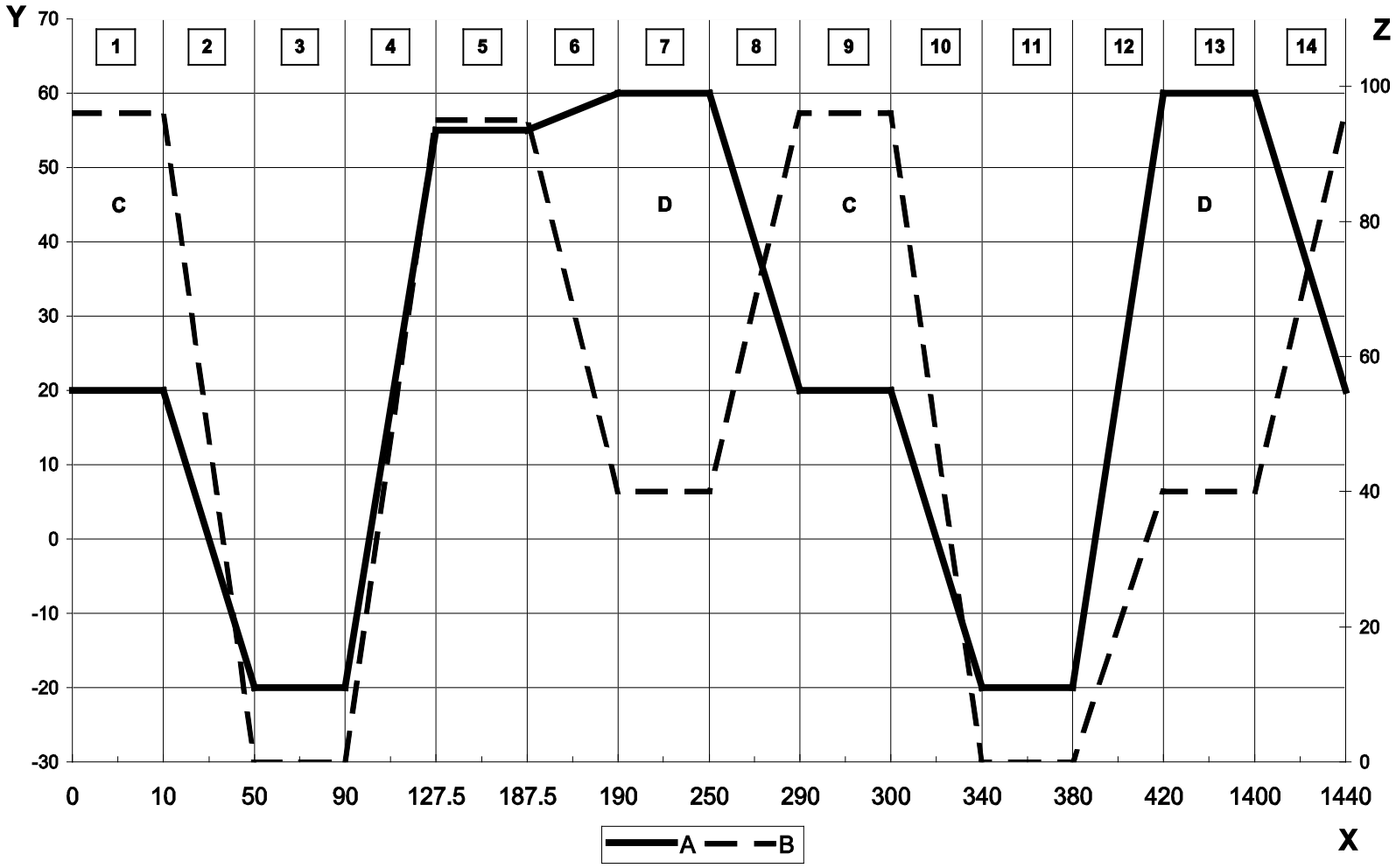
b) The acidity/alkalinity of the water shall be neutral with a ph value of 7 ± 0,2.

c) The pouring rain shall be performed by using an appropriate device. This device shall provide small drops of water falling down onto the sample with an incidence angle of 30° to 45°.

d) The flow of drops of water shall be sufficient in order to keep the samples wet.

Table B.1 — Combined aging test parameters

Phase number	Initial time mins	Final time mins	Initial temperature °C	Final temperature °C	Temperature gradient °C/min	Humidity	UV W/m^2
1	0	10	20	20	0	96 %	-
2	10	50	20	-20	-1	From 96 % to 0 %	-
3	50	90	-20	-20	0	0 %	-
4	90	127,5	-20	55	+2	From 0 % to 95 %	-
5	127,5	187,5	55	55	0	95 %	-
6	187,5	190	55	60	+2	From 95 % to 40 %	-
7	190	250	60	60	0	40 %	65
8	250	290	60	20	-1	From 40 % to 96 %	-
9	290	300	20	20	0	96 %	-
10	300	340	20	-20	-1	From 96 % to 0 %	-
11	340	380	-20	-20	0	0%	-
12	380	420	-20	60	+2	From 0 % to 40 %	-
13	420	1 400	60	60	0	40 %	65
14	1 400	1 440	60	20	-1	From 40% to 96%	-



Key

X – time (mins)
Y - temperature (°C)
Z – humidity (%)
A - temperature
B – humidity
C - rain
D - ultraviolet

Figure B.1 — Ageing graph

Annex C
(informative)

Environment checklist

Environmental Aspect	Stages of the life cycle										All stages
	Acquisition		Production		Use			End-of-Life			
	Raw materials and energy	Pre-manufactured materials and components	Production	Pack-aging	Use	Maintenance and repair	Use of additional products	Reuse / Material and Energy Recovery	Incineration without energy recovery	Deposition	Transportation
Inputs											
Materials	5.1	5.1		6.1.5 10		5.1	5.1	5.1 10		6.1.5	
Water											
Energy	5.1	5.1									5.1
Land											
Outputs											
Emissions to air											5.1
Discharges to water											
Discharges to soil											
Waste			6.1.5	10				6.1.5		6.1.5	
Noise, vibration, radiation, heat losses											5.1
Other relevant aspects											
Risk to the environment from accidents or unintended use		Intro			9						
Customer information					9						
Comments:											

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[1] EN ISO 14245, *Gas Cylinders — Specification and testing of LPG cylinder valves — Self-closing (ISO 14245)*

[2] EN ISO 15995, *Gas Cylinders — Specifications and testing of LPG cylinder valves — Manually operated (ISO 15995)*

[3] Measurement uncertainty leaflet (SP INFO 2000 27 uncertainty), Magnus Holmgren et al published by Swedish National Testing and Research Institute

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