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International Standard ISO 90/1

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Light gauge metal containers — Definitions and determination methods for dimensions and capacities — Part 1 : Open-top cans

Récipients métalliques légers — Définitions et méthodes de détermination des dimensions et des capacités — Partie 1 : Boîtes serties

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 90/1 was prepared by Technical Committee ISO/TC 52, *Light gauge metal containers.*

This first edition together with the first editions of ISO 90/2 and ISO 90/3 cancel and replace ISO 90-1977, of which they constitute a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Light gauge metal containers — Definitions and determination methods for dimensions and capacities — Part 1 : Open-top cans

0 Introduction

ISO 90 is a series of three parts which groups definitions, determination methods for dimensions and capacities, and tolerances and designations of light gauge metal containers.

This part of ISO 90 covers open-top cans as defined in 2.1 and is applicable to both round and non-round cans.

NOTE — Capacities, diameters and cross-sections are specified in ISO 1361, *Light gauge metal containers — Open-top cans — Round cans — Internal diameters,* and ISO 3004 (Parts 1 to 6), *Light gauge metal containers — Capacities and related cross-sections.*

The two other parts are

Part 2 : General use containers.

Part 3 : Aerosol cans.

NOTE — A "general use container" is a container which is sealed after filling with a closure that need not be double-seamed. An "aerosol can" is a non-refillable can intended to contain a product which is dispensed by pre-stored pressure in a controlled manner through a valve.

1 Scope and field of application

This part of ISO 90 defines open-top cans and can types, cross-sections, constructions, shapes, special features and capacities. It specifies methods for determining cross-sections and gross lidded capacities. It also gives tolerances on capacity and recommends an international designation.

2 Definitions

For the purposes of ISO 90 and related International Standards, the following definitions apply.

2.1 Cans

2.1.1 can : Rigid container made of metal with a maximum nominal material thickness of 0,49 mm.

2.1.2 open-top can : Can one end of which is double-seamed after filling.

2.1.2.1 open-top can for food products : Open-top can, tight to liquids and gases, preventing recontamination of the contents by micro-organisms.

2.1.2.2 diaphragmed can : Friction-closure can which is fitted with a diaphragm.

A friction-closure can is a can with a double-seamed ring on top and a plug which fits into the ring.

2.2 Cross-sections

2.2.1 round can: Can with a circular cross-section.

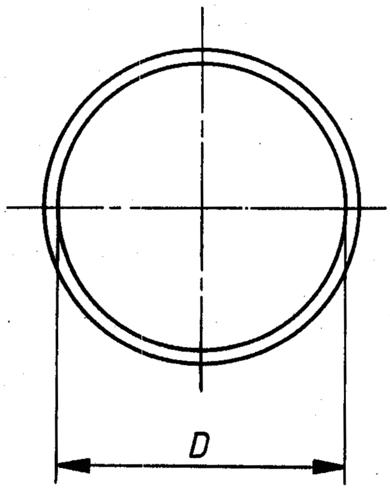


Figure 1

2.2.2 rectangular can: Can with a rectangular [see figure 2 a)] or square [see figure 2 b)] cross-section.

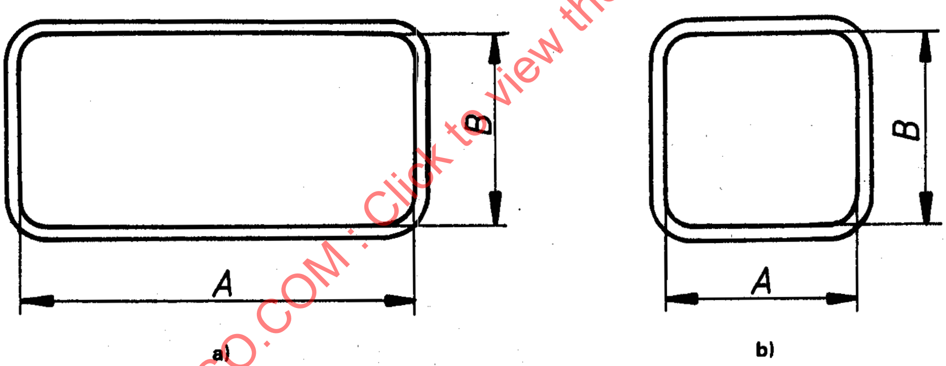


Figure 2

2.2.3 obround can: Can with a cross-section of parallel sides of equal length joined by two curved ends; these may be semicircular [see figure 3 a)] or include different radii [see figure 3 b)].

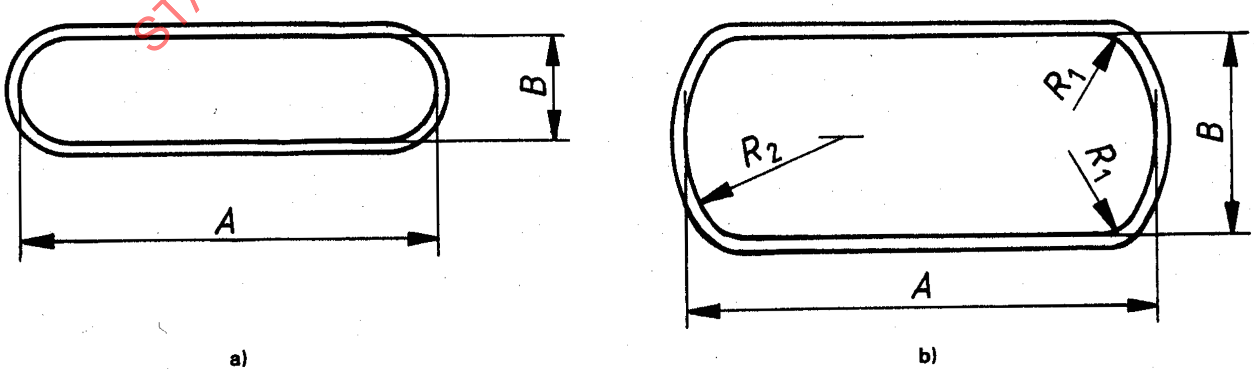


Figure 3

2.2.4 oval can: Can with an oval cross-section.

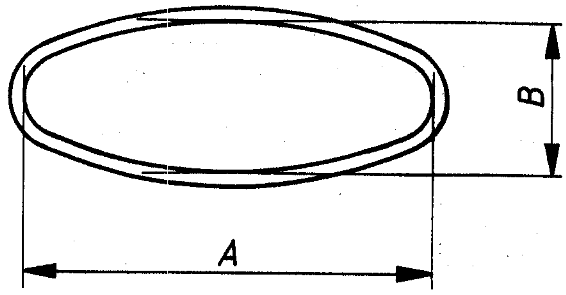
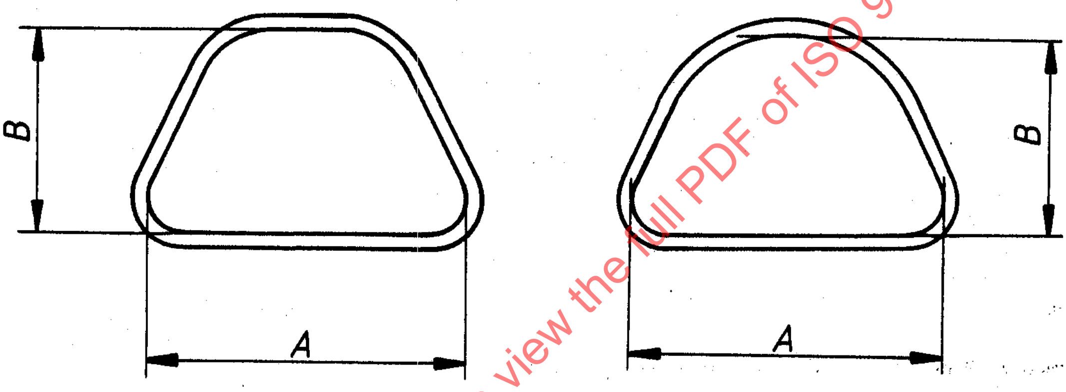


Figure 4

2.2.5 trapezoidal can: Can with an approximately trapezoidal cross-section with rounded corners. The shorter of the parallel sides [see figure 5 a)] and the non-parallel sides [see figure 5 b)] may be curved.



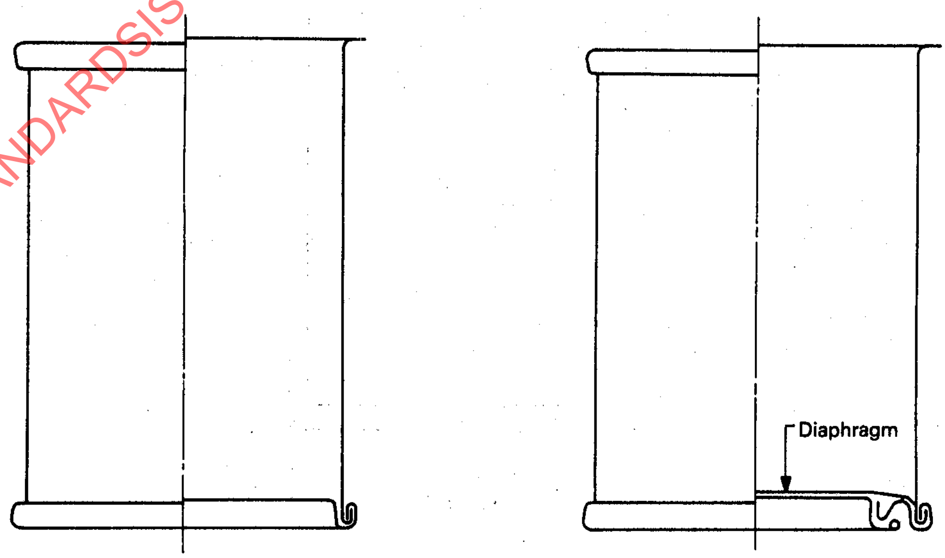
a) b)

Figure 5

NOTE — Some variations of the trapezoidal can are also known as pear-shaped cans.

2.3 Constructions

2.3.1 three-piece can; built-up can: Can made from three main components: body, top end and bottom end.



a) Open-top can b) Diaphragmed can

Figure 6

2.3.2 two-piece can: Can made from two main components: body and bottom which are one piece, and a top end.

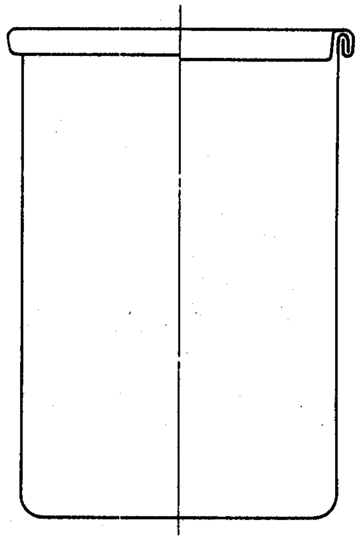


Figure 7

2.4 Shapes

NOTE — Figures 8 and 9 apply to both round and non-round cross-sections.

2.4.1 cylindrical can: Can the cross-section of which is constant in dimension from top to bottom, local variations caused by special features, such as beading, necking-in, etc., being disregarded.

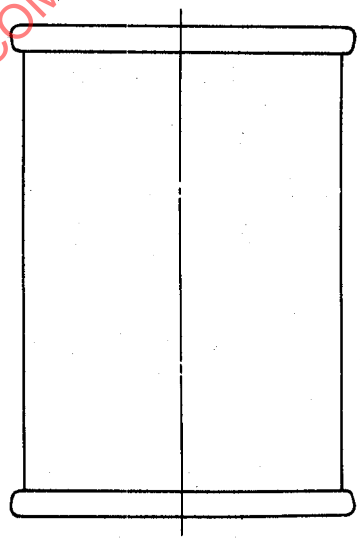


Figure 8

2.4.2 tapered can: Can the cross-section of which changes in dimension from top to bottom, local variations caused by special features, such as beading, necking-in, etc., being disregarded.

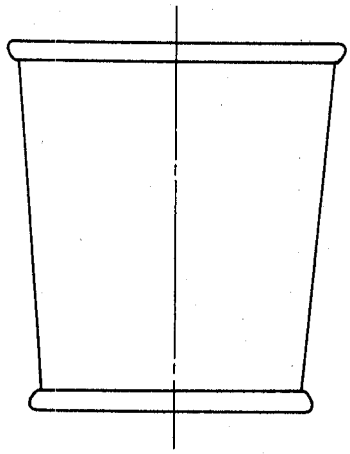


Figure 9

2.5 Special features

NOTE — Figures 10 to 12 apply to both round and non-round cross-sections.

2.5.1 necked-in can: Can the body of which has been reduced in cross-section at one or both extremities.

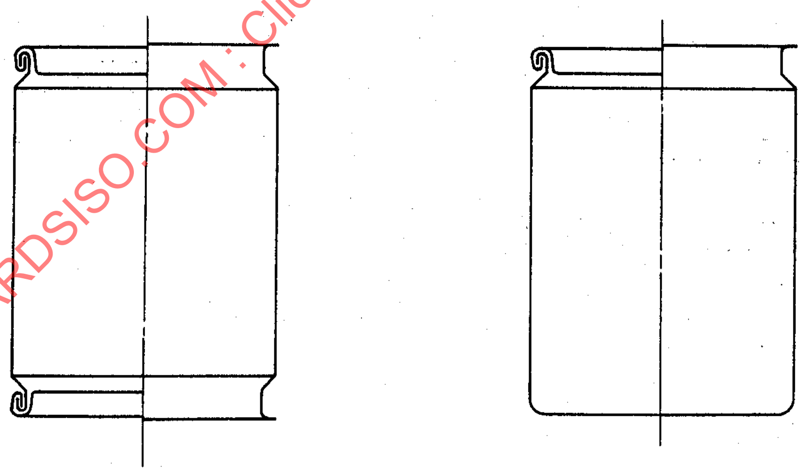


Figure 10

2.5.2 step-sided: Can of which one extremity of the body has been increased in cross-section.

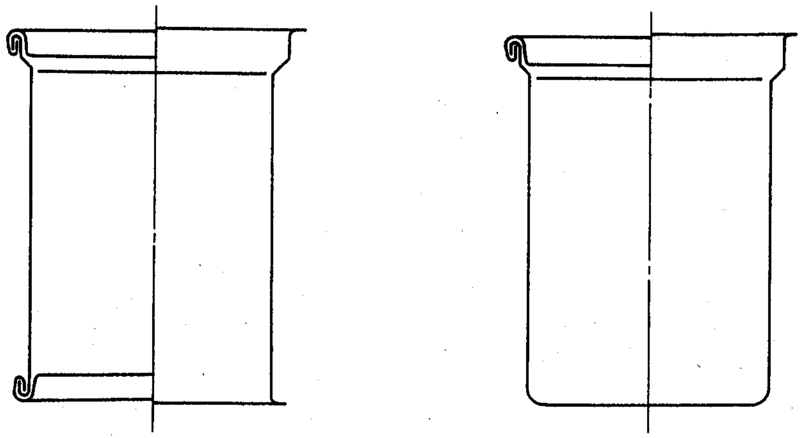


Figure 11

2.5.3 beaded can: Can the body of which has small internal and/or external peripheral changes in cross-section.

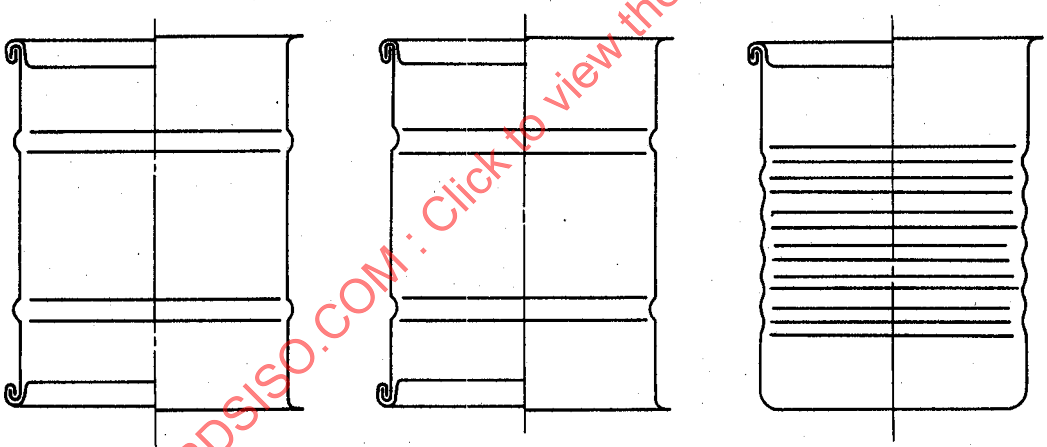


Figure 12

2.6 Capacities

2.6.1 nominal filling volume, V (in millilitres): The volume of product that the can is required to hold.

2.6.2 gross lidded capacity, C (in millilitres): The total capacity of a closed can, determined in accordance with 4.2 (empty can) or annex B (full can).

3 Determination of dimensions

3.1 Measurement of cross-sections

3.1.1 Measure the internal body cross-section using a plug gauge or derive it from the external cross-section measured with a vernier caliper.

3.1.2 Measure the necked-in or step-sided opening cross-section using a plug gauge applied to the internal cross-section of the extremity to which the end is to be fixed.

3.1.3 Measure the opening cross-section of a cylindrical or tapered can using a plug gauge applied to the internal cross-section of the extremity to which the end is to be fixed.

3.2 Nominal cross-sections

Where a series of standard internal body cross-sections has been agreed, the tolerances define the limits of acceptable deviation resulting from variations in can design and manufacture.

Determine nominal cross-sections by rounding the standard internal body cross-sections (see 3.1.1) or necked-in or step-sided cross-sections (see 3.1.2) to the nearest whole millimetre (if the first decimal is 5 or above, round up; in all other cases, round down).

3.3 Measurement of height

See annex A.

3.4 Characteristic dimensions

Nominal cross-sections are characterized by the data specified in 3.4.1 to 3.4.4.

3.4.1 Cylindrical round cans

Dimension D (see 2.2.1).

3.4.2 Cylindrical non-round cans

Dimensions A and B (see 2.2.2 to 2.2.5).

3.4.3 Tapered round cans

Dimensions D_1 and D_2, of which D_1 is the larger, and D_2 the smaller dimension (see clause 6).

3.4.4 Tapered non-round cans

Dimensions A_1, B_1, A_2 and B_2, of which A_1 and B_1 are the larger, and A_2 and B_2 the smaller dimensions (see clause 6).

3.5 Special features

3.5.1 Necked-in cans

The cross-sections in the necked-in area shall be indicated as follows (see clause 6):

- round cans: D_N
- non-round cans: $A_N \times B_N$

3.5.2 Step-sided cans

The cross-sections in the step-sided area shall be indicated as follows (see clause 6):

- round cans: D_S
- non-round cans: $A_S \times B_S$

4 Determination of gross lidded capacity

4.1 General

The methods for determining capacity all rely on obtaining the mass of water in the can. For cans with a capacity equal to or greater than 400 ml, a correction factor (see 4.1.1) can be applied, but only if a very precise determination of capacity is necessary.

4.1.1 Temperature-dependent correction factor

Table 1 — Correction factors

Water temperature °C	Correction factor F
12	1,000 5
14	1,000 8
16	1,001 1
18	1,001 4
20	1,001 8
22	1,002 2
24	1,002 7
26	1,003 3
28	1,003 8
30	1,004 4

4.1.2 Accuracy of the balances

The scales used for weighing the cans shall be at least as accurate as specified in table 2.

Table 2 — Balance accuracy

Mass of can m g	Accuracy g
$m <$ 500	± 0,5
500 $< m <$ 2 500	± 1,0
2 500 $< m <$ 5 000	± 2,5
5 000 $< m$	± 5,0

4.1.3 Cans with flexing top and bottom ends

The development of containers in relatively thin materials has in some cases led to the introduction of top/bottom ends with intentional flexibility: these ends are produced in convex shape; after sterilization and cooling, the bow changes to concave similar to other open-top can ends.

They are used for large cans on which the body would collapse due to the vacuum produced as a result of hot-filling, irrespective of whether they are beaded or not. On account of the changing bow of the ends the container has no absolute fixed capacity. As long as there is no acceptable method for measuring the capacity of cans with such flexing ends, this capacity has to be considered as equal to the capacity of similar cans with non-flexing ends.

4.2 Determination of gross lidded capacity, C (empty cans)

NOTE — The gross lidded capacity is normally determined on empty cans. If the capacity of filled cans has to be determined, the method described in annex B can be applied.

4.2.1 Attach one end to the body by the usual method for three-piece cans only.

4.2.2 Drill two holes, 3 to 6 mm in diameter and about 7 mm apart, in the loose end of the can from the inside surface outwards (the positioning of the holes depends on the end profile). In non-round ends, drill the holes as close as possible to a corner radius.

4.2.3 Attach this end to the body by the usual method.

4.2.4 Determine the mass of the empty can, m_1, in grams, as accurately as possible (see 4.1.2).

4.2.5 If necessary, measure the temperature of the water to be used (see 4.1.1).

4.2.6 Fill the can with water through one of the holes, with the can inclined at an angle to the vertical so that the holes are as high as possible.

When water runs out of the second hole, close the holes with the fingers, shake the can gently, and complete filling.

4.2.7 If the above filling method would result in distortion (due to deformation of the can), proceed as follows:

Place the can in a container, filled with water, with the can inclined at an angle to the vertical so that the holes are as high as possible. Fill the can completely with water through one of the holes. The water in the container should be not more than 10 mm below the highest point of the can. Close the holes with small strips of adhesive tape. Remove the can from the container.

4.2.8 Remove any surplus water from the outside of the can.

4.2.9 Determine the mass of the filled can, m_2, in grams, as accurately as possible (see 4.1.2).

4.2.10 The difference between the weighings $(m_2 - m_1)$, if necessary multiplied by the relevant correction factor (see 4.1.1), represents the gross lidded capacity, C, of the can, in millilitres.

5 Tolerances on capacities

5.1 General

Where a series of standard nominal capacities has been agreed, tolerances are as given in tables 3 and 4.

These tolerances define the limits of acceptable deviation resulting from variations in can design and manufacture.

At least 99,7 % of the individual cans shall lie within these limits.[1)]

5.2 Tolerances applicable to round cans

Table 3 — Tolerances on gross lidded capacities for round cans

Gross lidded capacity	Tolerances	
ml	%	ml
< 80	± 5	
80 to 100		± 4
101 to 150	± 4	
151 to 200		± 6
201 to 266	± 3	
267 to 320		± 8
321 to 520	± 2,5	
521 to 650		± 13
651 to 1 000	± 2	
1 001 to 1 334		± 20
1 335 to 2 000	± 1,5	
2 001 to 3 000		± 30
> 3 000	± 1	

1) This percentage is derived from statistical theory: when a variable, X, is distributed according to a normal distribution of parameters m and σ (where m is the arithmetical mean and σ is the standard deviation), 99,7 % of its values are between $(m - 3\sigma)$ and $(m + 3\sigma)$.

5.3 Tolerances applicable to non-round cans

Table 4 — Tolerances on gross lidded capacities for non-round cans

Gross lidded capacity ml	Tolerances %	Tolerances ml
< 80	± 5	
80 to 100		± 4
101 to 150	± 4	
151 to 200		± 6
201 to 266	± 3	
267 to 320		± 8
321 to 520	± 2,5	
521 to 650		± 13
> 650	± 2	

6 Designation

It is recommended that open-top cans be designated internationally by

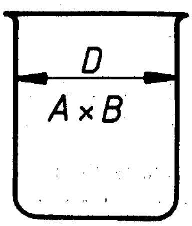
a) a code letter for tapered (T), step-sided (S), necked-in (N) or diaphragmed (D) cans;

b) their nominal gross lidded capacity, *C*, or their nominal filling volume (carbonated drink cans only), expressed in millilitres;

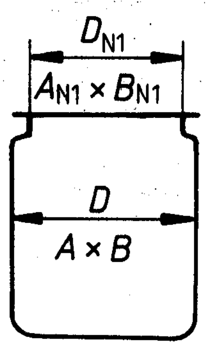
c) their characteristic nominal dimensions, expressed in millimetres, in accordance with 3.2 and 3.4;

d) the nominal dimensions of the ends for necked-in or step-sided cans in accordance with 3.5, immediately after the body dimensions.

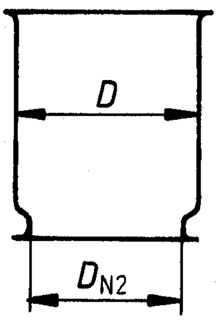
Designation examples are given in figure 13.



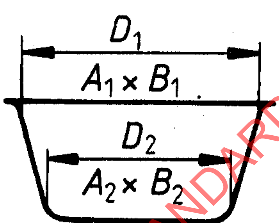
a) Cylindrical cans



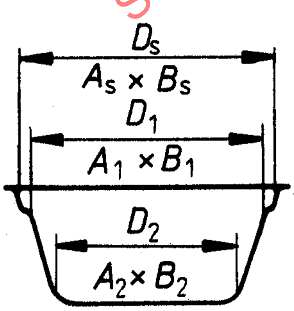
b) Necked-in cylindrical cans (top end)



c) Necked-in cylindrical cans (bottom end)



d) Tapered cans



e) Step-sided tapered cans

Designation examples

Code letter	Round cans	Non-round cans
—	$C - D$	$C - A \times B$
N	$C - D / D_{N1}$	$C - A \times B / A_{N1} \times B_{N1}$
N	$C - D / D_{N2}$	—
T	$C - D_1 / D_2$	$C - A_1 \times B_1 / A_2 \times B_2$
S	$C - D_1 / D_2 / D_S$	$C - A_1 \times B_1 / A_2 \times B_2 / A_S \times B_S$

Figure 13