
**Light gauge metal containers —
Non-refillable LPG cartridges —
General requirements**

*Réipients métalliques légers — Cartouches de GPL non rechargeables
— Exigences générales*

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Foreword

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This document was prepared by Technical Committee ISO/TC 52, *Light gauge metal containers*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Light gauge metal containers — Non-refillable LPG cartridges — General requirements

1 Scope

This document specifies minimum requirements for the construction, design, material, performance, test methods and marking at manufacture of non-refillable liquefied petroleum gas (LPG) cartridges.

This document is applicable to non-refillable LPG cartridges which:

- a) predominantly comprise butane fuel gas (iso/normal);
- b) have a total nominal capacity of up to 250 g net;
- c) are intended to deliver gas in the vapour state when either positioned upright or in a horizontal orientation;
- d) are used with certain types of gas appliances, e.g. portable gas cookers;
- e) are classified as UN 2037, RECEPTACLES, SMALL, CONTAINING GAS (GAS CARTRIDGES) without a release device, non-refillable for the transport of dangerous goods.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 1431-1:2012, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 11949, *Cold-reduced tinmill products — Electrolytic tinplate*

ISO 11951, *Cold-reduced tinmill products — Blackplate*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1
non-refillable liquefied petroleum gas cartridge
non-refillable LPG cartridge
cartridge only filled up once with LPG

3.2
flange

guide for setting the *non-refillable liquefied petroleum gas cartridges* (3.1) in the gas appliances in the appropriate direction

3.3

boss

protruding part at the centre of the *non-refillable liquefied petroleum gas cartridges* (3.1) that houses the *stem* (3.5) or another valve part

3.4

cartridge cap

cap for protecting the gas outlet of the *non-refillable liquefied petroleum gas cartridges* (3.1) for the gas appliances

3.5

stem

part for vapour withdrawal which is fitted to a gas appliance

3.6

burst prevention device

part of the *non-refillable liquefied petroleum gas cartridges* (3.1) which releases pressure or closes the gas flow inside the cartridges when the pressure or the temperature reaches a pre-set value

3.7

countersink release vent type

CRV type

burst prevention device (3.6) that, when the internal pressure of the cartridge rises and the cartridge is deformed, the explosion-proof part ruptures installed on the upper body in a state where the body and the upper body are not separated from each other to discharge the LPG and prevent the explosion

3.8

rim vent release type

RVR type

burst prevention device (3.6) that, when the internal pressure of the cartridge rises and the cartridge is deformed, the explosion-proof part ruptures installed on the rim in a state where the body and the upper body are not separated from each other to discharge the LPG and prevent the explosion

3.9

resealing valve type

burst prevention device (3.6) that, when the internal pressure of the cartridge rises, the resealing valve is opened to discharge the LPG and prevent the explosion, and after decreasing the internal pressure of the cartridge, the resealing valve is closed and used again

3.10

temperature sensing valve type

burst prevention device (3.6) that, when the internal heat of cartridge rises, while the surface of the pin inside the cartridge melts, the temperature sensing valve inside the cartridge closes the gas flow

4 Gas filled in cartridge

4.1 Composition

The composition of LPG, when tested by the method described in 8.3.10, shall conform to the requirements given in Table 1.

Table 1 — Composition

Composition	Distribution ratio
C ₄ H ₁₀ (butane)	≥ 95 % mass fraction
Other hydrocarbons	≤ 5 % mass fraction

4.2 Nominal LPG capacity

The nominal LPG capacity, when tested by the method described in [8.3.11](#), shall be up to 250 g.

4.3 Odour

The odour of LPG shall be detectable when LPG mixing ratio to air is 1/1 000 in volume.

5 Construction and design

5.1 Construction

When the test described in [8.3](#) is carried out for testing the construction of each composition of the cartridges, each composition shall be proven to have been manufactured with safety and durability considerations and shall be free from any leakage of LPG, burst or deformation that can be detrimental to use when used under normal service and transportation conditions.

The pressing jointed part shall be effective in pressing, and the edges likely to be touched by hands during use shall be smooth.

Exposure to such vibrations and impacts as can occur during transportation or service shall not reduce the gas tightness and pressure resistance of the cartridges.

The cartridges shall be constructed in such a way that allows the LPG to be discharged in a gaseous state when it is under normal service conditions.

NOTE Normal service conditions refers to conditions where the cartridge is installed in a gas appliance.

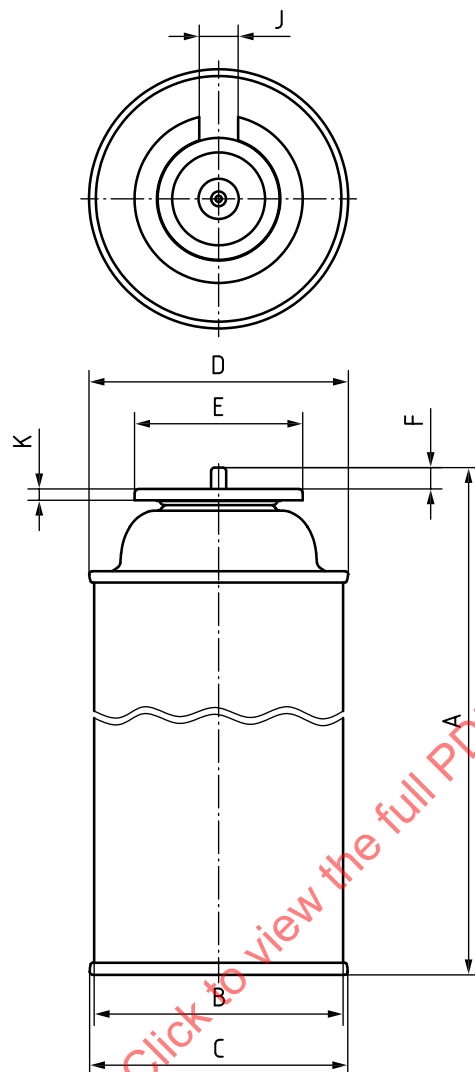
The cartridges shall be provided with a means to prevent LPG from being discharged when it is taken off from the gas appliances.

The cartridges shall be provided with a means to protect the protruding cartridge valve.

5.2 Design

5.2.1 Dimensions of cartridge and cartridge valve

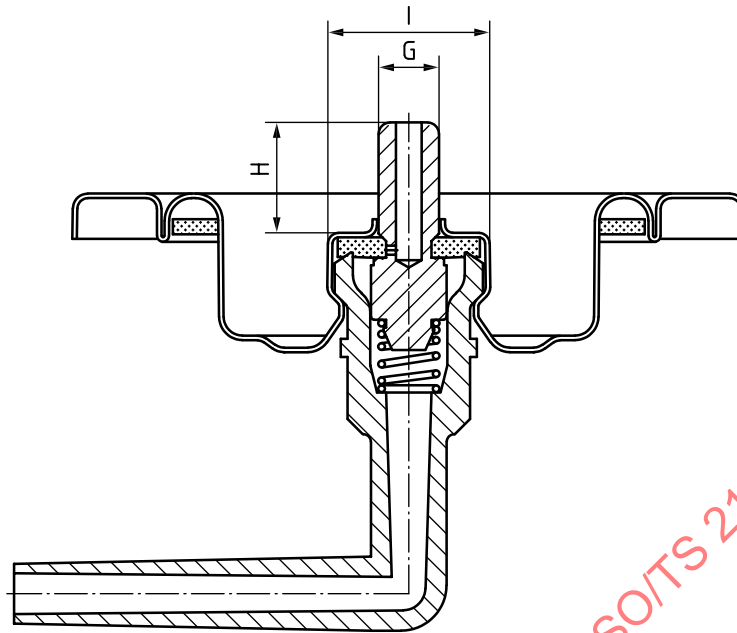
The dimensions of cartridge and cartridge valve, when tested by the method described in [8.3](#), shall conform to the requirements given in [Table 2](#) corresponding to respective parts indicated in [Figures 1](#) and [2](#).



Key

A	total height	E	flange diameter
B	outer diameter of can-shell	F	stem height
C	lower can diameter	J	flange cut-away width
D	upper can diameter	K	flange thickness

Figure 1 — Cartridge

**Key**

- G stem diameter
H stem length
I boss diameter

Figure 2 — Cartridge valve**Table 2 — Dimensions of cartridge and cartridge valve**

Key item	Name	Dimensions
A	Total height	$(185,0 \pm 1,5) \text{ mm}^b$
B	Outer diameter of can-shell	$(65,7 \pm 0,5) \text{ mm}$
C	Lower can diameter	$(68,2 \pm 0,4) \text{ mm}$
D	Upper can diameter	$(68,5 \pm 0,4) \text{ mm}$
E	Flange diameter	$(44,5 \pm 0,6) \text{ mm}$
F	Stem height	$(5,6 \pm 0,5) \text{ mm}$
G	Stem diameter	$(4,0 \pm 0,05) \text{ mm}$
H	Stem length	$(7,3 \pm 0,5) \text{ mm}$
I	Boss diameter ^a	$(10,65 \pm 0,1) \text{ mm}^b$
J	Flange cut-away width	$(10,3 \pm 0,3) \text{ mm}$
K	Flange thickness	$(3,15 \pm 0,25) \text{ mm}$

^a Boss diameter shall be an outside diameter measured at a position 1,5 mm below the upper end of the boss.

^b In China and Japan, the dimensions of cartridge and cartridge valve for total height and boss diameter shall conform to the requirements specified in [A.2](#).

5.2.2 Compressive (stroke) dimension and initial injection stroke of cartridge valve

The compressive (stroke) dimension and the initial injection stroke of cartridge valve, when tested by the methods described in [8.3.12](#), shall conform to the requirements given in [Table 3](#).

Table 3 — Stroke dimensions of cartridge valve

Item	Dimension mm
Cartridge valve compressive (stroke) dimension	1,7 to 2,8
Initial injection stroke dimension	0,2 to 0,9

6 Material

6.1 Material of cartridge body

The material used for cartridge body shall be as follows:

- The material shall be that specified in ISO 11949 or ISO 11951.
- If the material used is a steel or lightweight metal other than specified in ISO 11949 or ISO 11951, it shall be subjected to the corrosion resistance test specified in ISO 9227.

6.2 Material of cartridge stem

The material used for the cartridge stem shall be as follows:

- The material shall have a melting point above 500 °C.
- It shall be made of corrosion-resistant metal or the surfaces shall be treated for corrosion resistance.

In the Republic of Korea, the melting point of the material used for the cartridge stem shall conform to the requirements specified in [A.3.1](#).

In Japan, the material of the cartridge stem shall conform to the requirements specified in [A.3.2](#).

7 Performance

The performance of non-refillable LPG cartridges, when tested by the methods described in [8.3](#), shall conform to the requirements given [Table 4](#).

Table 4 — Performance

Item		Performance	Applicable test subclause
Gas resistance	Packings for cartridge valve	The mass change rate shall not exceed 20 %. There shall be no deformation or change that can be detrimental to use.	8.3.4
Ozone resistance		There shall be no cracks.	8.3.5
Gas tightness		There shall be no LPG leakage.	8.3.6
Pressure resistance	Deformation	There shall be no leakage and deformation.	8.3.7
	Burst	The cartridge shall not burst.	
Stem functioning load		12 N to 19 N	8.3.8
Repeated use		The requirements for gas tightness shall be met.	8.3.9
Accuracy of filled LPG mass to the nominal mass		It shall have a tolerance between +1 % and -2 %.	8.3.11
Initial partial air pressure		It shall not exceed 50 kPa at a temperature of 25 °C.	8.3.13

Table 4 (continued)

Item	Performance	Applicable test subclause
Valve flow rate	The flow rate shall be 8 l/min or more at the valve-inlet pressure of 0,2 MPa.	8.3.14
Flange strength	The maximum load before deformation of the edge of the flange notch shall be 100 N or greater.	8.3.15

8 Test methods

8.1 Test condition

Unless otherwise stated, the test conditions shall be as follows:

- a) ambient temperature: $(20 \pm 15) ^\circ\text{C}$;
- b) humidity: $(65 \pm 20) \%$;
- c) temperature variation during test: $\pm 5 ^\circ\text{C}$.

8.2 Test instruments and apparatus

Test instruments and apparatus shall be as given in [Figures 3, 4](#) and [5](#).

8.3 Tests for construction, design, material and performance

8.3.1 General

Unless otherwise specified in the test subclause, the evaluation of test results shall be performed by visual observation. For the dimensional evaluation in [5.2](#), the dimension of each part shall be measured using a suitable measuring instrument.

8.3.2 Vibration test

With the specimen, which has been packed for transportation, fixed horizontally on a vibration tester, apply first vertical vibrations and then lateral vibrations of 5 mm full amplitude at a rate of 600 cycles per minute (cpm) for 30 min. Test for gas tightness according to the method described in [8.3.6](#) and for pressure resistance according to the method described in [8.3.7](#).

8.3.3 Drop test

The drop test shall be as follows:

- a) Drop a cartridge, which has been packed for transportation, from a 1 m height with its top surface facing up onto a concrete floor. Test for gas tightness according to the method described in [8.3.6](#) and for pressure resistance according to the method described in [8.3.7](#). Also, examine for deformations detrimental to use.
- b) Drop a cartridge body with its cartridge cap on from a 30 cm height onto a wooden floor, directing the cartridge valve, three times each way: upward, downward and then in the horizontal position, for a total of nine times. After each drop, test for gas tightness according to the method described in [8.3.6](#) and for pressure resistance according to the method described in [8.3.7](#). Also, examine for deformations detrimental to use.
- c) Drop a cartridge with its cartridge cap removed from a 30 cm height onto a wooden floor directing its valve upward. Test for gas tightness according to the method described in [8.3.6](#) and for pressure

resistance according to the method described in [8.3.7](#). Also, examine for deformations detrimental to use.

8.3.4 Gas resistance test

For testing the gas resistance of the packing of a cartridge valve, measure the mass of a specimen, of which the initial mass has been previously measured, at the time of taking out after leaving in LPG of not less than 95 % C₄H₁₀ (butane) at a temperature of -10 °C or lower for at least 24 h, and after leaving in LPG of not less than 95 % C₄H₁₀ (butane) at a temperature of 40 °C or higher for at least 24 h. Calculate the mass change rate by using [Formula \(1\)](#). Also, examine visually for deteriorations or deformations detrimental to use.

$$\Delta M = \frac{M_A - M_B}{M_B} \times 100 \quad (1)$$

where

ΔM is the mass change rate, in %;

M_A is the mass after testing, in g;

M_B is the mass before testing, in g.

8.3.5 Ozone resistance test

For testing the ozone resistance of the packing of a cartridge valve, subject a cartridge, which has been emptied of the LPG it contained, to the condition of ozone concentration 50 pphm¹⁾ and test temperature (40 ± 2) °C for the test duration of 96 h by means of the test apparatus specified in ISO 1431-1:2012, Clause 5, and visually examine for the generation of fissures.

8.3.6 Gas tightness test

For testing the gas tightness of a cartridge, immerse a cartridge in warm water at a temperature of 48 °C to 50 °C for 30 min or longer and visually examine for LPG leakage from any part of the cartridge. When testing multiple cartridges, this test may be performed by immersion in warm water at a temperature of (55 ± 2) °C for 110 s or longer.

8.3.7 Pressure resistance test

8.3.7.1 General

The pressure resistance test for cartridges shall be given in [8.3.7.2](#) and [8.3.7.3](#).

NOTE For the purposes of the pressure resistance test, the valve can be removed for the test.

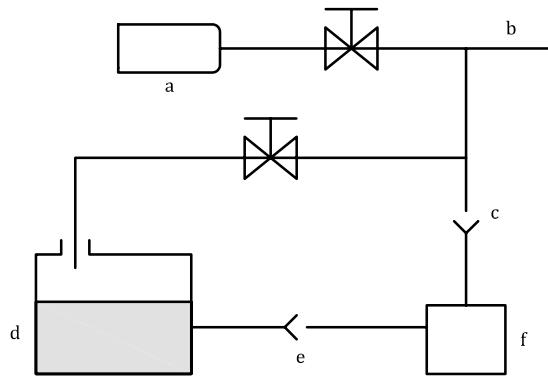
8.3.7.2 Deformation

Using the test apparatus given in [Figure 3](#) or any equivalent apparatus, apply hydraulic or aerostatic pressure to a cartridge which has been emptied of LPG it contained, gradually increase the pressure up to 1,3 MPa and then hold for 30 s. Examine visually for leakage or deformation of any part.

8.3.7.3 Burst

Apply a pressure of 1,5 MPa to the cartridge in the same manner as in [8.3.7.2](#) and see if any part of the cartridge bursts.

1) pphm = parts per hundred million parts

**Key**

- a test cartridge
- b test pressure gauge
- c check valve
- d water tank
- e check valve
- f pressure applying device such as booster pump and intensifier piston

Figure 3 — Hydraulic pressure resistance test apparatus

8.3.8 Stem functioning load test

For the functioning load test of the stem, measure the load which is acting on the stem when the stem is pushed in 1,5 mm. The load value shall be the arithmetic mean of five measured values.

8.3.9 Repeated use test

For the repeated use test of cartridge valves, after repeating the operation of pushing in the stem to the compressive (stroke) dimension of the cartridge valve for 100 times at a rate of once per second, carry out the test given in 8.3.6 and examine for any leakage. The above procedure shall be performed without discharge of LPG.

8.3.10 LPG composition test

The chemical analysis of the composition of the LPG filled in the cartridge shall be carried out by gas chromatography.

In Japan, the LPG composition test shall conform to the requirements specified in A.4.

8.3.11 Filled LPG mass test

For the test of mass of the LPG filled in the cartridge, measure the mass of the cartridge filled with LPG and that of the cartridge emptied of LPG, and calculate the mass of filled LPG by using Formula (2):

$$M = M_F - M_E \quad (2)$$

where

- M is the mass of filled LPG, in g;
- M_F is the mass of cartridge filled, in g;
- M_E is the mass cartridge emptied of LPG, in g

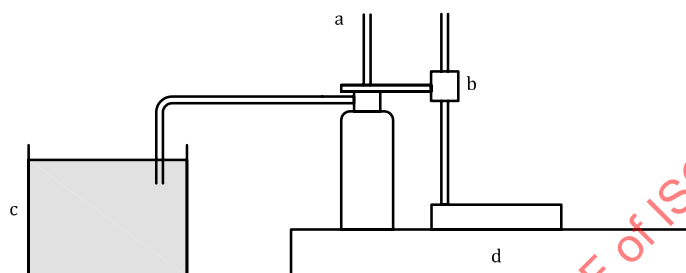
8.3.12 Test of compressive (stroke) dimension and initial injection stroke dimension of cartridge valve

8.3.12.1 Compressive (stroke) dimension of cartridge valve

Measure the travelling distance of the stem from the normal state to fully pushed-in state by means of a dial gauge.

8.3.12.2 Initial injection stroke dimension

Using the apparatus given in [Figure 4](#) or any equivalent apparatus, push in the stem gradually and measure the pushed-in dimension of the stem by means of a dial gauge when air bubbles appear intermittently.



Key

- a dial gauge
- b feeding wheel
- c water tank
- d surface plate

Figure 4 — Initial injection stroke test apparatus

8.3.13 Initial partial air pressure test

Immerse a new cartridge which has never discharged LPG in a constant-temperature water tank maintained at $(25 \pm 1)^\circ\text{C}$ for 30 min or longer. Attach a pressure gauge at the end of the stem to measure the initial inner pressure (P_1). Then, with care not to allow discharge of the liquid-phase LPG, push the stem to open the valve, and discharge the LPG for 10 s. Immerse the cartridge in the constant temperature water tank maintained at $(25 \pm 1)^\circ\text{C}$ for 30 min or longer until the temperature has stabilized, and attach a pressure gauge at the end of the stem to measure the inner pressure (P_2) after LPG discharge. Calculate the initial partial air pressure by using [Formula \(3\)](#):

$$P = P_1 - P_2 \quad (3)$$

where

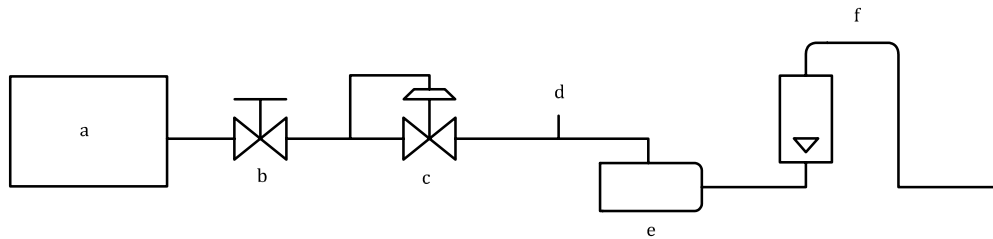
P is the initial partial air pressure, in kPa;

P_1 is the initial inner pressure, in kPa;

P_2 is the inner pressure after LPG discharge, in kPa.

8.3.14 Valve flow rate test

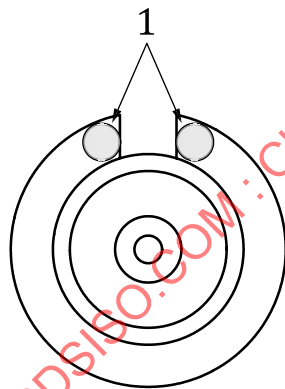
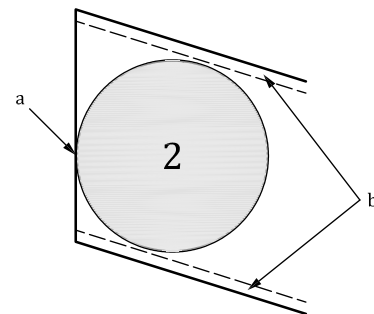
Connect an apparatus as shown in [Figure 5](#) to a vacant cartridge and, with the stem pushed in 1,5 mm and the pressure at upstream side of cartridge (valve-inlet pressure) regulated to 0,2 MPa, measure the valve flow rate by air.

**Key**

- a air source
- b shut-off valve
- c pressure regulator
- d pressure gauge
- e cartridge
- f flow meter

Figure 5 — Valve flow rate test apparatus**8.3.15 Flange strength test**

Stand the cartridge and, using a circular jig of 3,5 mm diameter positioned as shown in [Figure 6](#), depress the flange gradually in the vertical direction. Measure the maximum load (N) before the flange is deformed to reach the cartridge body. Test at both edges of the flange notch.

**a) Top view of flange****b) Flange notch part enlargement****Key**

- 1 circular jig
- 2 circular jig 3,5 mm in diameter
- a Align at the end face.
- b Bend part.

This is an example illustrating one of the edges of the flange notch. The jig shall be placed at the centre of the flange width, which excludes the bends on both sides of the flange.

Figure 6 — Measurement dimension of flange strength

9 Marking

A cartridge for gas appliances satisfying all the requirements in this document shall be indelibly marked at a noticeable place with the following information:

- a) caution against fire and high temperature;
- b) text explaining that, since a non-refillable LPG cartridge is a dangerous flammable product using high pressure gas, the following shall be observed in its use:
 - 1) do not burn charcoal on the gas appliances, or use two or more gas appliances by placing them side by side;
 - 2) since an evaluation in temperature can cause bursting of the product, avoid putting the cartridge in any place exposed to direct sunlight or near the fire where the temperature can become 40 °C or higher;
 - 3) do not put into fire;
 - 4) make sure the cartridge has been used up before disposing;
 - 5) do not refill the gas;
 - 6) do not place on an induction cooker (using on an induction cooker is strictly prohibited);
- c) for high pressure gas, the type of gas used;
- d) the name of the cartridge;
- e) information related to the installation of the cartridge;
- f) information related to the storage of the cartridge;
- g) information related to the handling of the used-up cartridge;
- h) information related to the use method of the cartridge;
- i) information related to the filled LPG;
- j) information related to the cautionary marking of an incorrect installation;
- k) information related to the caution against overheating the cartridge;
- l) information related to the danger of inhalation;
- m) information related to the ventilation and the using space;
- n) the name of gas filling works or an abbreviation thereof;
- o) the company name of the sales representative;
- p) the year and month of manufacture or an abbreviation thereof;
- q) the serial number or lot number;

The character size and colour required can be specified in the regulations of the country or region.

In Japan, the character size shall conform to the requirements specified in [A.5.1](#).

In Japan, the colour shall conform to the requirements specified in [A.5.2](#).

Annex A (normative)

Specific regional requirements

A.1 General

For the purposes of this annex, the specific regional requirements are applicable in the countries shown. Only the affected subclause is mentioned, hence the numbering is non-consecutive.

A.2 Dimensions of cartridge and cartridge valve

The dimensions of cartridge and cartridge valve for total height and boss diameter, when tested by the method described in 8.3, shall conform to the requirements given in Tables A.1 and A.2.

Table A.1 — Dimensions of cartridges and cartridge valve for total height

China and Japan
(185,2 ± 0,6) mm

Table A.2 — Dimensions of cartridges and cartridge valve for boss diameter

China and Japan
(10,65 ± 0,06) mm

A.3 Material of cartridge stem

A.3.1 In the Republic of Korea, the melting point of material for the cartridge stem shall be above 350 °C.

A.3.2 In Japan, the material of the cartridge stem shall be follows:

- a) the material of stem shall be the one specified in JIS H 3250;
- b) in cases where the material is other than JIS H 3250, the heat resistance test shall be carried out according to the following test method:
 - 1) place the sample in gas or electric furnace;
 - 2) after raising the temperature slowly up to 500 °C, keep the temperature for 1 h;
 - 3) confirm that there is no melting by a visual check.

A.4 LPG composition test

In Japan, the LPG composition test shall be in accordance with JIS K 2301.