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**Snap-on bottles for metering pumps —**

**Part 3:  
Plastic**

*Flacons encliquetables pour pompes doseuses —  
Partie 3: Plastique*

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 76, *Transfusion, infusion and injection, and blood processing equipment for medical and pharmaceutical use*.

A list of all parts in the ISO 24166 series can be found on the ISO website.

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](http://www.iso.org/members.html).

## Introduction

This document is part of a series of International Standards for containers made from different materials used in combination with metering pumps for medicinal applications.

Glass containers are mainly used for that purpose. Plastic containers can be used as an alternative.

This document can be used for the development of standardized filling and assembling equipment.

Based on the dimensions of the containers, appropriate components, such as metering pumps and other closure systems can be developed and standardized. As such this document provides important inputs for developing entire packaging systems for medicinal applications.

Primary packaging materials are an integral part of medicinal products. Thus, depending on the jurisdiction, the principles of the current Good Manufacturing Practices (cGMP) can apply to the manufacturing of these components (e.g. ISO 15378).

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# Snap-on bottles for metering pumps —

## Part 3: Plastic

### 1 Scope

This document specifies the shape, dimensions, fill capacities and performance requirements of plastic bottles for metering pumps. It also specifies the material for the manufacturing of such containers as well as the secondary packaging.

The document provides requirements for packaging of the plastic bottles and addresses nonsterile, ready to sterilize or sterile as three possible options.

This document is applicable to colourless or coloured containers moulded from plastic and intended to be used in the packaging, storage or transportation of products intended for medicinal use.

### 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 11607-1, *Packaging for terminally sterilized medical devices — Part 1: Requirements for materials, sterile barrier systems and packaging systems*

ISO 11607-2, *Packaging for terminally sterilized medical devices — Part 2: Validation requirements for forming, sealing and assembly processes*

### 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 base foil

packaging component for protection of the pallet load from contamination

#### 3.2 bottle vial

container made of a suitable material, which is intended for packaging, storage and application of liquid medicinal products

EXAMPLE Tubular glass, moulded glass or plastic.

**3.3**  
**brimful capacity**

volume of water required to fill a container, placed on a flat, horizontal surface

[SOURCE: ISO 4802-1:2016, 3.3]

**3.4**  
**chemical indicator**

test system that reveals change in one or more pre-defined process variables based on a chemical change resulting from exposure to a process

[SOURCE: ISO 11139: 2018, 3.43, modified — "pre-specified" was replaced with "pre-defined", "or physical" was deleted.]

**3.5**  
**customer**

business entity that purchases bottles for metering pumps and conducts further processing or filling as appropriate

[SOURCE: ISO 21882:2019, 3.1 modified — "sterilized ready for filling vials" was replaced with "bottles for metering pumps".]

**3.6**  
**dip-tube**

conduit, part of the metering pump, which delivers the product from the bottle to the metering mechanism

**3.7**  
**foil bag**

gas permeable or non-permeable bag

Note 1 to entry: Foil bags can be used as *sterile barrier system* (3.17) or as *protective packaging* (3.13), depending on final usage.

**3.8**  
**label**

written, printed or graphic information appearing on the item itself, on the packaging of each item or on the packaging of multiple items

[SOURCE: IMDRF/GRRP WG/N52:2019, 3.17, modified – replaced "unit" and "devices" with "item"]

**3.9**  
**manufacturer**

business entity that manufactures or is otherwise responsible for the manufacturing of the bottles ready to be filled by the *customer* (3.4)

[SOURCE: ISO 21882:2019, 3.14 modified – "performs" was replaced with "manufactures", "vials" was replaced with "bottles".]

**3.10**  
**metering pump**

device actuated by the user to deliver a specific dose of liquid

**3.11**  
**packaging system**

combination of a sterile barrier system and protective packaging

[SOURCE: ISO 11139:2018, 3.192]

**3.12**  
**pallet**

construction for transportation and storage of goods

**3.13****protective packaging**

configuration of materials designed to prevent damage to the sterile barrier system and its contents from the time of their assembly until the point of use

[SOURCE: ISO 11139:2018, 3.219]

**3.14****sealing ring**

bottle feature on top of the flange to support tightness

**3.15****shipper box**

protective packaging for the foil bags

**3.16****snap-on bottle**

container with press-fit for metering pumps

**3.17****sterile barrier system****SBS**

minimum package that minimizes the risk of ingress of microorganisms and allows aseptic presentation of the sterile contents at the point of use

[SOURCE: ISO 11139:2018, 3.272]

**3.18****transport cover**

outside packaging layer protecting against environmental hazards and keeping the *shipper boxes* ([3.15](#)) in place

**4 Symbols**

$t$	bottom concavity
$d_1$	outer diameter body
$h_1$	total length
$h_2$	length cylindrical part of the body
$h_3$	inner depth
$r_1$	shoulder radius
$r_2$	bottom radius
$s_1$	wall thickness body
$s_2$	wall thickness bottom
P	plastic

## 5 Dimensions

### 5.1 General

The dimensions including tolerances are a function of manufacturing processes and materials. The currently practiced processes to achieve the required tolerances are Injection Blow Molding (IBM) and Injection Stretch Blow Molding (ISBM).

To achieve the specified dimensions and tolerances, it is recommended that the offset of the mould halve and insert for forming the neck finish are vertically max. 0,05 mm and horizontally max. 0,1 mm.

The dimensions and tolerances are established to achieve a neck that allows a snap-on functionality with the metering pump. This functionality can be challenged by a tightness test. An example of a snap-on process including positioning of the dip-tube as well as a typical tightness test is given in [Annex A](#) and [Annex B](#).

A test method for the inner depth as shown in [Table 1](#) and [Table 2](#) is described in [Annex C](#).

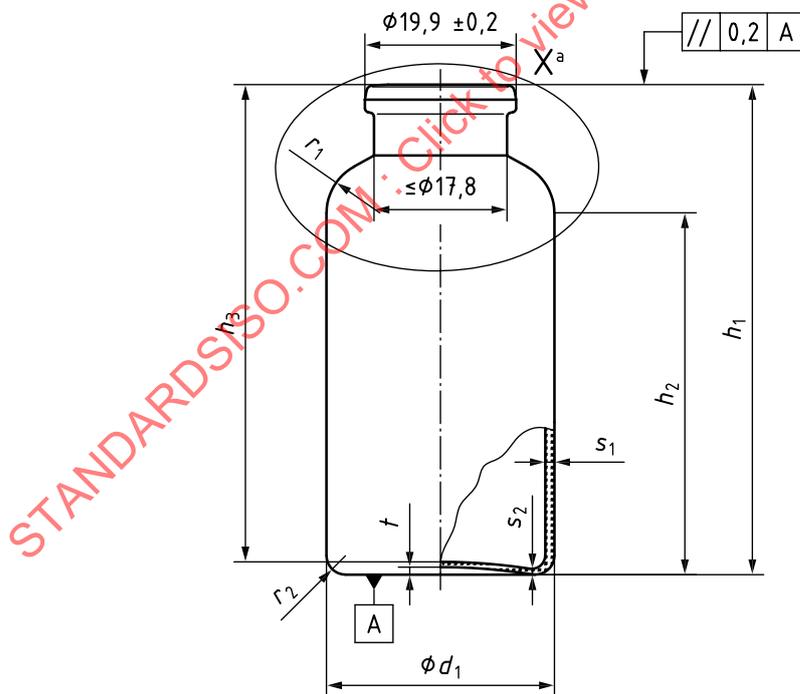
The material and wall thickness,  $s_1$ , shall meet the specified performance properties, e.g. oxygen and water vapour permeability and shall resist the vertical load as explained in [7.2](#).

The bottles can be manufactured with or without a sealing ring.

### 5.2 Bottles without sealing ring

The dimensions of snap-on bottles made of plastic shall meet the requirements of [Figure 1](#) and [Figure 2](#), as appropriate, and [Table 1](#); the brimful capacity shall be as shown in [Table 1](#).

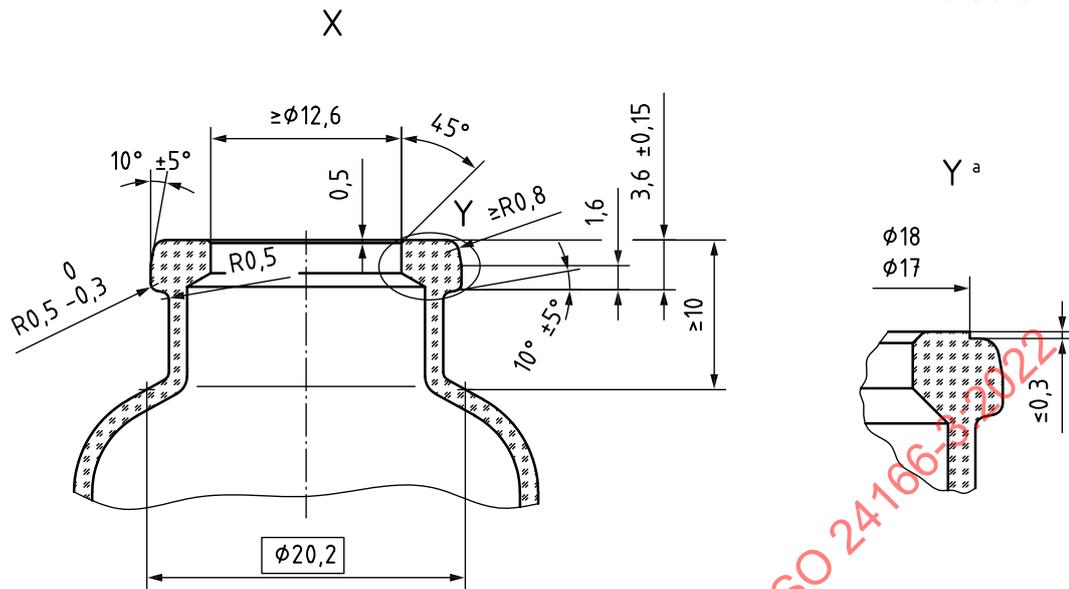
Dimensions in millimetres



<sup>a</sup> See [Figure 2](#).

**Figure 1 — Snap-on bottle without sealing ring**

Dimensions in millimetres



a Flat neck finish (an offset 0,3 is alternatively also feasible).

Figure 2 — Neck finish without sealing ring

Table 1 — Brimful capacity and dimensions of snap-on bottles made of plastic without sealing ring

Dimensions in millimetres

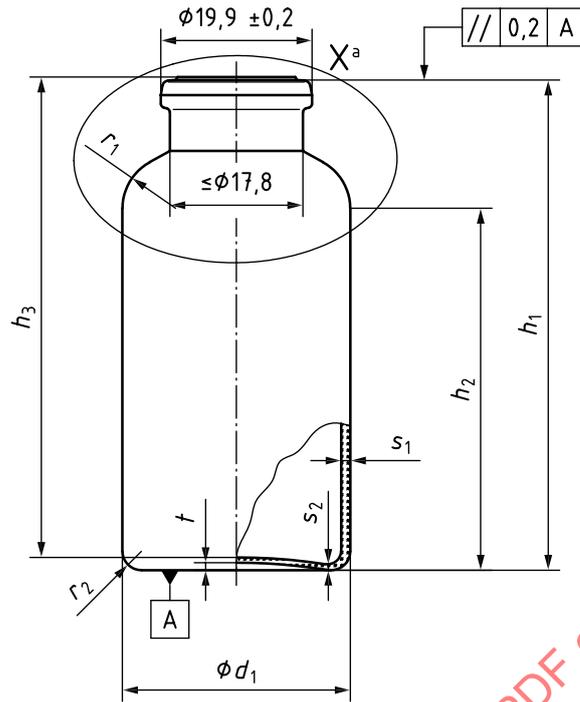
Size of the bottle	Brimful capacity ml	$d_1$		$h_1$		$h_2$		$h_3$		$r_1$	$r_2$	$s_1$	$s_2$	$t$
			Tol.		Tol.				Tol.					
5P	9,2	±1,0	22,0	±0,3	40,0	±0,5	23,5	38,4	±0,5	4,0	2,5	0,6	0,4	1,0
10P	16,8		25,5		49,2		29,5	45,3		5,0	2,5			
15P	19,7		55,3		±0,6		35,0	52,2		3,0	2,0			
20P	25,5	±1,5	31,0	±0,4	50,7	±0,7	27,5	48,0	±0,5	6,0	3,0	0,8	0,5	1,0
30P	35,0		65,2		42,0		61,8	7,0		3,5				
50P	60,5	±3,0	35,0	±0,5	85,6	±0,8	59,0	82,0	±0,5	7,0	3,5	0,8	0,5	1,0
100P	118,0		44,5		99,3		±1,0	75,0		95,0	4,5			

Wall thickness,  $s_1$ , shall be sufficient to resist the vertical force requirements.

### 5.3 Bottles with sealing ring

The dimensions of snap-on bottles made of plastic shall meet the requirements of [Figure 3](#), [Figure 4](#) and [Table 2](#). The brimful capacity shall be as shown in [Table 2](#).

Dimensions in millimetres



a See [Figure 4](#).

Figure 3 — Snap-on bottle with sealing ring

Dimensions in millimetres

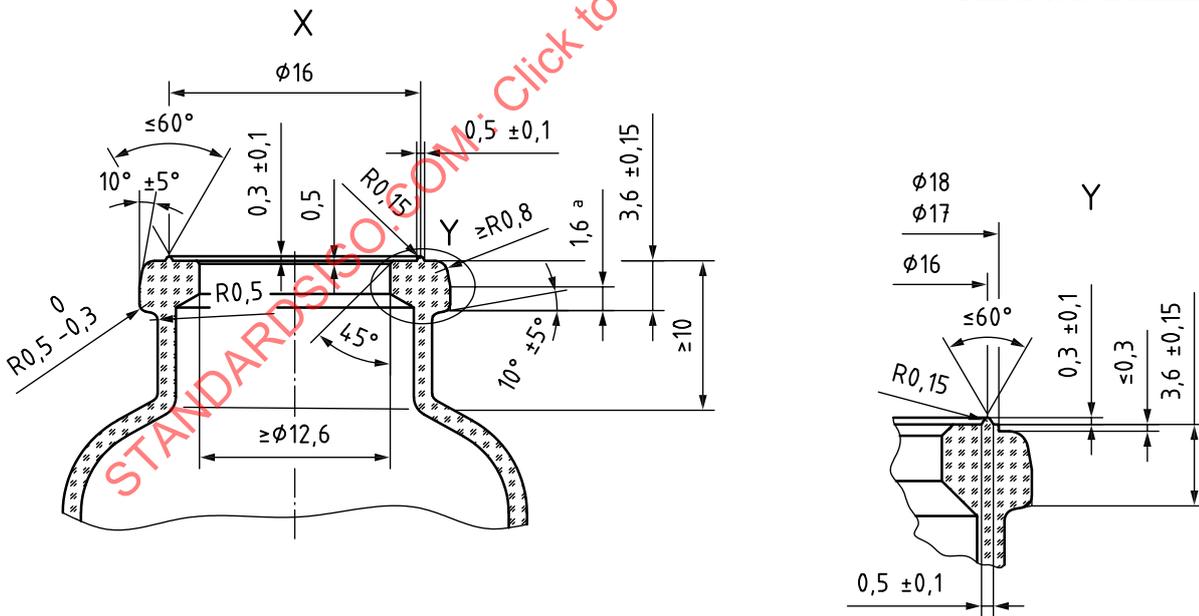


Figure 4 — Neck finish with sealing ring

**Table 2 — Brimful capacity and dimensions of snap-on bottles made of plastic with sealing ring**  
 Dimensions in millimetres

Size of the bottle	Brimful capacity ml		$d_1$		$h_1$		$h_2$	$h_3$		$r_1$	$r_2$	$t$
		Tol.		Tol.		Tol.			Tol.			min.
5P	9,2	±1,0	22,0	±0,3	40,3	±0,5	23,5	38,7	±0,5	4,0	2,5	1,0
10P	16,8		25,5		49,5		29,5	45,6		5,0	2,5	
15P	19,7		55,6		±0,6	35,0	52,5	3,0		2,0		
20P	25,5	±1,5	31,0	±0,4	51,0	27,5	48,3	6,0		3,0	3,0	
30P	35,0				65,5	±0,7	42,0					
50P	60,5		35,0	±0,5	85,9	±0,8	59,0	82,3		7,0	3,5	
100P	118,0	±3,0	44,5		99,6	±1,0	75,0	95,3		4,5		

Wall thickness,  $a$ , shall be sufficient to resist the vertical force requirements.

## 6 Materials

Materials for plastic bottles for use with metering pumps shall be suitable for the manufacturing process, the sterilization method, storage, and fill-finish process with assembly of metering pumps.

The following properties shall be considered when selecting the raw materials for the plastic bottle:

- physical and chemical properties e.g. oxygen and water vapour permeability;
- suitability for the intended sterilization process;
- functionality regarding fill-finish;
- robustness of the bottle during transport from the manufacturer to the customer (no deformation).

The following should be considered depending on the application and the intended use, as specified by the customer:

- conformity to applicable pharmacopoeia monographs;
- material composition requirements to meet specific drug/container interactions;
- shelf-life limitation requirements.

## 7 Requirements

### 7.1 General requirements

The following requirements shall be met to enable the functionality between the bottle and the metering pump:

- snap-on bottle sealing surfaces shall be free from grooves, ripples and undulations sufficient to affect the sealing performance when combined with the metering pump;
- the bottom shall have a shape and an inner surface that allows the dip-tube of the metering pump moving into a position of the bottle to minimize the residual volume;
- the supplier and the customer shall agree on the specifications for such sealing and bottom surfaces.

## 7.2 Physical requirements

### 7.2.1 Vertical Force

The bottles shall resist a vertical force of min 600 N. The supplier and the customer shall agree on an Acceptable Quality Limit (AQL) for this limit value. A test method is given in [Annex D](#).

### 7.2.2 Particulate contaminations

Plastic bottles for snap-on metering pumps shall be manufactured by processes that minimize the risk of particulate contamination.

The manufacturer and the customer should agree upon the size and number of visible particles and the test method.

NOTE 1 Currently no particle specifications are assigned for sub-visible particles regarding devices for non-parenteral products.

NOTE 2 Current pharmacopoeias identify visible particulates as undesirable but do not define the size or put a limit on the allowable number for non-parenteral products.

## 7.3 Chemical requirements

Raw materials with low migration properties should be preferred for manufacturing plastic bottles.

An investigation of extractables of the plastic bottles shall consider all manufacturing steps including sterilization as applicable and the impact of all packaging material around the bottle as provided to the customer.

NOTE For test methods, see regional or national pharmacopoeias or the EMA Guideline on plastic immediate packaging materials.

## 7.4 Sterilization

If the plastic bottles are provided sterile, the sterilization method shall be validated in accordance with a suitable sterilization International Standard (e.g. ISO 11135, ISO 17665-1, ISO 11137-1 or ISO 14937).

## 8 Marking of the bottle

The specification of the marking applied to the bottle, e.g. cavity number, are subject to agreement between customer and the manufacturer.

## 9 Packaging options

### 9.1 General packaging requirements

In general, there are three different conditions of packaging for the bottles due to the requirements of the customer. The product can be provided nonsterile, ready to sterilize or sterile.

The packaging shall protect the product from alteration, contamination or damage when exposed to expected conditions and hazards during processing, storage, handling and distribution.

All packaging configurations shall include the following parts (from outside to inside):

- pallet;
- label;
- transport cover;

- shipper box.

A base foil can be added as an optional component to protect the pallet load from particles, dust, environmental hazards, etc. that could be necessary for certain types of pallets.

An example is given in [Annex E](#).

## 9.2 Packaging for nonsterile plastic bottles

This packaging configuration is not designed for sterilization of the bottles. In addition to the packaging components specified in [9.1](#), the plastic bottles shall be packaged in double foil bags with a closure or seal that prevents contamination of the content.

## 9.3 Ready to sterilize or sterile plastic bottles

The packaging shall be designed and validated as a packaging system with protective packaging and sterile barrier system(s) in accordance with the requirements of ISO 11607-1 and ISO 11607-2 and compatible with the selected sterilization process. In addition to the packaging components specified in [9.1](#), the following requirements apply:

- the bottles shall be sealed in minimum 2 layers of foil bags. As a minimum, the last inner layer foil bag shall be designed and validated as a SBS. Further foil bags can be validated as an SBS depending on the requirement of the customer.
- the packaging shall be provided with an appropriate chemical indicator that indicates that the product has been exposed to the specified sterilization process.

## Annex A (informative)

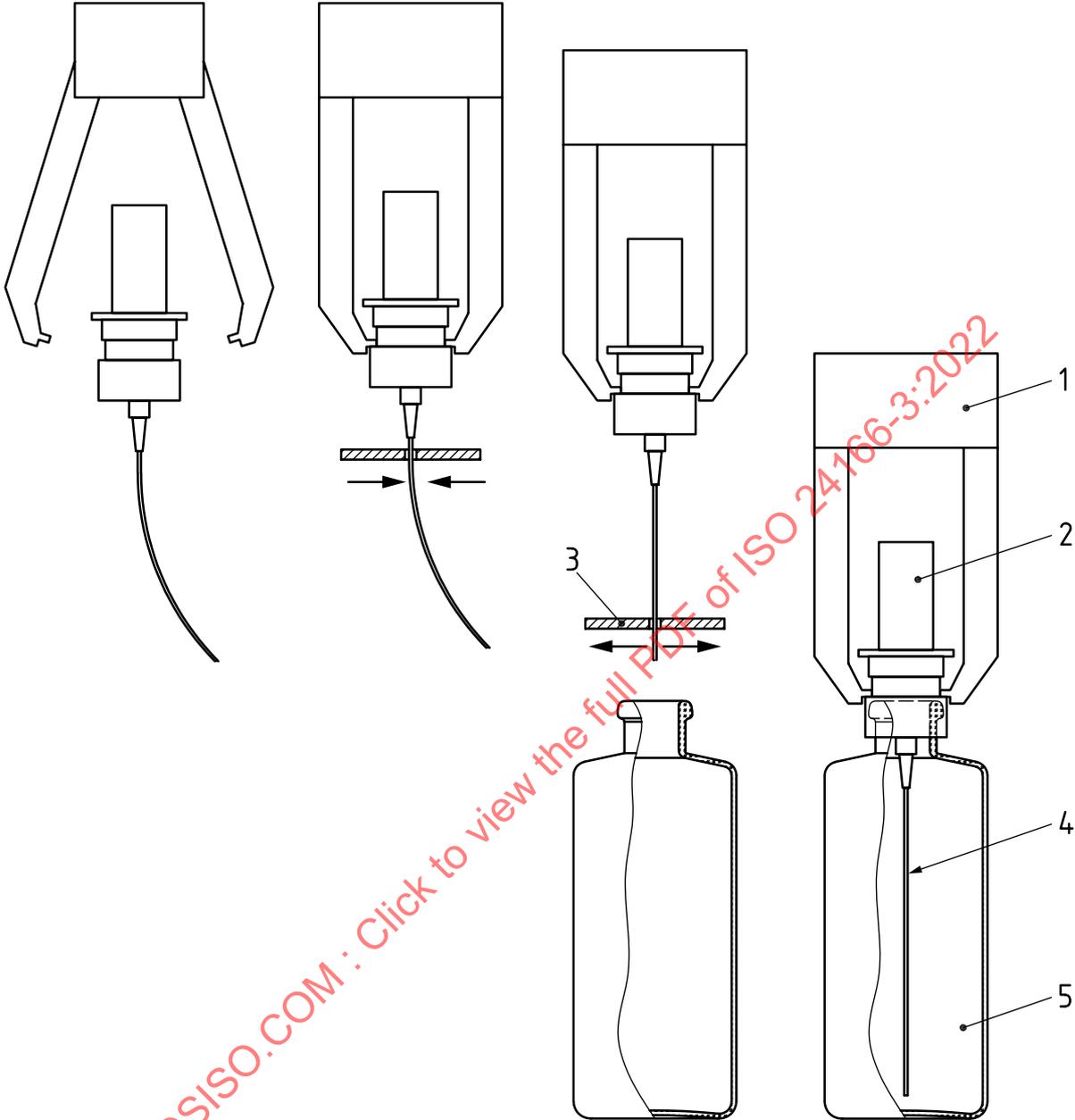
### Snap-on considerations

The following considerations are important for an efficient and safe snap-on process:

- the neck finish dimensions (see [Clause 5](#));
- the material of the bottle;
- the correct positioning of metering pump, dip-tube and bottle;
- the way how the force is applied to achieve the snap on.

[Figure A.1](#) shows an example of a snap-on process using a mechanical gripper system and a dip-tube stripper prism that maintains the dip-tube in a middle position. In this example, the force is transferred over the metering pump snap body, and not over the nasal adapter, to ensure that the resulting pressure is distributed evenly over the entire closure sealing rim.

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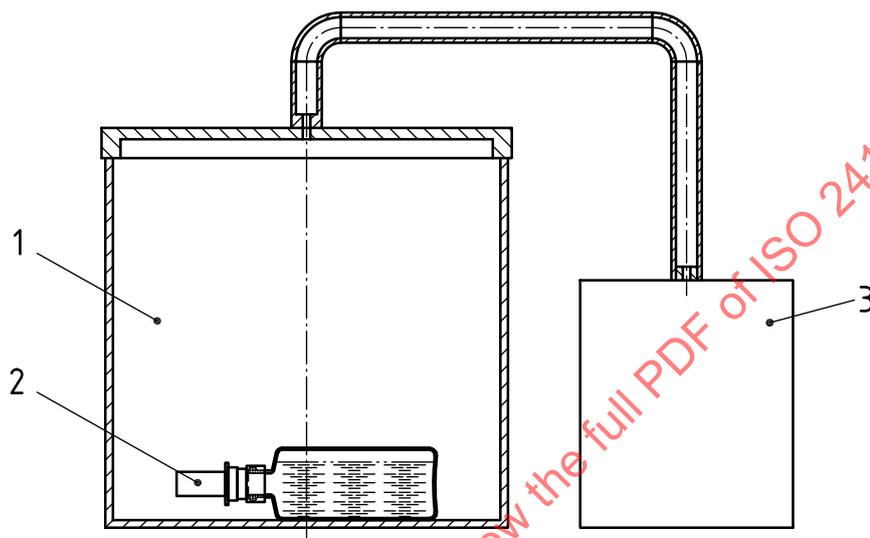
- Key**
- 1 mechanical gripper system
  - 2 metering pump
  - 3 dip-tube stripper prism
  - 4 dip-tube
  - 5 bottle

Figure A.1 — Snap-on process

## Annex B (informative)

### Tightness test

This annex proposes a test method suitable for verifying the integrity of the entire system. An example of a test equipment is shown in [Figure B.1](#).



#### Key

- 1 desiccator
- 2 test device filled with liquid, e.g. methylene blue solution
- 3 vacuum pump

**Figure B.1 — Schematic test description**

The filled device is placed for 10 min in a desiccator at 500 hPa absolute pressure. After the storage time the system is checked if any liquid leaked from the container. If yes, the test failed.

## Annex C (informative)

### Inner depth measuring

Place the bottle on a flat surface. The inner depth of the bottle results from the approached highest point at the neck finish area and the centre of the bottom of the bottles. An example of a measuring device is shown in [Figure C.1](#).

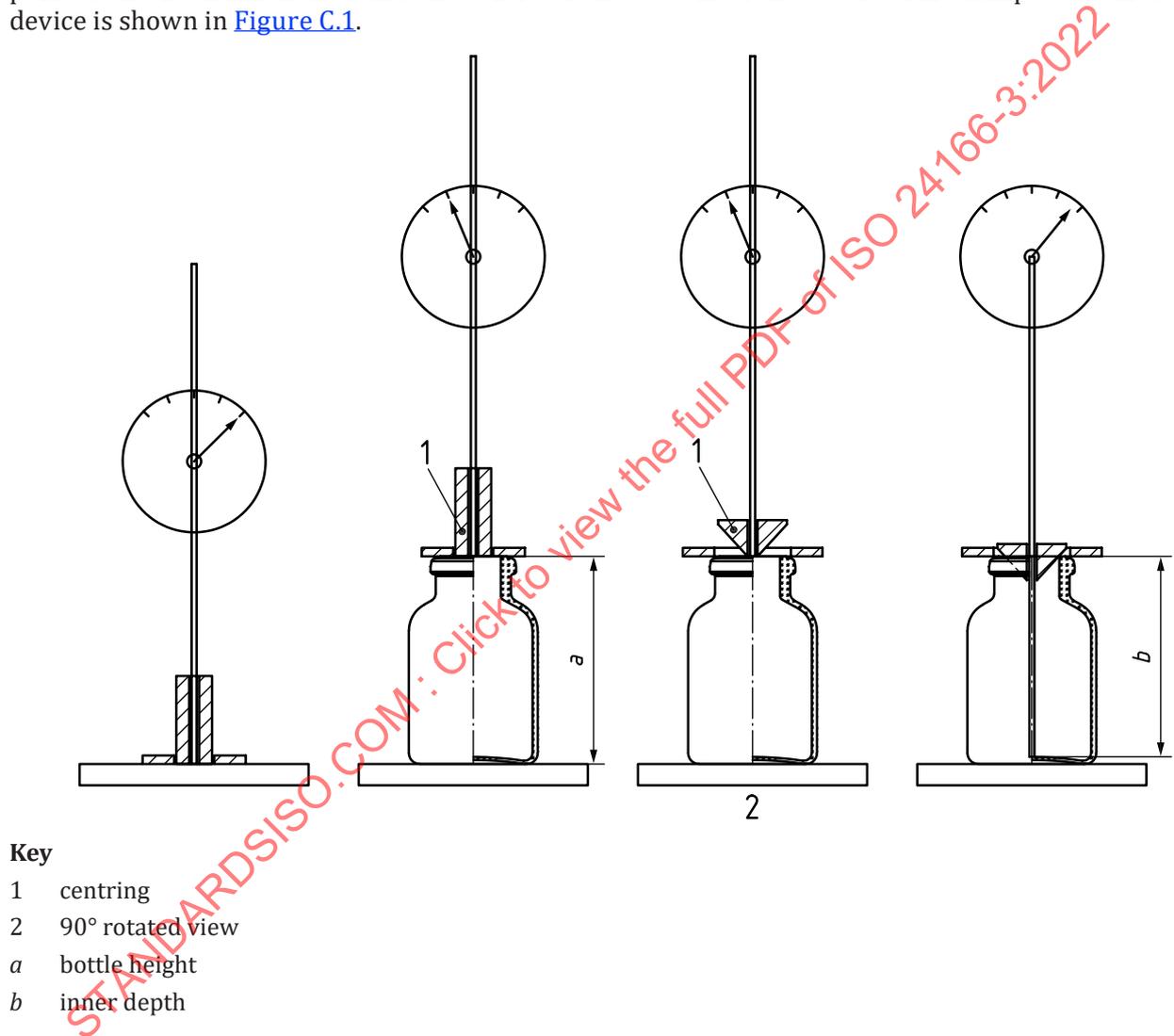


Figure C.1 — Bottle inner depth measurement

## Annex D (informative)

### Vertical force measurement technical method

#### D.1 Purpose

The aim of the test is to measure the force needed to deform the bottle from elastic area until plastic area.

#### D.2 Test equipment

**Universal testing machine** (compression bench).

#### D.3 Force measurement protocol

**D.3.1** The bottle shall be in a stand-up position.

**D.3.2** The base of the device shall come just in contact with the surface at the centre of the bottle top as shown on [Figure D.1](#). Test bench shall measure the force (in N) applied on the top regarding to the deformation (in mm).

**D.3.3** A downward motion force at a speed of 100 mm per minute shall be applied on the bottle until deformation as shown in [Figure D.2](#). The peak load of the first part of the curve defines the elastic limit of the bottle regarding vertical load. The average of 5 values is then recorded.