INTERNATIONAL STANDARD

ISO 1135-5

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Transfusion equipment for medical use —

Part 5: Transfusion sets for single use with pressure infusion apparatus

Matériel de transfusion à usage médical —

Partie 5: Appareils de transfusion non réutilisables avec les appareils de perfusion sous pression

Reference number
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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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 76, *Transfusion, infusion and injection, and blood processing equipment for medical and pharmaceutical use*.

This first edition of ISO 1135-5, together with ISO 1135-4, cancels and replaces ISO 1135-4:2012, which has been technically revised with the following changes:

— the scope of ISO 1135-4 has been restricted to gravity feed applications, whereby, ISO 1135-5 is focused on pressure infusion applications;

— a new Annex D on 'Storage volume' has been added.

ISO 1135 consists of the following parts, under the general title *Transfusion equipment for medical use*:

— *Part 3: Blood-taking sets for single use*

— *Part 4: Transfusion sets for single use, gravity feed*

— *Part 5: Transfusion sets for single use with pressure infusion apparatus*

Transfusion equipment for medical use —

Part 5: Transfusion sets for single use with pressure infusion apparatus

1 Scope

This part of ISO 1135 specifies requirements for single use transfusion sets for use with pressure infusion equipment capable of generating pressures up to 200 kPa (2 bar). This International Standard ensures compatibility with containers for blood and blood components as well as intravenous equipment.

Secondary aims of this part of ISO 1135 are to provide guidance on specifications relating to the quality and performance of materials used in transfusion sets, to present designations for transfusion set components, and to ensure the compatibility of sets with red cell and plasma blood components.

Platelet components should not be transfused under pressure using these sets.

In some countries, the national pharmacopoeia or other national regulations are legally binding and take precedence over this part of ISO 1135.

2 Normative references

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

ISO 594-1[1)], *Conical fittings with a 6 % (Luer) taper for syringes, needles and certain other medical equipment — Part 1: General requirements*

ISO 594-2[1)], *Conical fittings with 6 % (Luer) taper for syringes, needles and certain other medical equipment — Part 2: Lock fittings*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 3826-1:2013, *Plastics collapsible containers for human blood and blood components — Part 1: Conventional containers*

ISO 3826-2, *Plastics collapsible containers for human blood and blood components — Part 2: Graphical symbols for use on labels and instruction leaflets*

ISO 10993-1, *Biological evaluation of medical devices — Part 1: Evaluation and testing within a risk management process*

ISO 10993-4, *Biological evaluation of medical devices — Part 4: Selection of tests for interactions with blood*

ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness*

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

1) To be replaced by ISO 80369-7.

3 Terms and definitions

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

NOTE These terms and definitions are specifically applicable to Annex D.

3.1
filling volume
V_F
volume of tube during “pressure less” filling, respectively filling by gravity

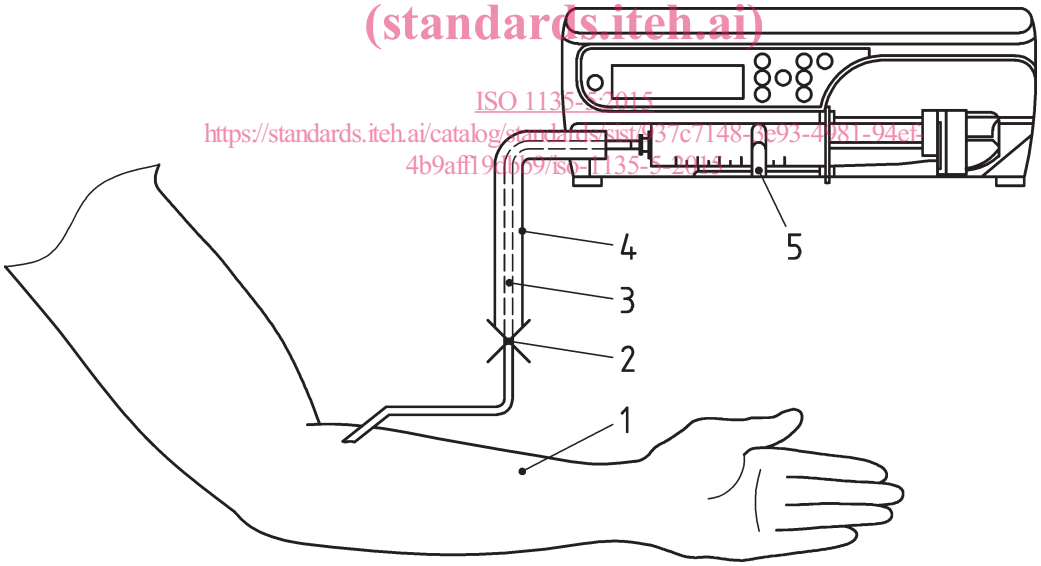
Note 1 to entry: The tube remains unstressed.

Note 2 to entry: The filling volume is to be equated with the calculated volume of the tube.

3.2
storage volume
V_S
tube volume during pressurization equal to filling volume, V_F, plus bolus volume, V_S: $V_S = V_F + V_B$

3.3
bolus volume
V_B
increased tube volume during pressurization (storage volume, V_S) in comparison with the unstressed tube (filling volume, V_F)

Note 1 to entry: For illustration of the bolus volume, see Figure 1.



Key

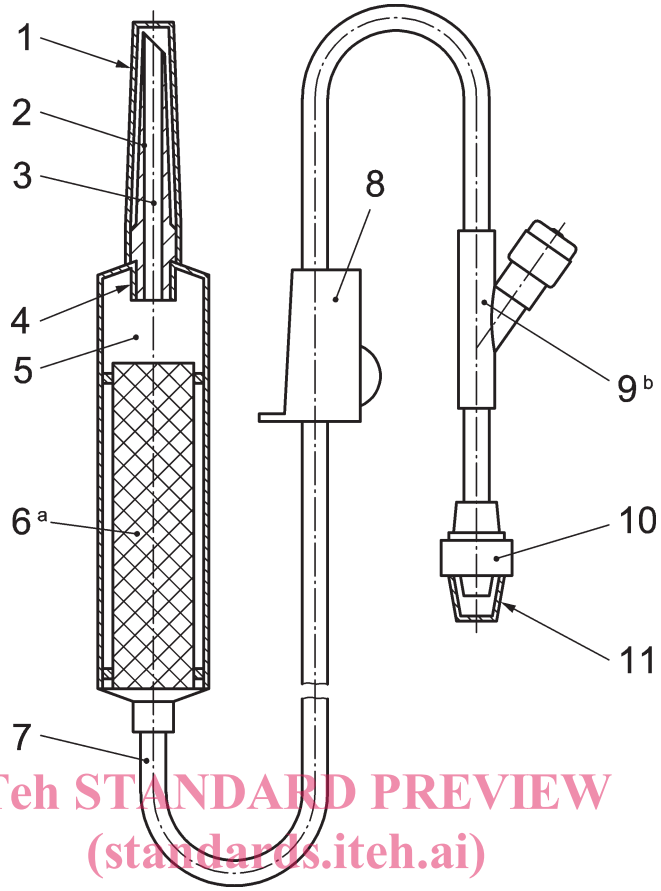
1	patient	4	bolus volume
2	occlusion	5	syringe pump
3	tube		

Figure 1 — Bolus volume

4 General requirements

4.1 Nomenclature for components of the transfusion set

The nomenclature for components of transfusion sets is given in Figure 2.



Key

1	protective cap of the closure-piercing device	8	flow regulator
2	closure-piercing device	9	injection site
3	fluid channel	10	male conical fitting
4	drip tube	11	protective cap of the male conical fitting
5	drip chamber	a	Indicates alternative locations of the filter for blood and blood components. Other designs are acceptable, if the same safety aspects are ensured.
6	filter for blood and blood components	b	Injection site is optional.
7	tubing		

Figure 2 — Example of a transfusion set

4.2 Maintenance of sterility

The transfusion set shall be provided with protective caps to maintain sterility of the internal parts of the set until the set is used.

5 Materials

The materials from which the transfusion sets given in Clause 4 are manufactured shall comply with the requirements specified in Clause 6. If components of the transfusion set come into contact with blood and blood components, they shall additionally comply with the requirements specified in Clauses 7 and 8.

6 Physical requirements

6.1 Particulate contamination

The transfusion sets shall be manufactured under conditions that minimize particulate contamination. All parts shall be smooth and clean at the fluid pathway surfaces. When tested as specified in A.1, the number of particles detected shall not exceed the contamination index limit.

6.2 Leakage

The transfusion set, when tested in accordance with A.2, shall show no signs of air leakage.

6.3 Tensile strength

Any connections between the components of the transfusion set, excluding protective caps, shall withstand a static tensile force of not less than 15 N for 15 s.

6.4 Closure-piercing device

6.4.1 The dimensions of the closure-piercing device shall conform to the dimensions shown in Figure 3.

NOTE The dimension of 15 mm in Figure 3 is a reference measurement. The cross-section of the piercing device at this site is a circle.

Dimensions in millimetres

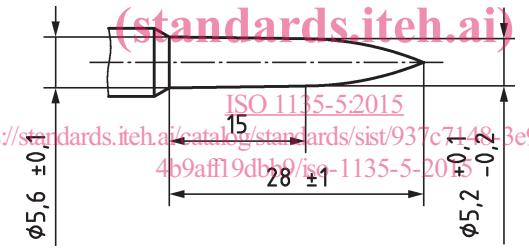


Figure 3 — Dimensions of the closure-piercing device

6.4.2 The closure-piercing device shall be capable of piercing and penetrating the closure of a container for blood and blood components without pre-piercing. No coring should occur during this procedure.

NOTE 1 A carefully controlled surface treatment of the closure-piercing device (e.g. siliconization) is recommended to facilitate its insertion into the blood bag port. The same effect can be achieved by a careful selection of material for the closure-piercing device. Typical results including test equipment for penetration forces between spikes and blood bag ports have been published. See References [11] and [12].

NOTE 2 A central closure-piercing device tip is preferred to an asymmetric design in order to aid its insertion.

6.4.3 When inserted into a blood bag port conforming to ISO 3826-1:2013, the closure-piercing device shall resist a pull force of 15 N for 15 s.

6.4.4 When tested in accordance with ISO 3826-1:2013, 5.3, the connection between the closure-piercing device and the blood bag port shall show no evidence of leakage.

6.5 Tubing

6.5.1 The tubing, made of flexible material, shall be transparent or sufficiently translucent so that the interface of air and water during the passage of air bubbles can be observed with normal or corrected-to-normal vision.

6.5.2 The tubing from the distal end to the drip chamber shall be not less than 1 500 mm in length, including the injection site, when provided, and the male conical fitting.

6.5.3 The tubing from the distal end to the drip chamber shall be capable of resisting (without collapsing) negative pressures generated by the pressure infusion apparatus.

6.6 Filter for blood and blood components

The transfusion set shall be provided with a filter for blood and blood components. The filter shall have uniform pores and shall cover a total area of not less than 10 cm^2. When tested in accordance with A.3[2)], the mass of solid material retained on the filter shall be not less than 80 % (mass fraction) of that retained on the reference filter.

If the filter has a confirmed thread diameter of (100 ± 10) µm and a pore size of (200 ± 20) µm, with a single warp and a single weft, a filtration performance test can be exempted.

Pore size measurement can be performed by microscopic inspection.

6.7 Drip chamber and drip tube

The drip chamber shall permit continuous observation of the fall of drops. The liquid shall enter the drip chamber through a tube which projects into the chamber. There shall be a distance of not less than 40 mm between the end of the drip tube and the outlet of the chamber, or a distance of not less than 20 mm between the drip tube and the filter for blood and blood components. The wall of the drip chamber shall not be closer than 5 mm to the end of the drip tube. The drip tube shall be such that 20 drops of distilled water at (23 ± 2) °C and at a flow rate of (50 ± 10) drops/min deliver (1 ± 0,1) ml [(1 ± 0,1) g].

The drip chamber should permit and facilitate the procedure of priming.

6.8 Flow regulator

The flow regulator shall adjust the flow of the blood and blood components between zero and maximum.

The flow regulator should be capable of continuous use throughout a transfusion without the tubing being damaged. There should be no deleterious reaction between the flow regulator and the tubing when stored in such a manner that there is contact.

6.9 Flow rate of blood and blood components

The transfusion set shall deliver not less than 1 000 ml of blood at (23 ± 2) °C in 30 min with a pressure difference of 10 kPa[2)]. The transfusion set shall also deliver not less than 500 ml of blood in 2 min under a pressure of 30 kPa above atmospheric pressure.

The blood shall be collected into a suitable anticoagulant solution and stored for not less than two weeks, and be free of large clots.

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2) In countries where human blood is not available for testing, equivalent test methods may be established.

6.10 Injection site

When provided, the self-sealing injection site shall reseal when tested in accordance with A.4, and there shall be no leakage of more than one falling drop of water.

Transfusion sets for use with pressure infusion apparatus shall not be fitted with an elastomeric buffer.

The injection site should be located near the male conical fitting.

NOTE The co-administration of drugs through the injection site is not permitted in some countries.

6.11 Male conical fitting

The distal end of the tubing shall terminate in a male conical fitting conforming with ISO 594-1 or ISO 594-2.

Luer lock fittings in accordance with ISO 594-2 should be used.

6.12 Protective caps

The protective caps at the end of the transfusion set shall maintain the sterility of the closure-piercing device, the male conical fitting, and the interior of the transfusion set.

Protective caps should be secure but easily removable.

6.13 Storage volume

The storage volume shall be stated according to 9.2 l). For a definition of the storage volume and for a test method for the determination of the storage volume, see Annex D.

7 Chemical requirements

7.1 Reducing (oxidizable) matter

When tested in accordance with B.2, the difference of volume of $Na_2S_2O_3$ solution [$c(Na_2S_2O_3)$ = 0,005 mol/l] for the extract solution, S_1, and volume of $Na_2S_2O_3$ solution for blank solution, S_0, shall not exceed 2,0 ml.

7.2 Metal ions

The extract shall not contain in total more than 1 µg/ml of barium, chromium, copper, lead, and tin, and not more than 0,1 µg/ml of cadmium, when determined by atomic absorption spectroscopy (AAS) or an equivalent method.

When tested in accordance with B.3, the intensity of the colour produced in the test solution shall not exceed that of the standard matching solution containing (Pb^{2+}) = 1 µg/ml.

7.3 Titration acidity or alkalinity

When tested in accordance with B.4, not more than 1 ml of either standard volumetric solution shall be required for the indicator to change to the colour grey.

7.4 Residue on evaporation

When tested in accordance with B.5, the total amount of dry residue shall not exceed 5 mg.

7.5 UV absorption of extract solution

When tested in accordance with B.6, the extract solution, S_1, shall not show absorption greater than 0,1.

8 Biological requirements

8.1 General

The transfusion set shall not release any substances which may adversely affect the patient, see C.2.

8.2 Sterility

The transfusion set in its unit container shall have been subjected to a validated sterilization process (see References [4], [5], and [6]).

8.3 Pyrogenicity

The transfusion set shall be assessed for freedom from pyrogens using a suitable test and the results shall indicate that the transfusion set is free from pyrogenicity. Testing for pyrogenicity shall be carried out in accordance with Annex C.

8.4 Haemolysis

The transfusion set shall be assessed for freedom from haemolytic constituents and the result shall indicate that the transfusion set is free from haemolytic reactions.

NOTE Guidance on testing for haemolytic constituents is given in ISO 10993-4.

8.5 Toxicity

Materials shall be assessed for toxicity by carrying out suitable tests and the results of the tests shall indicate freedom from toxicity.

NOTE Guidance on testing for toxicity is given in ISO 10993-1.

8.6 Assessment of blood component depletion

Sets shall be assessed against the range of blood components for which they are recommended to ensure that no more than 5 % of the relevant constituent(s) of a single adult therapeutic dose of each blood component is retained by the set[3]. The assessment should compare samples of the blood component taken prior to and after passage through the transfusion set.

NOTE For guidance, relevant constituents are typically present in the following doses or concentrations:

— red cell components: >36 g haemoglobin per unit;

— fresh frozen plasma: >0,7 IU Factor VIIIc per ml.

8.7 Assessment of damage to blood components

Transfusion sets shall be assessed against the range of blood components for which they are recommended to ensure that the relevant constituent(s) of each blood component is not significantly damaged (or where applicable, activated or inactivated) by passage through the set[3].

Dedicated transfusion sets shall be additionally assessed against the pressure transfusion equipment and protocols for which they are recommended to ensure that the relevant constituent(s) of each blood

3) In countries where human blood is not available for testing, equivalent test methods may be established.