BS EN ISO 6710:2017

BSI Standards Publication

Single-use containers for human venous blood specimen collection (ISO 6710:2017)

bsi.

National foreword

This British Standard is the UK implementation of EN ISO 6710:2017. It is identical to ISO 6710:2017. It supersedes BS EN 14820:2004, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CH/212, IVDs.

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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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 6710

September 2017

ICS 11.040.20

Supersedes EN 14820:2004

English Version

Single-use containers for human venous blood specimen collection (ISO 6710:2017)

Récipients non réutilisables pour prélèvements de sang veineux humain (ISO 6710:2017)

Gefäße zur einmaligen Verwendung für die venöse Blutentnahme (ISO 6710:2017)

This European Standard was approved by CEN on 23 August 2017.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

This document (EN ISO 6710:2017) has been prepared by Technical Committee ISO/TC 76 “Transfusion, infusion and injection, and blood processing equipment for medical and pharmaceutical use” in collaboration with Technical Committee CEN/TC 140 “In vitro diagnostic medical devices” the secretariat of which is held by DIN.

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 March 218, and conflicting national standards shall be withdrawn at the latest by September 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This document supersedes EN 14820:2004, of which the following has been changed:

— Clause "Introduction" has been updated;

— Clause "Scope" has been updated and phrased clearer. Blood culture bottles have been excluded from this standard, as it does not address the special needs for this kind of testing;

— Clause "Normative references" has been updated;

— Clause 'Terms and definitions" has been updated and extended;

— Clause "Materials" has been updated;

— Clause "Nominal liquid capacity" has been shortened and renamed to "Draw volume";

— Clause "Graduation and fill lines" has been deleted;

— Clause "Design" has been updated;

— Clause "Construction" has been updated and shortened;

— Clause "Sterility and special microbiological states" has been technically revised;

— Clause "Additives" has been updated and shortened;

— Clause "Information supplied by the manufacturer" has been updated to meet current general requirements (except local requirements), and renamed to "Marking and labelling";

— Clause "Receptacle and additive identification" has been updated and renamed to "Container identification". Table "Letter codes identifying the more common additives for blood specimen receptacles" within this clause has been renamed to "Letter codes for identifying additives and accessories" and extended by additional entries for additives;

— Tests in Normative Annexes A to D have been updated in alignment with the requirements in the body part of the standard. Annex A "Test for nominal liquid capacity and graduation marks, for non-evacuated blood specimen receptacles" was renamed to "Draw volume test for non-evacuated containers". Annex B "Test for draw volume for evacuated receptacles" was renamed to "Draw volume test for evacuated containers" and a figure was added for better explanation. Annex C "Test for leakage from the closure of a receptacle" was renamed to "Test for leakage of container". Annex D "Test for the robustness of a receptacle that is intended for centrifugations" was renamed to "test for robustness of the container";

— Normative Annex E "Concentrations of additives and volume of liquid additives" has been added;

— Informative Annex F "Recommended colour codes for identifying additives and accessories" has been added;

— The Bibliography has been updated.

The following referenced documents are indispensable for the application of this document. For undated references, the latest edition of the referenced document (including any amendments) applies. For dated references, only the edition cited applies. However, for any use of this standard 'within the meaning of Annex ZA', the user should always check that any referenced document has not been superseded and that its relevant contents can still be considered the generally acknowledged state-of-art.

When an IEC or ISO standard is referred to in the ISO standard text, this shall be understood as a normative reference to the corresponding EN standard, if available, and otherwise to the dated version of the ISO or IEC standard, as listed below.

NOTE The way in which these referenced documents are cited in normative requirements determines the extent (in whole or in part) to which they apply.

Table — Correlations between normative references and dated EN and ISO standards

Normative references as listed in Clause 2 of the ISO standard	Equivalent dated standard	
	EN	ISO or IEC
ISO 15223-1	EN ISO 15223-1:2016	ISO 15223-1:2016

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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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).

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).

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

For an explanation on 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 the following URL: 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*.

This second edition cancels and replaces the first edition (ISO 6710:1995), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the Scope has been updated and phrased clearer. Blood culture bottles have been excluded from this document, as it does not address the special needs for this kind of testing;

— Clause 3 has been updated and extended;

— Clause 4 has been updated;

— Clause 5 has been shortened and renamed to “Draw volume”;

— Clause 6 has been updated;

— Clause 8 has been technically revised and renamed to “Sterility and special microbiological states”;

— Clause 9 has been extended;

— Clause 10 has been slightly updated to meet current general requirements (except local requirements);

— Table 1 has been extended by additional entries for additives. It has been reduced to the specified letter codes, while the information on recommended colour codes for identifying additives has been moved to a new Annex F (for clarification, see Introduction);

— tests in Annexes A to D have been updated in alignment with the requirements in the body of this document;

— Annex E has been completely revised;

— references in Clause 2 and Bibliography have been updated.

Introduction

ISO 6710 was first published in 1995. With the first revision starting in the year 2000, the Vienna Agreement was applied to develop the updated edition of this document in parallel between ISO and CEN.

However, in 2002 the parallel ballot on ISO 6710, respectively prEN ISO 6710, failed on ISO level. The ongoing development was continued only on European level and led finally to the publication of EN 14820:2004. Although, during the development, no consensus could be reached between the CEN member states to add a specification for a common colour code for identifying containers with different additives.

The EU commission considered the absence of colour code specifications as potential safety risk and submitted in 2006 the standardization mandate M/384 to CEN with the request to solve the issue. But even with this confirmed need it was not possible to find a consensus between the CEN members.

Based on a Swedish standardization proposal in 2014, this subject was raised again and led finally to the initiation of the revision of ISO 6710:1995. The Vienna Agreement was applied in order to revise as well EN 14820:2004 with the final goal again to develop an International Standard in parallel with a harmonized European Standard.

During the development, it was recognized that at least recommendations for appropriate colour code specifications should be amended. In order to avoid further disputes on this subject, it was decided to add these recommendations in Annex F. This provides the potential users the possibility of a smooth implementation of the colour code identification without being under pressure to comply with this document in this subject. This way of introducing a common colour code allows manufacturers and/or users in healthcare to grant an evaluation phase. If there will be a higher acceptance after the publication of this document, with the next revision there is the intention to possibly move the content of Annex F to the normative part of this document.

In some countries, the national pharmacopoeia or other national regulations are legally binding and take precedence over this document.

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INTERNATIONAL STANDARD **ISO 6710:2017(E)**

Single-use containers for human venous blood specimen collection (ISO 6710:2017)

1 Scope

This document specifies requirements and test methods for evacuated and non-evacuated single-use venous blood specimen containers.

It does not specify requirements for blood collection needles, needle holders, blood culture receptacles or "arterial" blood gas collection devices that can be used for venous blood.

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 15223-1, *Medical devices — Symbols to be used with medical device labels, labelling and information to be supplied — Part 1: General requirements*

3 Terms and definitions

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

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
accessory
component inside the *container* (3.4) which is intended by the manufacturer to assist in the collection, or mixing, or separation of the *specimen* (3.15)

Note 1 to entry: Examples of accessories are small plastic inert balls or a separate gel found in a serum or plasma container designed to separate the serum or plasma from the cells after centrifugation.

3.2
additive
substance (other than inside surface treatments designed to be irremovable) that is placed in the *container* (3.4) in order to facilitate the creation of the desired sample

3.3
closure
component by which the *container* (3.4) is sealed, which may consist of several parts

3.4
container
vessel, whether evacuated or not, intended to contain a *specimen* (3.15), together with any container *accessory* (3.1) and *additive* (3.2), with *closure* (3.3) in place

3.5
container interior
inner surface of the *container* (3.4) exposed to the *specimen* (3.15)

3.6
draw volume
volume of whole blood that will be collected in the *container* (3.4)

3.7
evacuated container
container (3.4) intended for blood collection by means of evacuation either already induced by the manufacturer (i.e. pre-evacuated containers) or induced by the user before or during blood collection

3.8
expiry date
date after which the product shall not be used

3.9
fill indicator
line marked on a *tube* (3.16) or its label to indicate the correct filling

3.10
free space
space above the drawn sample

3.11
nominal liquid capacity
draw volume (3.6) plus volume of *additive* (3.2) not including any accessories

3.12
primary colour
dominant colour of *closure* (3.3) component most representative of the *additive* (3.2) in the *container* (3.4)

Note 1 to entry: Dominant is the colour of the closure that covers the majority of the surface.

3.13
primary pack
smallest package of *containers* (3.4)

3.14
relative centrifugal force
RCF
force that is generated during the sample centrifugation process, which is specified by the manufacturer for adequate separation

3.15
specimen
venous blood collected in a *container* (3.4)

3.16
tube
part of the *container* (3.4), without the *closure* (3.3), that contains the *specimen* (3.15)

3.17
visual inspection
inspection by an observer with normal or corrected-to-normal vision without magnification under a uniform illuminance between 500 lx and 1 000 lx

4 Materials

4.1 The tube shall be made of material which allows a clear view of the contents when subjected to visual inspection, unless exposure to ultraviolet light or visible light would degrade the contents.

4.2 If a container is intended specifically for the determination of a certain element/substance, the maximum level of the element/substance in the container interior and the analytical method employed shall be stated by the manufacturer in supporting literature or on the label or packaging (see also 10.4).

For the determination of specified metals and other specified substances, the formulation of the closure material should be such as not to interfere with the determination thereby affecting the results.

For highly sensitive determinations (for example those using fluorimetry) or little-used tests, limits of interference may not have been agreed on. In such cases, the laboratory should establish a blank value and consult the manufacturer.

4.3 The container shall be free from foreign matter when subjected to visual inspection.

5 Draw volume

When tested in accordance with the methods specified in Annexes A and B, the volume of water should be within ±10 % of the draw volume. If ±10 % of draw volume is not met throughout the shelf life, the manufacturer shall ensure that correct results shall be obtained.

6 Design

6.1 The closure shall not become loose during mixing when tested for leakage in accordance with the methods specified in Annex C or other equivalent method and no fluorescence shall be detectable in the water in which the container has been immersed.

6.2 Where a closure is intended to be removed, it shall be designed so that it can be removed by gripping with the fingers and/or by mechanical means, so that the part of the closure that could be in contact with the specimen is not touched.

6.3 Consideration in the design shall be given to ensure compatibility with transportation systems, processes, pre-analytical and analytical automation.

7 Construction

7.1 The container holding the specimen shall not break, crack or leak, when centrifuged at an RCF of 3 000 *g* or the value specified by the manufacturer for the intended use, when tested in accordance with the method specified in Annex D.

NOTE $g = 9{,}806\ 65\ m/s^2$.

7.2 When subjected to visual inspection, the container shall not have a sharp edge, projection or surface roughness capable of accidentally cutting, puncturing or abrading the skin of the user.

8 Sterility and special microbiological states

8.1 For evacuated containers, the interior shall be sterile if unused. The container interior and any accessory or additive shall be subjected to a validated process designed to achieve sterility.

8.2 For non-evacuated containers, if a manufacturer claims that the interior of the unopened and unused container, or the whole container, is sterile or has a special microbiological state, the container interior and any accessory or additive shall be subjected to a validated process designed to achieve that claim.

8.3 For non-evacuated containers with microbe-supporting additives, such as trisodium citrate or citrate phosphate dextrose adenine, solution shall be subjected to a validated process to remove or to render non-viable microbes in the additive and the container interior.

9 Additives

9.1 The stated nominal amount of additive shall be within the range specified in Annex E.

9.2 For containers with an additive, provision shall be made for mixing by using the free space bubble to facilitate agitation or by some other physical means.

NOTE This document does not specify a validation procedure for adequate mixing of the blood specimen.

9.3 The free space in containers for coagulation testing should not impact the analytical results. The manufacturer should assess the risk associated with the free space in the correctly filled containers.

10 Marking and labelling

10.1 Non-transparent labels shall not completely encircle the tubes.

10.2 The marking and labelling on the container shall remain adherent over its shelf life, under storing conditions as specified by the manufacturer.

10.3 Each primary pack shall be marked on the outside at least with the following information:

a) the manufacturer's or supplier's name or trademark;

b) the batch number;

c) the expiry date which should be expressed in the format YYYY-MM or YYYY-MM-DD;

d) a description of the contents, which shall include the following:

- the nominal liquid capacity or draw volume;
- the letter code (see Clause 11) and/or product name and/or a description of the contents;
- the word "STERILE" or the appropriate graphical symbol according to ISO 15223-1 if the manufacturer claims that the unopened container interior and any contents of the container are sterile;
- the words "Single-use only" or the appropriate graphical symbol according to ISO 15223-1;
- storage requirements;
- labelling requirements from the local legislation.

10.4 If a container is provided specifically for the determination of a certain substance, the maximum level of contamination with that substance shall be stated on the label, the primary pack or in the supporting information.

10.5 If a container has a liquid additive, its volume shall be stated on the label, the primary pack or in the supporting information.

10.6 Containers shall have the following information marked directly onto the tube or on the label:

a) the manufacturer's or supplier's name or trademark;

b) the batch number;

c) the letter code (see Clause 11) and/or product name and/or a description of the contents;

d) the expiry date which should be expressed in the format YYYY-MM or YYYY-MM-DD;

e) the nominal liquid capacity or draw volume, specified where appropriate on the container;

f) the words “Single-use only” or the appropriate graphical symbol according to ISO 15223-1;

g) a fill indicator; if that is not possible, information on how to fill the container correctly shall be provided on the primary pack or in the supporting literature;

h) the word “STERILE” or the appropriate graphical symbol according to ISO 15223-1 if the manufacturer claims that the unopened and unused container interior and any contents of the container are sterile.

10.7 If the container is intended to be stored, or used, under specific conditions, this shall be clearly stated on the container or on the label and/or on the supporting literature in the primary pack.

11 Container identification

Containers shall be identified by means of the letter code and/or a description of the contents for the additives and accessories given in Table 1 and/or product name. Where there are additives and accessories other than those in Table 1, containers shall be identified by means of the description of the additive and/or product name.

Recommended colour codes for identifying additives and accessories are provided in Annex F (for more details, see also Introduction).

Table 1 — Letter codes for identifying additives and accessories

Additive/Accessory	Letter code
EDTA[a] dipotassium salt tripotassium salt	K2E K3E
Trisodium citrate 9:1[b]	9NC
Trisodium citrate 4:1[b]	4NC
Fluoride oxalate Fluoride EDTA Fluoride heparin Fluoride, citric acid	FX FE FH FC
Lithium heparin Lithium heparin and gel Sodium heparin	LH LH NH
Citrate phosphate dextrose adenine Acid citrate dextrose	CPDA ACD
Clot activator Clot activator with gel	CAT CAT
None	Z

[a] EDTA is the abbreviation for ethylenediaminetetraacetic acid which by established custom is used in preference to the correct systematic name, i.e. (ethylenedinitrilo)tetraacetic acid.

[b] Denotes the ratio between the intended volumes of blood and liquid anticoagulant (e.g. 9 volumes of blood to 1 volume of citrate solution).

Annex A
(normative)

Draw volume test for non-evacuated containers

A.1 Reagents and apparatus

A.1.1 **Deionized water**.

A.1.2 **Calibrated electronic balance**, accurate to a minimum of three decimal places, 0,001 g.

A.1.3 **Device**, to hold the test container vertically in the correct orientation on the balance.

A.1.4 **Vessel**, to enable dispensing of water into the test container, e.g. syringe, pipette.

A.2 Test conditions

A.2.1 The tests shall be carried out in ambient conditions of 101 kPa and 20 °C; make corrections if other conditions are used.

A.2.2 The containers to be tested shall be unused.

A.3 Test procedure

A.3.1 Fill the vessel with the deionized water.

A.3.2 Place the container onto the balance and tare (zero).

A.3.3 Position the test container with closure removed and fill with water until the meniscus is level with the fill indicator.

A.3.4 Place the test container on the previously tared balance and read the weight in grams.

A.3.5 Calculate the fill volume 1 000 g = 1 000 mL.

A.4 Test criteria

The container shall pass the draw volume test as specified in Clause 5.

Annex B
(normative)

Draw volume test for evacuated containers

B.1 Reagents and apparatus

B.1.1 **Deionized water**.

B.1.2 **Calibrated electronic balance**, accurate to a minimum of three decimal places, 0,001 g.

B.1.3 **Device**, to hold the test container vertically in the correct orientation on the balance.

B.1.4 **Reservoir**, with spout at its base to enable connection to the tubing.

B.1.5 **Tubing**, that can be pierced with a blood collection needle, fitted with a spring clip at one end and attached to the reservoir at the other end (see Figure B.1).

B.1.6 **Blood collection needles**, as recommended by the manufacturer of the test container.

B.1.7 **Holder**, as recommended by the manufacturer of the test container.

B.2 Test conditions

B.2.1 The tests shall be carried out in ambient conditions of 101 kPa and 20 °C; make corrections if other conditions are used.

B.2.2 The container to be tested shall be unused.

B.3 Test procedure

B.3.1 Assemble the reservoir to the tubing, tighten the spring clip on end of the tubing.

B.3.2 Fill the reservoir with the water.

B.3.3 Bleed the water through the spring clip to fill the tubing.

B.3.4 If not supplied ready-assembled, fit the blood collection needle into the holder in accordance with the manufacturer's instructions.

B.3.5 Place the test container on to the balance and tare (zero).

B.3.6 Insert the intravenous needle of the blood collection needle/holder assembly through the wall of the tubing until the needle is well inside the lumen of the tubing.

B.3.7 Connect the test container to the needle/holder assembly in accordance with the manufacturer's instructions.

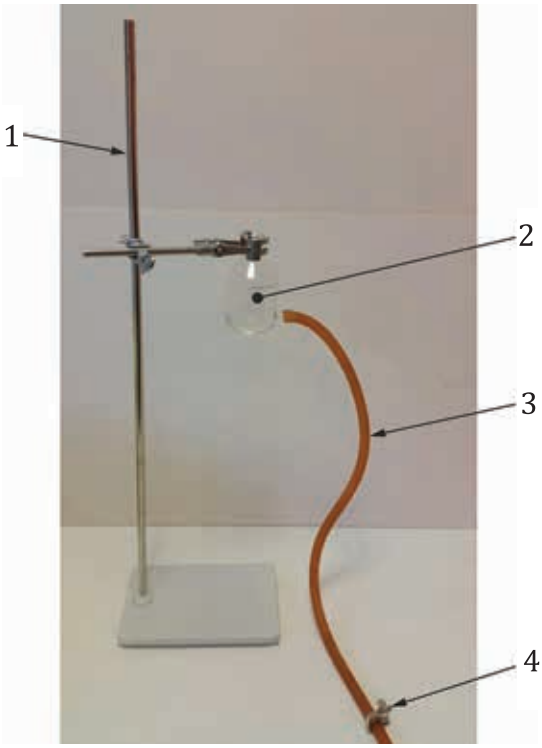
B.3.8 Allow the test container to fill for at least 1 min or fill as specified by the manufacturer.

B.3.9 Place the test container on the previously tared balance and read the weight in grams.

B.3.10 Calculate the fill volume 1 000 g = 1 000 mL.

B.4 Test criteria

The container shall pass the draw volume test as specified in Clause 5.



Key

1 clamps stand
2 water reservoir
3 tubing
4 spring clip

Figure B.1 — Water reservoir assembly for draw volume test for evacuated containers

Annex C
(normative)

Test for leakage of container

C.1 Reagents

C.1.1 **Solution**, prepared by dissolving 2,5 g of sodium fluorescein (uranine; CAS number 518-47-81)[1)] in 100 mL of 0,15 mol/l sodium chloride (NaCl; CAS number 7647-14-5) solution containing 60 g/l Dextran 70 (CAS number 9004-54-0) or equivalent.

C.1.2 **Deionized water** that shows no sign of fluorescence when viewed under ultraviolet light (C.2.2) in a darkened room by an observer with normal or corrected-to-normal vision without magnification.

C.2 Apparatus

C.2.1 **Apparatus**, to fill non-evacuated containers as described in A.1.4, **apparatus** to fill evacuated containers as described in B.1.3 to B.1.7.

C.2.2 **Long-wave ultraviolet light (UV) source**.

C.2.3 **Roller-type mixer** or other mixer recommended by the manufacturer of the container.

C.2.4 **Torque wrench** (where necessary).

C.3 Test procedure for non-evacuated container

C.3.1 Fill the vessel with the reagent (C.1.1).

C.3.2 Remove the closure from the container and fill it to its nominal liquid capacity from the vessel, taking care not to contaminate the outside of the tube or closure with the reagent. Fit the closure exactly as specified by the manufacturer.

C.3.3 With normal or corrected-to-normal vision without magnification, examine the container in a darkened room to ensure that there is no surface contamination with the reagent. If necessary, wash off contamination with water, examining under UV light as before.

C.3.4 Rotate the container on the roller-type mixer for 2 min or mix as recommended by the manufacturer of the container. Immerse the container upside down in a tank containing not more than 100 mL of the water to cover the closure completely. Leave at between 15 °C and 20 °C for 60 min. Remove the container from the water and examine the water under UV light as described in C.3.3.

C.4 Test procedure for evacuated container

C.4.1 Fill the reservoir with the reagent (C.1.1).

1) CAS number means Chemical Abstracts Service Registry Number.

C.4.2 Fill the container to its nominal liquid capacity from the reservoir fitted with the blood collection needle as described in B.3, taking care not to contaminate the outside of the container with the reagent. When the container has been filled, remove it from the needle and wash the outside of the container free of any contamination with the reagent, examining under UV light as described in C.3.3.

C.4.3 Follow the procedure described in C.3.4.

C.5 Test criteria

The container shall pass the test as specified in 6.1.

Annex D
(normative)

Test for robustness of the container

D.1 Reagents and apparatus

D.1.1 **A test liquid**, having the same specific gravity as normal human blood.

D.1.2 **Blood sample container.**

D.1.3 **Centrifuge**, capable of subjecting the base of the container to an RCF of 3 000 *g* for 10 min.

D.2 Test procedure

D.2.1 Fill the container with the test liquid using the method specified by the manufacturer, removing and replacing the closure where necessary (see Annex A and B for more details).

D.2.2 Take care to ensure that the container is correctly supported and adequately balanced in the centrifuge bucket.

D.2.3 Centrifuge the filled container, subjecting the base of it to an RCF of 3 000 *g* for 10 min, then carefully place in a rack and subject to visual inspection.

D.3 Test criteria

The material shall pass the test as specified in 7.1.

Annex E
(normative)

Concentrations of additives and volume of liquid additives

E.1 General specifications for additives

If the additive used in blood collection tubes is listed in the United States Pharmacopeia (USP), European Pharmacopoeia (Ph. Eur.), American Chemical Society, Analytical Reagent Grade or equivalent specifications, chemical additives shall either meet the specifications of those compendia or shall be clearly documented on the Certificate of Analyses (COA) or equivalent from the supplier.

If the additive is not listed in any of the referenced compendia, then specific acceptance criteria should be defined by the manufacturer and clearly documented in the manufacturing specification for the particular collection device.

NOTE Additives can be present in several physical forms, for example as a solution, dried by heat from solution, lyophilized or as a powder. The ranges of concentrations allow for the different rates of solubility and diffusions of these various forms, especially for EDTA.

E.2 Ethylenediaminetetraacetic acid, EDTA (CAS: 60-00-04, M = 292,26 g/mol)

Blood concentrations of ethylenediaminetetra-acetic acid (EDTA) shall be within the range of 0,004 11 mol/l to 0,006 84 mol/l. That means, for the free acid (M = 292,24 g/mol), there should be 1,2 mg to 2 mg EDTA per mllilitre of blood.

Current EDTA compounds for application in blood collection tubes are, for example, ethylenediaminetetraacetic acid dipotassium salt dihydrate, K_2-EDTA (CAS: 25102-12-9, M = 404,45 g/mol), ethylenediaminetetraacetic acid tripotassium salt dihydrate, K3-EDTA (CAS: 65501-24-8, M = 442,54 g/mol) or ethylenediaminetetraacetic acid disodium salt dihydrate Na_2-EDTA (CAS: 6381-92-6, M = 372,24 g/mol).

E.3 Trisodium citrate (CAS: 6132-04-3, M = 294,10 g/mol)

E.3.1 The solution of trisodium citrate dihydrate (CAS: 6132-04-3, M = 294,10 g/mol) used for the preparation of blood collection tubes shall have a concentration within the range of 0,100 mol/l to 0,136 mol/l. The permitted tolerance on the specified volume of additive solution in the tube shall be ±10 %.

E.3.2 Coagulation studies: 9 volumes of blood shall be added to 1 volume of trisodium citrate solution[1] (see E.3.1).

E.3.3 Erythrocyte sedimentation rate by the Westergren method: 4 volumes of blood shall be added to 1 volume trisodium citrate solution[2].

E.4 Fluoride/Oxalate

Blood concentration of potassium oxalate monohydrate (CAS: 6487-48-5, M = 184,23 g/mol) shall be within the range of 1 mg/mL to 3 mg/mL, respectively, 0,005 43 mol/l to 0,016 28 mol/l and of, for example, sodium fluoride (CAS: 7681-49-4, M = 41,99 g/mol) within the range of 1 mg/mL to 4 mg/mL, respectively, 0,023 8 mol/l to 0,095 3 mol/l.

E.5 Fluoride/EDTA

Blood concentration of EDTA free acid (CAS: 60-00-4, M = 292,24 g/mol) shall be within the range of 1,2 mg/mL to 2 mg/mL, respectively, 0,004 11 mol/l to 0,006 84 mol/l and of, for example, sodium fluoride (CAS: 7681-49-4, M = 41,99 g/mol) within the range of 1 mg/mL to 4 mg/mL, respectively, 0,023 8 mol/l to 0,095 3 mol/l.

E.6 Fluoride/Heparin

Blood concentration of heparin shall be within the range of 10 IU/mL to 30 IU/mL and of, for example, sodium fluoride (CAS: 7681-49-4, M = 41,99 g/mol) within the range of 1 mg/mL to 4 mg/mL, respectively, 0,023 8 mol/l to 0,095 3 mol/l.

E.7 Heparin Sodium (CAS: 9041-08-1) and Heparin Lithium (CAS: 9045-22-1)

Blood concentrations of heparin shall be within the range of 10 IU/mL to 30 IU/mL.

E.8 Citrate phosphate dextrose adenine (CPDA)

E.8.1 The formulation shall be as follows[3].

Table E.1 — Composition of CPDA

Additive component	Formula/CAS number	Amounts
Citric acid (anhydrous)	CAS: 77-92-9	2,99 g
Trisodium citrate (dihydrate)	CAS: 6132-04-3	26,3 g
Monobasic sodium phosphate (monohydrate)	$NaH_2PO_4 \cdot H_2O$; CAS: 10049-21-5	2,22 g
Dextrose (monohydrate)	CAS: 5996-10-1	31,9 g
Adenine	$C_5H_5N_5$; CAS: 73-24-5	0,275 g
Purified water	H_2O	Sufficient volume to create a final solution of 1 000 mL

E.8.2 Six volumes of blood shall be added to 1 volume of CPDA solution.

E.8.3 The permitted tolerance on the specified volume of additive shall be within ±10 %.

Annex F
(informative)

Recommended colour codes for identifying additives and accessories

In addition to the letter codes for identifying additives and accessories specified in Table 1, the colour codes according Table F.1 are recommended to identify additives and accessories.

If colour coding is on the label, the printing on the tube or the tube label should be similar to that of the closure as described in Table F.1.

When developing new containers with additives or accessories not listed in Table F.1, manufacturers should consider to use other colour codes.

Table F.1 — Recommended colour codes for identifying additives and accessories

Additive/Accessory	Letter code[c]	Recommended primary colour of closure
EDTA[a] dipotassium salt tripotassium salt	K2E K3E	Lavender[d] Lavender[d]
Trisodium citrate 9:1[b]	9NC	Light blue
Trisodium citrate 4:1[b]	4NC	Black
Fluoride oxalate Fluoride EDTA Fluoride heparin Fluoride, citric acid	FX FE FH FC	Grey Grey Grey Pink
Lithium heparin Lithium heparin and gel Sodium heparin	LH LH NH	Green[d] Light green Brown[d]
Citrate phosphate dextrose adenine Acid citrate dextrose	CPDA ACD	Yellow Yellow
Clot activator Clot activator with gel	CAT CAT	Red[d,e] Dark yellow[e]
None	Z	White

a EDTA is the abbreviation for ethylenediaminetetraacetic acid which by established custom is used in preference to the correct systematic name, i.e. (ethylenedinitrilo)tetraacetic acid.

b Denotes the ratio between the intended volumes of blood and liquid anticoagulant (e.g. 9 volumes of blood to 1 volume of citrate solution).

c According to Clause 11.

d Dark blue for trace element.

e Orange for thrombin clot activator.

Bibliography

[1] Recommended methodology for using WHO International Reference Preparations for Thromboplastin. World Health Organization, Geneva, Switzerland, 1983

[2] International Committee for Standardization in Haematology, 1977, Recommendation for measurement of erythrocyte sedimentation rate of human blood, American Journal of Clinical Pathology, 68 [4], 1977, pp. 505–507

[3] Anticoagulant Citrate Phosphate Dextrose Adenine Solution, pp. 101–102, The United States Pharmacopoeia, The National Formulary, USP XXII, NF XVII, 1990, United States Pharmacopoeial Convention, Inc., Rockville, MD, USA

[4] ISO 11137-1, *Sterilization of health care products — Radiation — Part 1: Requirements for development, validation and routine control of a sterilization process for medical devices*

[5] ISO 11137-2, *Sterilization of health care products — Radiation — Part 2: Establishing the sterilization dose*

[6] ISO 17665-1, *Sterilization of health care products — Moist heat — Part 1: Requirements for the development, validation and routine control of a sterilization process for medical devices*

[7] ISO/TS 17665-2, *Sterilization of health care products — Moist heat — Part 2: Guidance on the application of ISO 17665-1*

[8] EN 556-1, *Sterilization of medical devices — Requirements for medical devices to be designated "STERILE" — Part 1: Requirements for terminally sterilized medical devices*

[9] EN 556-2, *Sterilization of medical devices — Requirements for medical devices to be designated "STERILE" — Part 2: Requirements for aseptically processed medical devices*

[10] EN 14820:2004, *Single-use containers for human venous blood specimen collection*

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