
**Small-bore connectors for liquids and
gases in healthcare applications —**

**Part 7:
Connectors for intravascular or
hypodermic applications**

*Raccords de petite taille pour liquides et gaz utilisés dans le domaine
de la santé —*

*Partie 7: Connecteurs pour les applications intravasculaires ou
hypodermiques*



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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 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.

This document was prepared by Technical Committee ISO/TC 210, *Quality management and corresponding general aspects for medical devices*, and IEC/SC62D, *Electromedical equipment*, in collaboration with the European Committee for Standardization (CEN) Technical Committee, CEN/CENELEC JTC3/WG 2, *Small-bore connectors*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 80369-7:2016), which has been technically revised.

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

- Tolerances of several reference *connector* dimensions are increased to facilitate easier manufacturing and certification. Most of the affected tolerances are for features that do not contact the test *connector* and therefore do not affect the test results. The angle tolerance for the bearing side of the threads do contact the *connector* under test but the change in the tolerance is considered likely have minimal to no effect on test outcomes.
- Some requirements for *Luer connectors* have been separated for *semi-rigid materials* and *rigid materials* to better ensure compatibility at the extreme of the design space. Definitions of *semi-rigid material* and *rigid material* have been added.
- The distance from the tip of the *connector* to the bottom of the first complete thread profile of the internal thread (*t* dimension) has been made an *auxiliary dimension* due to the difficulty in its measurement. The functional impact of the dimension is evaluated with the resistance to separation (from axial load) functional test.
- The N1 and N2 dimensions of the female *Luer lock connector* variant A (with lugs at right angle to axis) have been changed to allow measurement from the open end of the *connector*, to better ensure compatibility at the extreme of the design space.

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.

Introduction

This document was developed because of several incidents, with catastrophic consequences, resulting from inappropriate medication, liquid nutritional formula or air being administered intravenously. Many incidents have been reported leading to international recognition of the importance of these issues and a need has been identified to develop specific *connectors* for *medical devices* and their *accessories* used to deliver fluids in other *applications*.

The ISO 80369 series was developed to prevent misconnection between *small-bore connectors* used in different *applications*. ISO 80369-1 specifies the requirements necessary to verify the designs and dimensions of *small-bore connectors* to ensure that

- a) they do not misconnect with other *small-bore connectors*, and
- b) they safely and securely connect with their mating half.

This document specifies the design and the dimensions and the drawings of *small-bore connectors* intended to be used as conical fittings with a 6 % (Luer) taper for *connections* in intravascular or hypodermic *applications*. [Annex D](#) to [Annex G](#) describe the methods by which this design has been assessed. Other parts of ISO 80369 include requirements for *small-bore connectors* used in different *application* categories.

Connectors manufactured to the dimensions set out within this document are dimensionally incompatible with any of the other *connectors* for *applications* identified in the ISO 80369 series of documents for *small-bore connectors*, except as indicated in [Annex G](#). If fitted to the relevant *medical devices* and *accessories*, these *connectors* should reduce the *risk* of air, non-vascular medication and liquid nutritional formula being delivered through an alternative route, such as intravenously or through an airway device.

In this document, the conjunctive “or” is used as an “inclusive or” so a statement is true if any combination of the conditions is true.

In this document, the following verbal forms are used:

- “shall” indicates a requirement;
- “should” means that conformance with a requirement or a test is recommended but is not mandatory for conformance with this document;
- “may” indicates a permission;
- “can” indicates a possibility or a capability.

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Small-bore connectors for liquids and gases in healthcare applications —

Part 7: Connectors for intravascular or hypodermic applications

1 Scope

This document specifies dimensions and requirements for the design and functional performance of *small-bore connectors* intended to be used for *connections* in intravascular *applications* or hypodermic *connections* in hypodermic *applications* of *medical devices* and *accessories*.

EXAMPLES Hypodermic syringes and needles or intravascular (IV) cannulae with male and female *Luer slip connectors* and *Luer lock connectors*.

NOTE 1 See [Annex A](#).

NOTE 2 The *Luer connector* was originally designed for use at pressures up to 300 kPa.

This document does not specify requirements for the *medical devices* or *accessories* that use these *connectors*. Such requirements are given in particular documents for specific *medical devices* or *accessories*.

This document does not specify requirements for the following *small-bore connectors*, which are specified in other documents:

- haemodialyser, haemodiafilter and haemofilter blood compartment ports (ISO 8637 [5] and applicable portion of ISO 8638 [6] referencing blood compartment ports);
- haemodialysis, haemodiafiltration and haemofiltration equipment *connectors* (ISO 8637 [5]);
- infusion system closure piercing *connectors* (ISO 8536-4 [4]).

NOTE 3 *Manufacturers* are encouraged to incorporate the *small-bore connectors* specified in this document into *medical devices* or *accessories*, even if currently not required by the relevant particular *medical device* documents. It is expected that when the relevant particular *medical device* documents are revised, requirements for *small-bore connectors*, as specified in ISO 80369, will be included.

NOTE 4 ISO 80369-1:2018, Clause 7, specifies alternative methods of conformance with ISO 80369-1:2018, for *small-bore connectors* intended for use with intravascular *applications* or hypodermic *application medical devices* or *accessories*, which do not conform with this document.

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 14971:2019, *Medical devices — Application of risk management to medical devices*

ISO 80369-1:2018, *Small-bore connectors for liquids and gases in healthcare applications — Part 1: General requirements*

ISO 80369-6:2016, *Small bore connectors for liquids and gases in healthcare applications — Part 6: Connectors for neuraxial applications*

ISO 80369-20:2015, *Small-bore connectors for liquids and gases in healthcare applications — Part 20: Common test methods*

IEC 62366-1:2015, *Medical devices — Part 1: Application of usability engineering to medical devices*

3 Terms and definitions

For the purposes of this document, the terms and definitions specified in ISO 80369-1:2018, ISO 80369-20:2015, ISO 14971:2019, IEC 62366-1:2015 as indicated in [Annex J](#) and the following apply.

NOTE For convenience, the sources of all defined terms used in this document are given in [Annex J](#).

— ISO Online browsing platform: available at <https://www.iso.org/obp>

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

3.1

auxiliary dimension

dimension derived from other dimensions given for information purposes only

[SOURCE: ISO 10209:2012^[7], 4.2]

3.2

Luer connector

small-bore connector that contains a conical mating surface with a 6 % (Luer) taper intended for use in intravascular or hypodermic applications of medical devices and related accessories

Note 1 to entry: A *Luer connector* can be either a *Luer slip connector* or a *Luer lock connector*.

Note 2 to entry: See [Annex A](#).

3.3

Luer slip connector

Luer connector without a lock

Note 1 to entry: The *Luer slip connector* is indicated by the abbreviation L1.

Note 2 to entry: See [Annex A](#).

3.4

Luer lock connector

Luer connector that contains a locking mechanism

Note 1 to entry: The *Luer lock connector* is indicated by the abbreviation L2.

Note 2 to entry: See [Annex A](#).

3.5

normal use

operation, including routine inspection and adjustments by any *user*, and stand-by, according to the instructions for use

Note 1 to entry: *Normal use* should not be confused with *intended use*. While both include the concept of use as intended by the *manufacturer*, *intended use* focuses on the medical purpose while *normal use* incorporates not only the medical purpose, but maintenance, service, transport, etc. as well.

[SOURCE: IEC 60601-1:2005+A1:2012 ^[12], 3.71, modified — replaced “operator” with “user”.]

3.6

rated

<value> term referring to a value assigned by the *manufacturer* for a specified operating condition

[SOURCE: IEC 60601-1:2005 ^[12], 3.97]

3.7

rigid material

material with a modulus of elasticity either in flexure or in tension greater than 3 433 MPa

EXAMPLE Metals, glass, some fibre-reinforced polymers and high-performance polymers.

3.8

semi-rigid material

material with a modulus of elasticity either in flexure or in tension, between 700 MPa and 3 433 MPa

EXAMPLE Thermoplastics.

4 General requirements

4.1 General requirements for *Luer connectors*

Luer connectors made in conformance with this document conform with the general requirements of ISO 80369-1:2018, unless otherwise indicated in this document.

In some tolerance combinations, the inside diameter of the fluid lumen of male *Luer connector* may contact the sealing surfaces of the N1 male *connector* (N1), as specified in ISO 80369-6, in *LMC* and thereby these *connectors* mutually fail when evaluating the *non-interconnectable* characteristics tests of ISO 80369-1:2018, Annex B. Additional information is provided in [G.2.2](#).

The reference *connectors* for evaluation of the *non-interconnectable* characteristics are described in [Annex C](#) ([Figures C.1](#), [C.2](#), [C.4](#) and [C.5](#), as appropriate).

Where a *medical device* or *accessory* is designed to provide features of the *Luer connector* of this document, those features shall be included in the *verification* to this document. When necessary, install the *small-bore connector* on the *medical device* or *accessory* to demonstrate conformance with ISO 80369-1:2018, Annex B.

NOTE 1 The summary of *medical devices* and their attributes with *connections* within this *application* is provided in [Annex D](#).

NOTE 2 The summary of the *usability* requirements for *Luer connectors* is provided in [Annex E](#).

NOTE 3 The summary of *Luer connectors* criteria and requirements is provided in [Annex F](#).

NOTE 4 The summary of assessment of the design of *Luer connectors* according to ISO 80369-1:2018, 6.1, is contained in [Annex G](#).

NOTE 5 This document has been prepared to address the relevant essential principles of safety and performance of ISO 16142-1:2016 [9] as indicated in [Annex H](#).

NOTE 6 This document has been prepared to address the relevant general safety and performance requirements of European regulation (EU) 2017/745 [15] as indicated in [Annex I](#).

4.2 Type tests

Conformance with the requirements of this document shall be determined by *type tests*.

5 Dimensional requirements for *Luer connectors*

Luer connectors shall conform with the dimensions and tolerances as given in

- [Figure B.1](#) and [Table B.1](#) for a male *Luer slip connector* (L1),
- [Figure B.2](#) and [Table B.2](#) for a female *Luer slip connector* (L1),
- [Figure B.3](#) and [Table B.3](#) for a male *Luer lock connector* (L2), with fixed collar,

- [Figure B.4](#) and [Table B.4](#) for a male *Luer lock connector* (L2), with floating or rotatable collar,
- [Figure B.5](#) and [Table B.5](#) for a female *Luer lock connector* (L2),
- [Figure B.6](#) and [Table B.6](#) for a female *Luer lock connector* (L2), with lugs at right angle to axis, variant A,
- [Figure B.7](#) and [Table B.7](#) for a female *Luer lock connector* (L2), with lugs at right angle to axis, variant B, and
- [Figure B.8](#) and [Table B.8](#) for a female *Luer lock connector* (L2), with lugs at right angle to axis, variant C.

Check conformance by confirming the dimensions and tolerances specified in [Annex B](#), for the appropriate figure and table.

NOTE See [Annex A](#).

6 Performance requirements

6.1 Fluid leakage

6.1.1 Fluid leakage requirement

Luer connectors shall be evaluated for leakage using either the leakage by pressure decay *test method* or the positive pressure liquid leakage *test method*.

6.1.2 Leakage by pressure decay

Luer connectors evaluated for fluid leakage performance with the leakage by pressure decay *test method* shall not exceed a leakage rate of 0,005 Pa·m³/s while being subjected to an applied pressure of between 300 kPa and 330 kPa over a hold period between 15 s and 20 s using air as the medium.

Check conformance by applying the tests of ISO 80369-20:2015, Annex B, while using the leakage reference *connector* specified in [Annex C](#) ([Figures C.1](#), [C.2](#), [C.4](#) and [C.5](#), as appropriate). A greater applied pressure may be used.

6.1.3 Positive pressure liquid leakage

Luer connectors evaluated for fluid leakage performance with the positive pressure liquid leakage *test method* shall show no signs of leakage, sufficient to form a falling drop of water, over a hold period of 30 s to 35 s while being subjected to an applied pressure of between 300 kPa and 330 kPa.

Check conformance by applying the tests of ISO 80369-20:2015, Annex C, while using the leakage reference *connector* specified in [Annex C](#) ([Figures C.1](#), [C.2](#), [C.4](#) and [C.5](#), as appropriate). A greater applied pressure may be used.

6.2 Sub-atmospheric pressure air leakage

Luer connectors shall be evaluated for sub-atmospheric pressure air leakage. *Luer connectors* shall not leak by more than 0,005 Pa·m³/s while being subjected to an applied sub-atmospheric pressure of between 80,0 kPa and 88,0 kPa over a hold period of between 15 s and 20 s.

Check conformance by applying the tests of ISO 80369-20:2015, Annex D, while using the leakage reference *connector* specified in [Annex C](#) ([Figures C.1](#), [C.2](#), [C.4](#) and [C.5](#), as appropriate). A greater applied sub-atmospheric pressure may be used.

6.3 Stress cracking

Luer connectors shall be evaluated for stress cracking. *Luer connectors* shall meet the requirements of [6.1.1](#) after being subjected to stresses of ISO 80369-20:2015, Annex E.

Check conformance by applying the tests of ISO 80369-20:2015, Annex E, while using the stress cracking reference *connector* specified in [Annex C](#) ([Figures C.1](#), [C.2](#), [C.4](#) and [C.5](#), as appropriate).

6.4 Resistance to separation from axial load

Luer connectors shall be evaluated for separation from axial load. *Luer connectors* shall not separate from the reference *connector* over a hold period between 10 s and 15 s while being subjected to a disconnection applied axial force between

- a) 23 N and 25 N for *Luer slip connectors*, and
- b) 32 N and 35 N for *Luer lock connectors*.

Check conformance by applying the tests of ISO 80369-20:2015, Annex E, while using the resistance to separation from axial load reference *connector* specified in [Annex C](#) ([Figures C.2](#), [C.3](#), [C.5](#) and [C.6](#), as appropriate). A greater disconnection applied axial force or a longer hold period may be used.

6.5 Resistance to separation from unscrewing

Luer lock connectors shall be evaluated for separation from unscrewing. *Luer lock connectors* shall not separate from the reference *connector* for a hold period between 10 s and 15 s while being subjected to an unscrewing torque of between 0,018 N·m to 0,020 N·m.

Check conformance by applying the tests of ISO 80369-20:2015, Annex G, while using the resistance to separation from unscrewing reference *connector* specified in [Annex C](#) ([Figures C.1](#) and [C.4](#), as appropriate). A greater applied unscrewing torque or a longer hold period may be used.

6.6 Resistance to overriding

Luer lock connectors shall be evaluated for resistance to overriding. *Luer lock connectors* shall not override the threads or lugs of the reference *connector* while being subjected to an applied torque of between 0,15 N·m to 0,17 N·m over a hold period between 5 s and 10 s.

Check conformance by applying the tests of ISO 80369-20:2015, Annex H, while using the resistance to overriding reference *connector* specified in [Annex C](#) ([Figures C.3](#) and [C.6](#), as appropriate). A greater applied torque or a longer hold period may be used.

Annex A (informative)

Rationale and guidance

A.1 General guidance

This annex provides a rationale for some requirements of this document and is intended for those who are familiar with the subject of this document but who have not participated in its development. An understanding of the rationale underlying these requirements is considered to be essential for their proper use. Furthermore, as clinical practice and technology change, it is believed that a rationale will facilitate any revision of this document necessitated by those developments.

A.2 Rationale for particular clauses and subclauses

The clauses and subclauses in this Annex have been numbered to correspond to the numbering of the clauses and subclauses of this document to which they refer. The numbering is, therefore, not consecutive.

Clause 1 Scope

The scope includes the fittings described previously in ISO 594-1 and ISO 594-2.

In 2000, a Task Group of the European standards organization CEN proposed a strategy to reduce incidents of accidental misconnection of *patient* therapy lines by the use of a series of *non-interconnectable connectors*, differentiated by design, for use in different medical applications. The strategy reserves the use of *Luer connectors* solely for use in *medical devices* used to access the vascular system or for hypodermic applications so that they can achieve their intended function [14].

During the development of this document, the committees frequently debated how *Luer connector* activated *medical devices* (LADs) should be interpreted. In context of this document, “LADs” are considered to be a “component” of the *medical device* and are typically a female valve designed to interconnect with male *Luer connector*. The following guidance relates specifically to the LAD (or female valve end) component only and does not include the rest of a *medical device*.

A LAD typically includes a valve that opens and permits access to the fluid conduit when a standard male *Luer connector* is inserted into it. By design, it forms one-half of the *connection* that establishes a fluid conduit with a male *Luer connector*. However, such LADs typically do not conform with this document. Specifically, they often are made of materials that are softer than *semi-rigid materials* (since their mating surfaces often include elastomeric materials) nor do they fully conform dimensionally to [Clause 5](#). Thus, a typical LAD is not a *Luer connector*. As such, they are not within the scope of this document.

The committees, however, felt compelled to provide some guidance on the LAD due to the obvious similarities of intended use with *Luer connectors*. It is advisable that *manufacturers* of LADs utilize the features providing *non-interconnectable* characteristics of this document, wherever possible, to address the *risk* of misconnections to their *medical devices*. These elements can include the appropriate combinations of the following:

- materials conformance (i.e. ≥ 700 MPa) for interference features;
- dimensional conformance (i.e. dimensions *H*, *J*, *D*, and *G* from [Annex B](#));
- dimensional and/or CAD analysis showing interference features;

- *non-interconnectable* characteristics testing per ISO 80369-1:2018, Annex B;
- usability testing demonstrating *non-interconnectable* characteristics.

Additionally, the functional performance requirements of [Clause 6](#) should also be considered for the LAD component.

In this way, the LADs can be evaluated for both *non-interconnectable* characteristics and performance characteristics associated with the ISO 80369 series.

The LADs by definition continue to not be considered a "conforming" *Luer connector* (i.e. not conforming with this document), however they can be considered 'compatible with' a *medical device* utilizing a male *Luer connector* (by way of functional performance).

Manufacturers and *responsible organizations* are encouraged to report their experience with the *Luer connectors* specified in this document to the Secretariat of ISO/TC 210, so that it can consider this feedback during the revision of the relevant part of the ISO 80369 series.

Definition 3.2 *Luer connector*

Definition 3.3 *Luer slip connector*

Definition 3.4 *Luer lock connector*

For clarity, the new terms *Luer connector*, *Luer slip connector*, and *Luer lock connector* replace conflicting and confusing terms used in ISO 594-1 and ISO 594-2. The new terms align and harmonize this document with ISO 80369-1, which does not utilize the legacy terms fitting, conical, or taper. The new terms are equivalent to those now generically used to describe the *small-bore connectors* commonly named after their inventor, 19th century German medical instrument maker Hermann Wülfig Luer.

Clause 5 Dimensional requirements for *Luer connectors*

Legacy Luer gauges cannot be used to verify the performance of *connectors* that are intended to prevent misconnection because they lack the dimensions for surfaces not intended to form *connections* with *Luer connectors*. Maintenance of production quality (i.e. using gauges) is outside the scope of this document. The dimensional requirements in [Annex B](#) are a more precise description of the design and performance characteristics for both intended *connections* and avoidance of misconnections.

Dimensions and tolerances not previously identified in ISO 594-1 and ISO 594-2 are added to this document to reduce the *risk* of misconnections between *medical devices* or between *accessories* for different *applications* with non-*Luer connectors* that are being developed under other parts of the ISO 80369 series. These new requirements were selected to represent the inherent design and dimensions of *Luer connectors* in clinical use at the time this document was developed.

Since the configurations of the *connectors* proposed within this document are *small-bore connectors* with or without a threaded collar, the requirements and parameters from ISO 594-1 and ISO 594-2 have been used where applicable.

The maximum inside diameter at the tip of the male taper (through bore), $\varnothing$, of 2,900 mm was chosen to describe the majority of *Luer connectors* available to *users* at the time of publication of this document. The committees considered the clinical needs of high flow rate intravascular *medical devices* and determined that the incremental increase in flow if $\varnothing$ is increased to a theoretical sharp edge of 3,50 mm was not warranted in view of the increased *risk* of misconnection with smaller male *small-bore connectors* in the ISO 80369 series.

Commercially developed glass prefilled syringes [\[8\]](#) routinely mate with *Luer connector* equipped *medical devices* in order to effectively administer the medication stored within the syringe. Examples: disposable needles, needleless ports and other forms of Luer access. Current state-of-technology syringe tip glass forming technology for manufacturing glass-prefilled syringes cannot conform completely to either previous Luer fitting standard, ISO 594 or this document. Both the previous standard and this document have been developed using ground glass, metal and injection moulded technology and plastic resins as the baseline for conformance and capabilities.

The minimum inside diameter at the tip of the male taper (through bore), $\emptyset f$, is not defined to accommodate the very small bore of glass syringes.

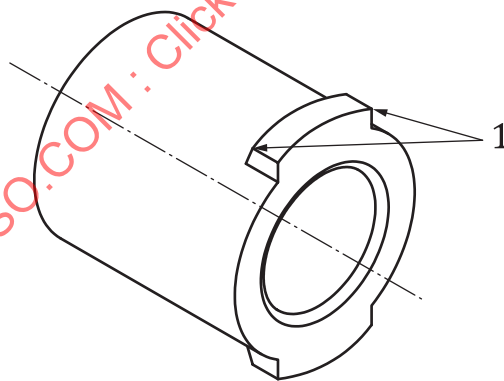
The committees acknowledge the differences in the manufacturing methodologies and the need for expanded tolerances in the glass forming manufacturing *process*. The baseline specifications of the tapered tip need to remain similar. However, to accommodate the glass forming manufacturing *process*, there needs to be expanded dimensional tolerances. While these tolerances are outside of the range of this document with respect to some of the dimensions, a glass formed tip does successfully mate with the injection moulded female *Luer connectors*. Refer to ISO 11040-4 [8] for a listing of those critical dimensions, their expanded corresponding tolerances and functional *test methods* that accommodate the formed tip manufacturing *process*.

A dimensional analysis of the female *Luer lock connector* (L2), variant A thread form was conducted during the development of this document to ensure both

- proper connection to other male *Luer connectors*, and
- prevention of misconnection to the other *connectors* of the ISO 80369 series.

The analysis demonstrated that in certain instances the thread form detailed in [Figure B.6](#) and [Table B.6](#) could, if taken to certain extremes, collide with non-sealing features of the mating male *Luer connector* (i.e. [Figure B.3](#) and [Figure B.4](#)) prior to a fluid tight seal being achieved. Specifically, the diagonal distance between the corners of the right-angle thread of the female *Luer lock connector* of [Figure B.6](#) could bind between adjacent threads of the mating male *Luer connector*. [Figure A.1](#) and [Figure A.2](#) illustrate this possible interference. This can be worsened by the allowable variations in thread profile, thread pitch and thread lead, of the features of the mating male *Luer connector*. This situation is unchanged from the legacy ISO 594-2, the same magnitude of interference was possible with conforming *connectors*.

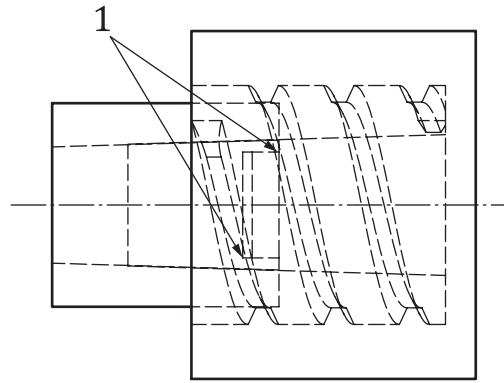
Due to the proliferation of existing *Luer connectors* and general lack of data indicating a problem in use, the committees determined that the same level of interference would be permitted by this document (i.e. the permissible design is unchanged).



Key

- 1 corners that can interfere

Figure A.1 — Lug corners that can interfere

**Key**

1 area of potential interfere

Figure A.2 — Area of potential interference

The analysis also demonstrated that in certain instances the taper surfaces of male and female *Luer lock connectors* made from *semi-rigid materials*, if taken to certain extremes, might not engage deep enough to allow the threads to engage properly. In these instances, the resulting *connection* is only equal to a *Luer slip connector* and does not benefit from the additional retention of the locking threads. This potential is mitigated by the deformability of the *semi-rigid materials* from which most *connectors* are made that allow the tapers to engage further as they deform as they are connected. There is a general lack of data indicating a problem in actual use. For these reasons the dimensions have not been changed to eliminate this potential, but a newly recommended (informative) minimum value for the $\varnothing D$ and $\varnothing G$ dimensions has been added. Conforming with this recommendation reduces the likelihood of this possibility. All *connectors* are still required to conform with the resistance to separation from axial load functional test of [6.4](#).

The distance from the tip of the *connector* to the bottom of the first complete thread profile of the internal thread, the t dimension, is also essential for an effective locking *connection*. It has also been noted that there is a general lack of data indicating there is a problem even when many of the current male *Luer lock connectors* on the market made from *semi-rigid materials* do not meet the ideal maximum dimension of 3,200 mm. For this reason, combined with the difficulty in measuring this feature, the recommended dimension for *connectors* made from *semi-rigid materials* has changed and have been made an *auxiliary dimension*. All *connectors* are still required to conform with the resistance to separation from axial load functional test of [6.4](#).

In addition, due to the commercial evolution of existing *Luer connectors*, a *connector* conforming with ISO 594-2:1988, Figure 3, Variant A (female *Luer connector* with thread lug at right angle) was elusive to locate for testing purposes. Most participating *manufacturers*, who offer a “lug” version of threads, offer a version that has one side at a right angle with the other inclined at pitch “ p ”, thus these are a hybrid between the traditional ISO 594-2:1988, Figure 3, Variant A and ISO 594-2:1988, Figure 4. Since the diameters provide the features that ensure the *non-interconnectable* characteristics are maintained, the committees decided to permit these hybrid thread lugs with the inclusion of features $N1$ and $N2$ (width of the thread lug at the root of the leading and trailing ends, respectively).

NOTE The same level of interference as described above (with threads at right angles) is possible within the tolerances specified. Each *manufacturer* is encouraged to check the performance of their design to ensure the *risk* of leakage is minimized.

Annex B
(normative)

Luer connectors

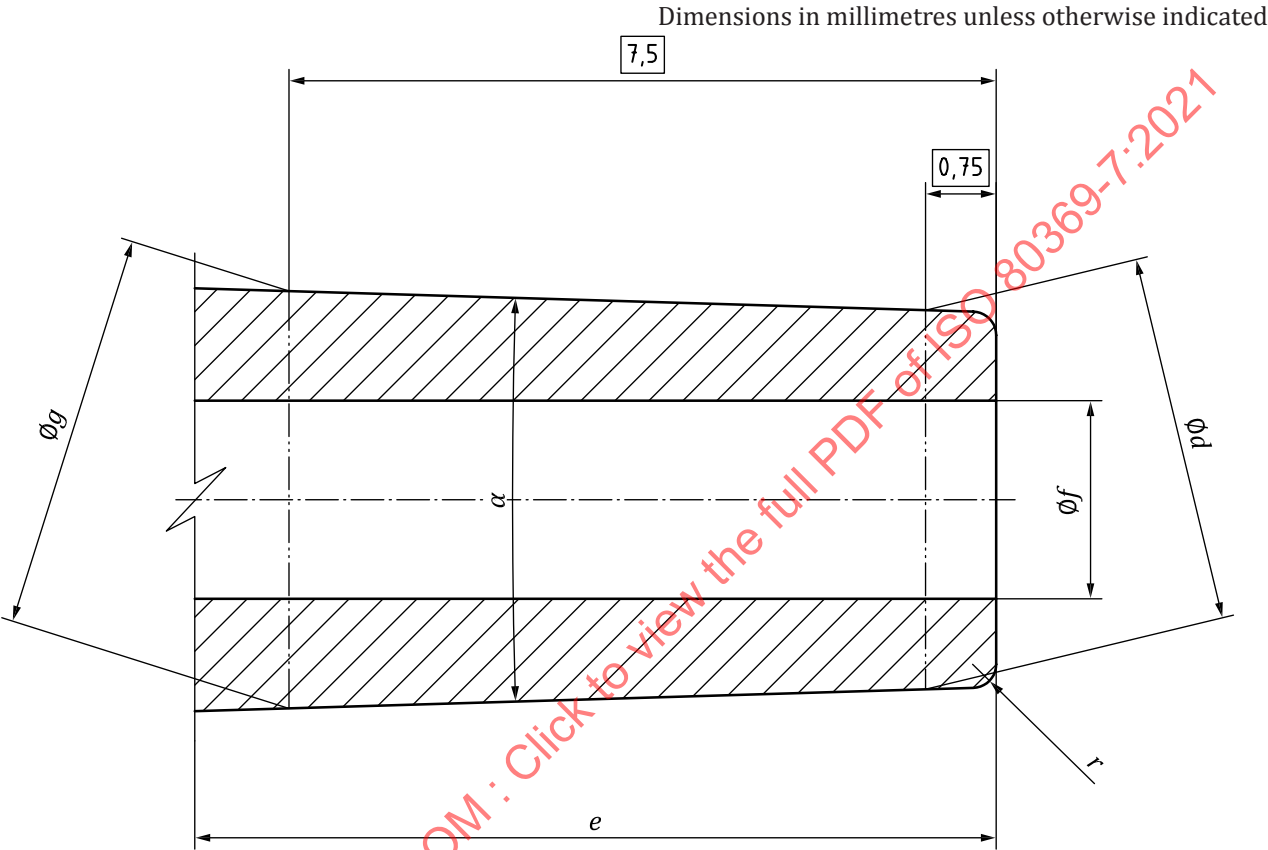


Table B.1 contains the dimensions for this figure.

Figure B.1 — Male *Luer slip connector* (L1)

Table B.1 — Male *Luer slip connector* dimensions (L1)

Dimensions in millimetres unless otherwise indicated
Auxiliary dimensions are in parenthesis

Male <i>Luer slip connector</i> (L1)				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
α	Angle of the taper (6 % taper nominal) (degrees, auxiliary dimension)	—	(3,44°)	—
^a This dimension also defines the extent of the connector.				

Table B.1 (continued)

Male Luer slip connector (L1)				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
$\emptyset d$	For <i>rigid material</i> : Outside diameter at the tip of the male taper at 0,750 (basic dimension) from the tip (small end) of the male taper	3,970	—	4,035
	For <i>semi-rigid material</i> : Outside diameter at the tip of the male taper at 0,750 (basic dimension) from the tip (small end) of the male taper	3,970	—	4,072
e	Length of the male taper ^a	7,500	—	10,500
$\emptyset f$	Inside diameter at the tip of the male taper	—	—	2,900
$\emptyset g$	For <i>rigid material</i> : Outside diameter of the larger end of the male taper at 7,500 (basic dimension) from the tip (small end) of the male taper	4,375	—	4,440
	For <i>semi-rigid material</i> : Outside diameter of the larger end of the male taper at 7,500 (basic dimension) from the tip (small end) of the male taper	4,375	—	4,477
r	Radius or chamfer at the outside tip of the male taper	0,000	—	0,500
^a This dimension also defines the extent of the <i>connector</i> .				

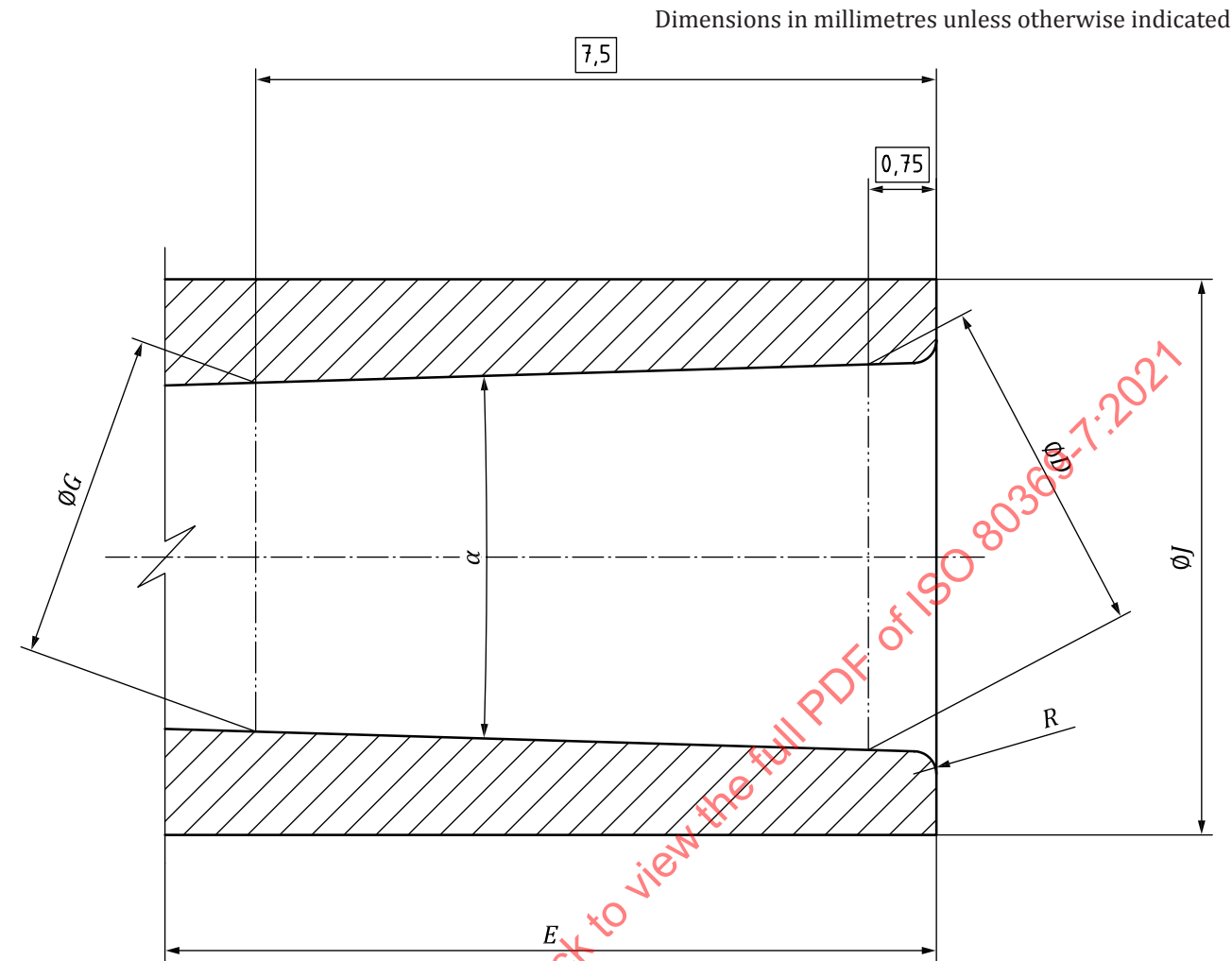


Table B.2 contains the dimensions for this figure.

Figure B.2 — Female *Luer slip* connector (L1)

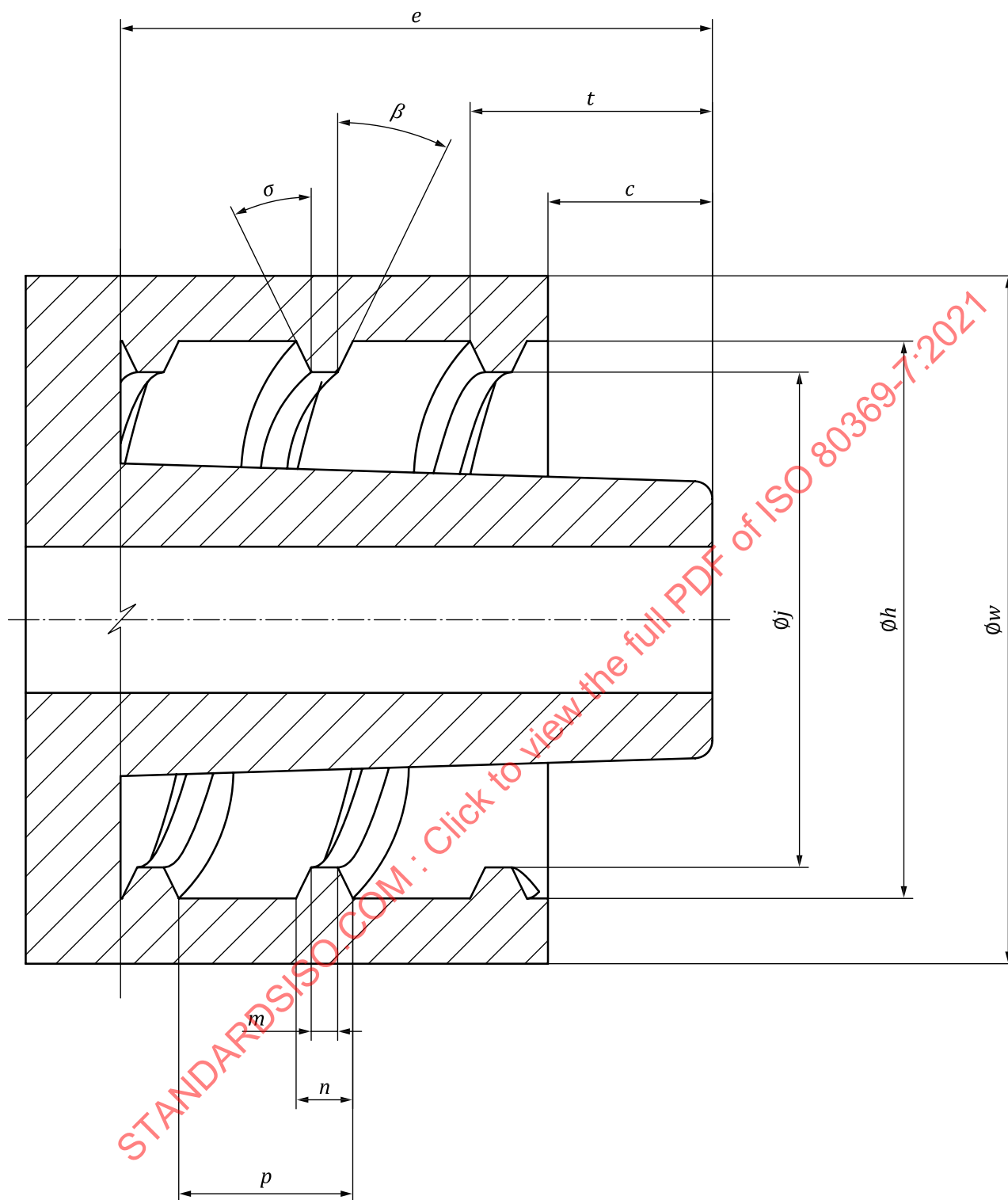
Table B.2 — Female *Luer slip* connector dimensions (L1)

Dimensions in millimetres unless otherwise indicated
Auxiliary dimensions are in parenthesis

Female <i>Luer slip</i> connector (L1)				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
α	Angle of the taper (6 % taper <i>nominal</i>) (degrees, auxiliary dimension)	—	(3,44°)	—
^a This dimension also defines the extent of the <i>connector</i> .				
^b It is recommended that <i>connectors</i> made from <i>semi-rigid materials</i> should consider 4,225 as the minimum value for ØD and 3,820 as the minimum value for ØG to ensure thread engagement with all male <i>Luer lock</i> connectors. See Annex A, Clause 5 .				

Table B.2 (continued)

Female Luer slip connector (L1)				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
$\emptyset D$	For <i>rigid material</i> : Inside diameter at the open end of the female taper at 0,750 (basic dimension) from the opening (large end) of the female taper	4,225	—	4,270
	For <i>semi-rigid material</i> : Inside diameter at the open end of the female taper at 0,750 (basic dimension) from the opening (large end) of the female taper	4,198 ^b	—	4,298
E	Depth of the female taper ^a	7,500	—	10,500
$\emptyset G$	For <i>rigid material</i> : Inside diameter of the smaller end of the female taper at 7,500 (basic dimension) from the opening (large end) of the female taper	3,820	—	3,865
	For <i>semi-rigid material</i> : Inside diameter of the smaller end of the female taper at 7,500 (basic dimension) from the opening (large end) of the female taper	3,793 ^b	—	3,893
$\emptyset J$	Outside diameter of the female <i>Luer slip connector</i> of the smallest cylinder that encompasses the outside surfaces of external features of the <i>connector</i> . This diameter shall not be increased above the maximum for a distance from the hub face of 5,5 mm.	6,000	—	6,730
R	Radius or chamfer at the entrance of the female taper	—	—	0,500
^a This dimension also defines the extent of the <i>connector</i> . ^b It is recommended that <i>connectors</i> made from <i>semi-rigid materials</i> should consider 4,225 as the minimum value for $\emptyset D$ and 3,820 as the minimum value for $\emptyset G$ to ensure thread engagement with all male <i>Luer lock connectors</i> . See Annex A, Clause 5 .				



[Table B.3](#) contains the dimensions for this figure.

Figure B.3 — Male Luer lock connector (L2), with fixed collar

Table B.3 — Male Luer lock connector with fixed collar dimensions (L2)

Dimensions in millimetres unless otherwise indicated

Auxiliary dimensions are in parenthesis

Male Luer lock connector (L2) with fixed collar				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
β	Angle of internal thread profile on the non-bearing surface against separation (degrees)	25,0°	—	—
c	Projection of the tip of the <i>connector</i> from the thread collar	2,100	—	—
e	Length of the male taper ^a	7,500	—	10,500
$\varnothing h$	Major inside thread diameter (diameter at the thread root)	7,900	—	8,100
$\varnothing j$	Minor inside thread diameter (diameter at the thread crest)	6,800	—	7,200
m	Width of the thread profile at the crest	0,300	—	—
n	Width of the thread profile at the root	—	—	1,000
p	Nominal pitch of the double-start, right-hand thread (<i>auxiliary dimension</i>) (5 mm lead)	—	(2,500)	—
σ	Angle of internal thread profile on the bearing surface against separation (degrees)	25,0°	—	30,0°
t	For <i>rigid material</i> : Distance from the tip of the <i>connector</i> to the bottom of the first complete thread profile of the internal thread (<i>auxiliary dimension</i>)	—	—	(3,200)
	For <i>semi-rigid material</i> : Distance from the tip of the <i>connector</i> to the bottom of the first complete thread profile of the internal thread (<i>auxiliary dimension</i>)	—	—	(3,650) ^c
$\varnothing w$	Diameter of the smallest cylinder that encompasses the outside surfaces of the external features of the collar ^b	8,800	—	11,500

The design and dimensions of the thread profile (σ , β and m) may vary from those designated provided the *connector* meets the performance requirements of [Clause 6](#).

NOTE 1 The design and dimensions of the thread profile (σ , β and m) are not considered important to ensure *non-interconnectable* characteristics.

NOTE 2 The dimension t is essential for an effective Luer lock connection but is very difficult to measure therefore the effectiveness of this feature is assessed with the resistance to separation from axial load functional test of [6.4](#).

The length of the thread is not specified but shall provide clearance for the thread of the female *connector*.

The male *Luer lock connector* shall include the dimensions and tolerances of the male *Luer slip connector* as specified in [Figure B.1](#) and [Table B.1](#) except as indicated in this table.

^a This dimension also defines the extent of the *connector*.

^b The specified dimensional range shall be maintained for a minimum length of 1 mm from the open end of the collar. Beyond 1 mm, the diameter may be smaller than the specified minimum. The maximum diameter specified shall be maintained for a minimum length of e . This dimension may be achieved by either the *connector* or the *medical device* which incorporates this *connector*. Alternatively, *non-interconnectable* characteristics may be demonstrated using ISO 80369-1:2018, Annex B.

^c It is recommended that *connectors* made from *semi-rigid materials* should consider 3,200 as the maximum value for t to ensure thread engagement with all female *Luer lock connectors*. See [Annex A, Clause 5](#).

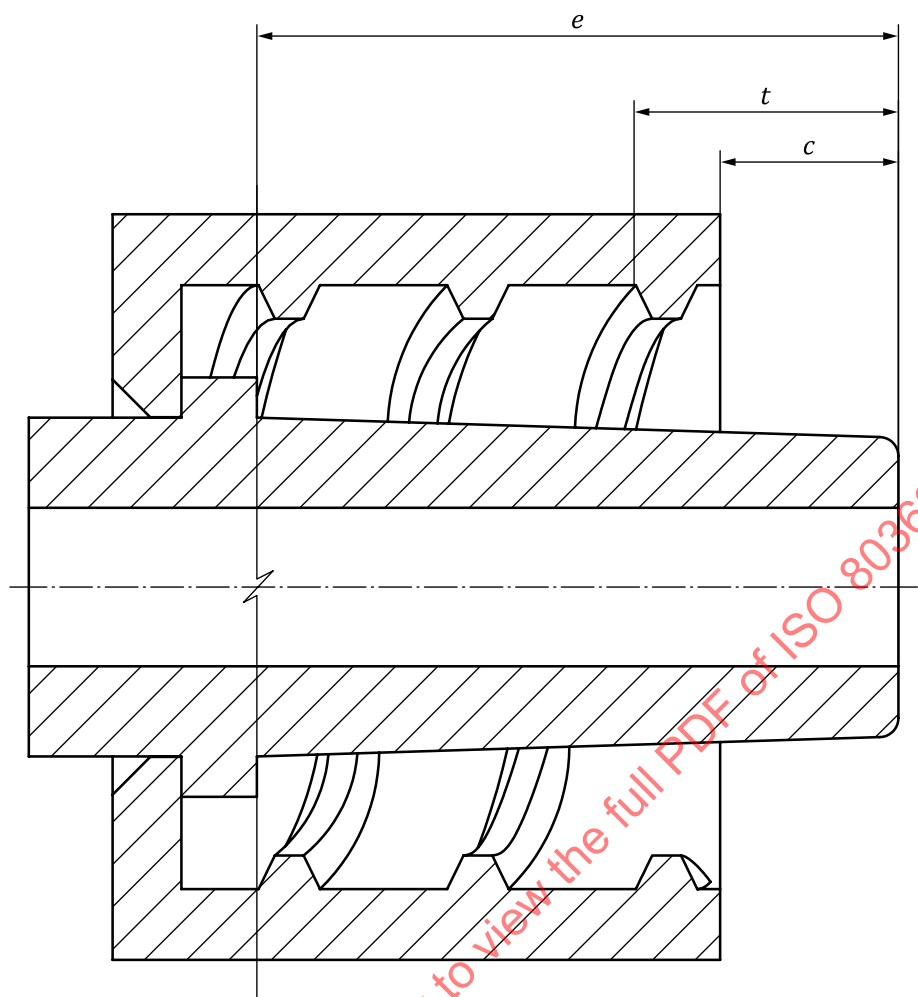


Table B.4 contains the dimensions for this figure.

Figure B.4 — Male Luer lock connector (L2), with rotatable collar

Table B.4 — Male Luer lock connector (L2), with a rotatable collar dimensions

Dimensions in millimetres unless otherwise indicated
Auxiliary dimensions are in parenthesis

Male Luer lock connector (L2), with a rotatable collar				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
c^a	Projection of the tip of the <i>connector</i> from the thread collar	2,100	—	—
e	Length of the male taper ^b	7,500	—	10,500

The male *Luer lock connector* with rotatable collar shall include the dimensions and tolerances of the male *Luer lock connector* as specified in [Figure B.3](#) and [Table B.3](#) except as indicated in this table.

NOTE The dimension t is essential for an effective locking *connection* but is very difficult to measure. Therefore the effectiveness of this feature is assessed with the resistance to separation from axial load functional test of [6.4](#).

^a This dimension is when the floating or rotatable collar is positioned fully toward tip of the *connector*.

^b This dimension also defines the extent of the *connector*.

^c It is recommended that *connectors* made from *semi-rigid materials* should consider 3,200 as the maximum value for t to ensure thread engagement with all female *Luer lock connectors*. See [Annex A, Clause 5](#).

Table B.4 (continued)

Male Luer lock connector (L2), with a rotatable collar				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
t^a	For <i>rigid material</i> : Distance from the tip of the <i>connector</i> to the bottom of the first complete thread profile of the internal thread (<i>auxiliary dimension</i>)	—	—	(3,200)
	For <i>semi-rigid material</i> : Distance from the tip of the <i>connector</i> to the bottom of the first complete thread profile of the internal thread (<i>auxiliary dimension</i>)	—	—	(3,650) ^c
The male <i>Luer lock connector</i> with rotatable collar shall include the dimensions and tolerances of the male <i>Luer lock connector</i> as specified in Figure B.3 and Table B.3 except as indicated in this table.				
NOTE The dimension t is essential for an effective locking <i>connection</i> but is very difficult to measure. Therefore the effectiveness of this feature is assessed with the resistance to separation from axial load functional test of 6.4 .				
^a This dimension is when the floating or rotatable collar is positioned fully toward tip of the <i>connector</i> .				
^b This dimension also defines the extent of the <i>connector</i> .				
^c It is recommended that <i>connectors</i> made from <i>semi-rigid materials</i> should consider 3,200 as the maximum value for t to ensure thread engagement with all female <i>Luer lock connectors</i> . See Annex A, Clause 5 .				

Dimensions in millimetres unless otherwise indicated

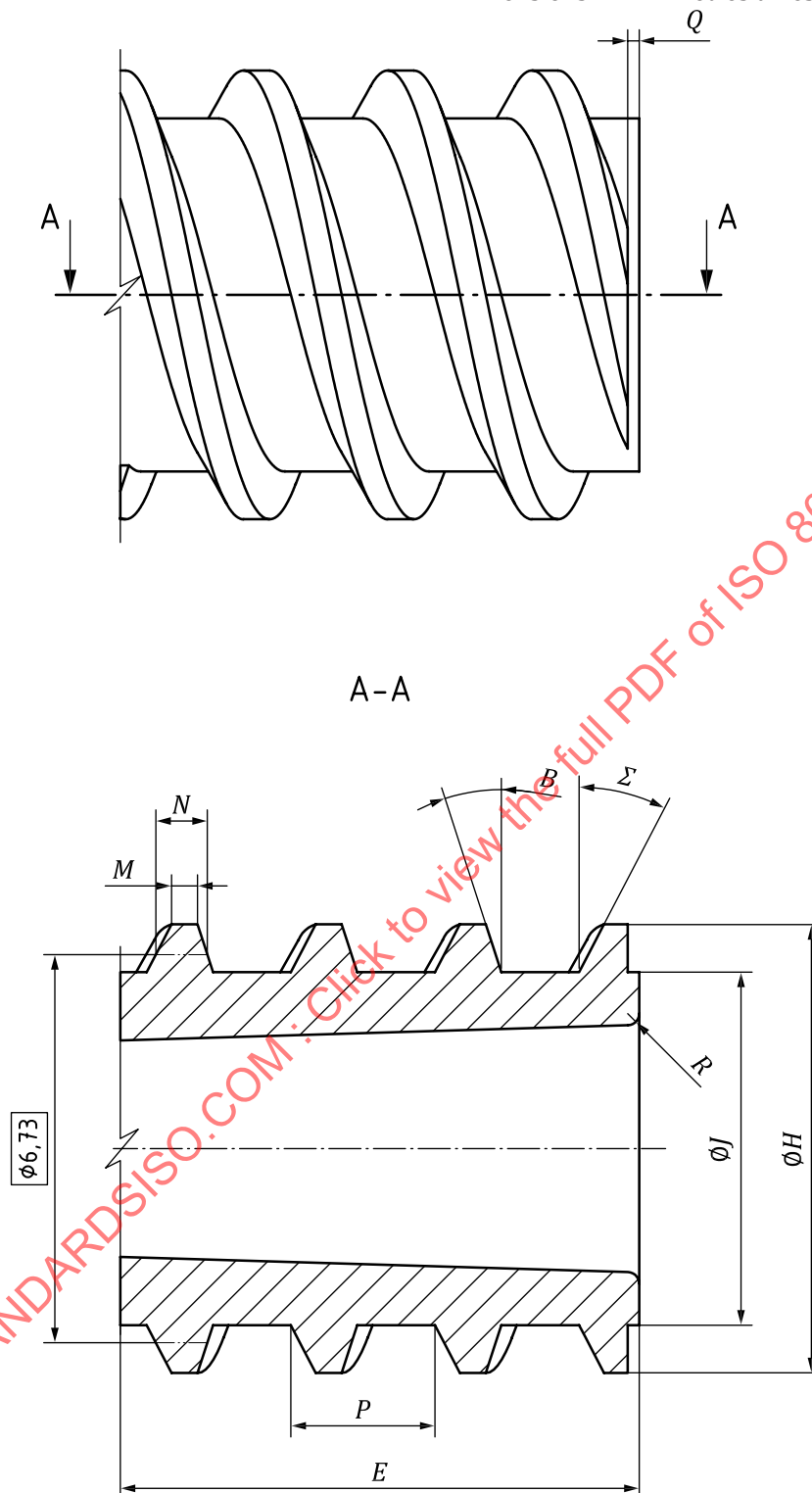


Table B.5 contains the dimensions for this figure. This design and the associated dimensions shall apply to any female *Luer lock connector* that has threads in a plane inclined to the axis of the *connector*. There are no dimensional restrictions on thread length. Figure B.6, Figure B.7 and Figure B.8 apply to designs utilizing lugs that are at a right angle to axis of the *connector*.

Figure B.5 — Female *Luer lock connector* (L2)

Table B.5 — Female Luer lock connector dimensions (L2)

Dimensions in millimetres unless otherwise indicated

Auxiliary dimensions are in parenthesis

Female Luer lock connector (L2)				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
<i>B</i>	Angle of the external thread profile on the non-bearing surface against separation (degrees)	0,0°	—	—
<i>E</i>	Depth of the female taper ^a	7,500	—	10,500
$\emptyset H$	Major outside thread diameter (diameter at thread crest) for the extent of the thread feature. This defines the diameter of the smallest cylinder of depth 5,5 mm from the face of the <i>connector</i> that encompasses the outside surfaces of the external features of the <i>connector</i> . This diameter shall not be increased above the maximum for a distance from the hub face of 5,5 mm.	7,730	—	7,830
$\emptyset J$	Minor outside thread diameter (diameter at the thread root) This diameter shall not be increased above the maximum for a distance from the hub face of 5,5 mm.	5,515	—	6,730
<i>M</i>	Width of the thread profile at the crest	0,300	—	—
<i>N</i>	Width of the thread profile at the root at a diameter corresponding to $\emptyset J$ max (6,730)	—	—	1,200
<i>P</i>	Nominal pitch of the double-start, right-hand thread (<i>auxiliary dimension</i>) (5 mm lead)	—	(2,500)	—
<i>Q</i>	Distance from the face of the <i>connector</i> to the base of the thread at the non-load bearing side	—	—	0,300
<i>R</i>	Radius or chamfer at the entrance of the female taper	—	—	0,500
Σ	Angle of external thread profile on the bearing surface against separation (degrees)	25,0°	—	30,0°
The design and dimensions of the thread profile (Σ , <i>B</i> and <i>M</i>) may vary from those designated provided the <i>connector</i> meets the performance requirements of Clause 6 .				
NOTE The design and dimensions of the thread profile (Σ , <i>B</i> , <i>M</i> and <i>P</i>) are not considered important to ensure <i>non-interconnectable</i> characteristics.				
The female Luer lock connector shall include the dimensions and tolerances of the female Luer slip connector as specified in Figure B.2 and Table B.2 except as indicated in this table.				
^a This dimension also defines the extent of the <i>connector</i> .				

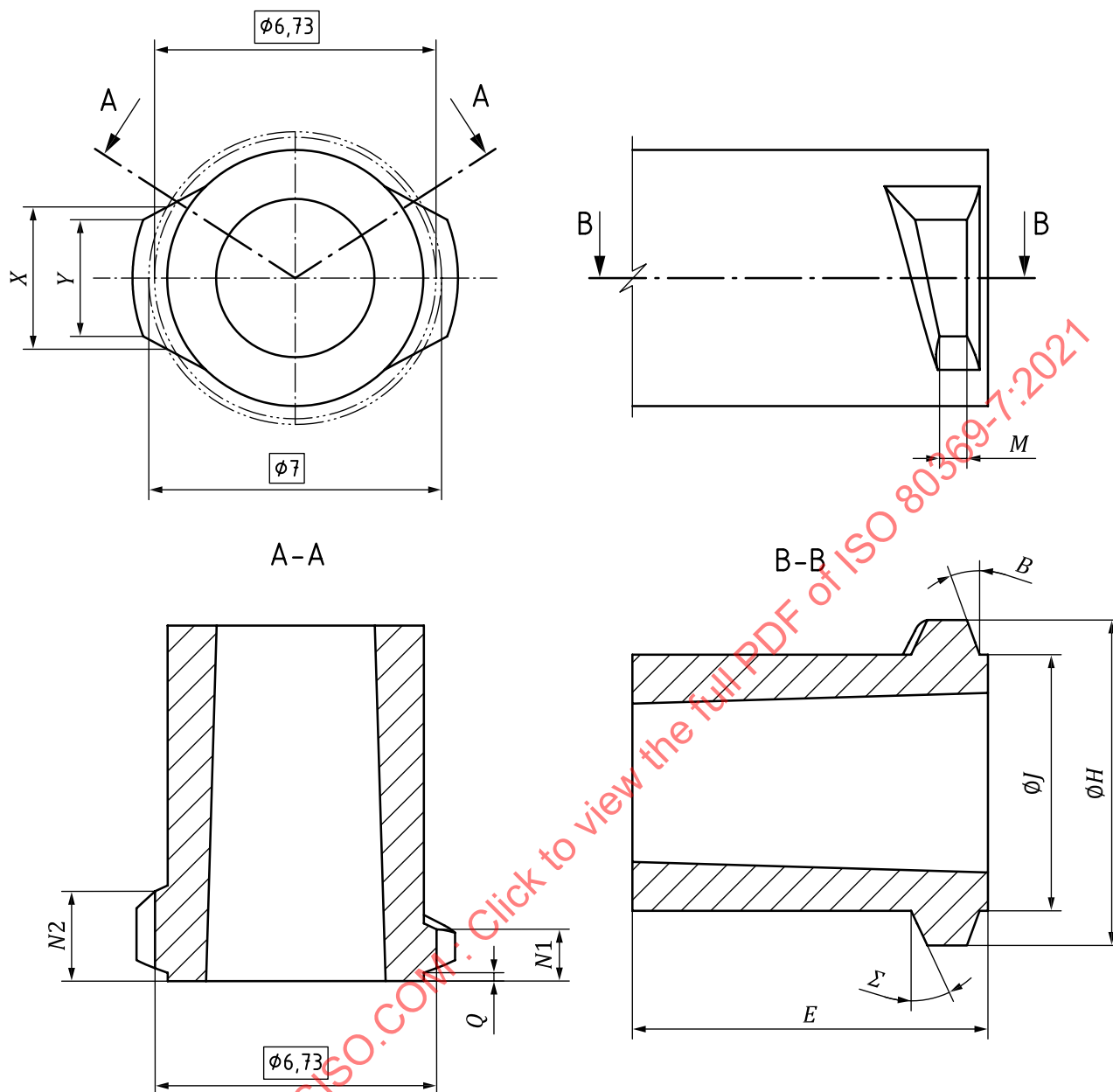


Table B.6 contains the dimensions for this figure.

Figure B.6— Female *Luer lock* connector with lugs at right angle to axis (L2), variant A

Table B.6 — Female Luer lock connector dimensions (L2), variant A

Dimensions in millimetres unless otherwise indicated

Auxiliary dimensions are in parenthesis

Female Luer lock connector (L2), variant A				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
<i>B</i>	Angle of the external lug profile on the non-bearing surface against separation (degrees)	0,0°	—	—
<i>E</i>	Depth of the female taper ^a	7,500	—	10,500
$\emptyset H$	Major outside lug diameter (diameter at the lug crest)	7,730	—	7,830
$\emptyset J$	Minor outside lug diameter (diameter at the lug root) This diameter shall not be increased above the maximum for a distance from the hub face of 5,5 mm.	5,515	—	6,730
<i>M</i>	Width of the lug profile at the crest	0,300	—	—
<i>N1</i>	Distance from the face of the <i>connector</i> to the leading end of the lug as it is screwed into the male <i>connector</i> at a diameter corresponding to 6,730.	—	—	1,200
<i>N2</i>	Distance from the face of the <i>connector</i> to the trailing end of the lug as it is screwed into the male <i>connector</i> at a diameter corresponding to 6,730.	—	—	2,070
<i>Q</i>	Distance from the face of the <i>connector</i> to the base of the lug	—	—	0,300
Σ	Angle of external lug profile on the bearing surface against separation (degrees)	25,0°	—	30,0°
<i>X</i>	Chord length at the base of the lug in a plane at a right angle to the axis of the <i>connector</i> , to be measured on a chord of a circle, the diameter of which is 7,000	—	—	3,500
<i>Y</i>	Chord length at the extremity of the lug in a plane at a right angle to the axis of the <i>connector</i>	2,710	—	—
The design and dimensions of the thread profile (Σ, <i>B</i> and <i>M</i>) may vary from those designated provided the <i>connector</i> meets the performance requirements of Clause 6. NOTE The design and dimensions of the thread profile (Σ, <i>B</i> and <i>M</i>) are not considered important to ensure <i>non-interconnectable</i> characteristics. The female Luer lock connector with external lugs shall include the dimensions and tolerances of the female Luer slip connector as specified in Figure B.2 and Table B.2 except as indicated in this table. <i>Y</i> shall not be greater than <i>X</i>. ^a This dimension also defines the extent of the <i>connector</i>.				

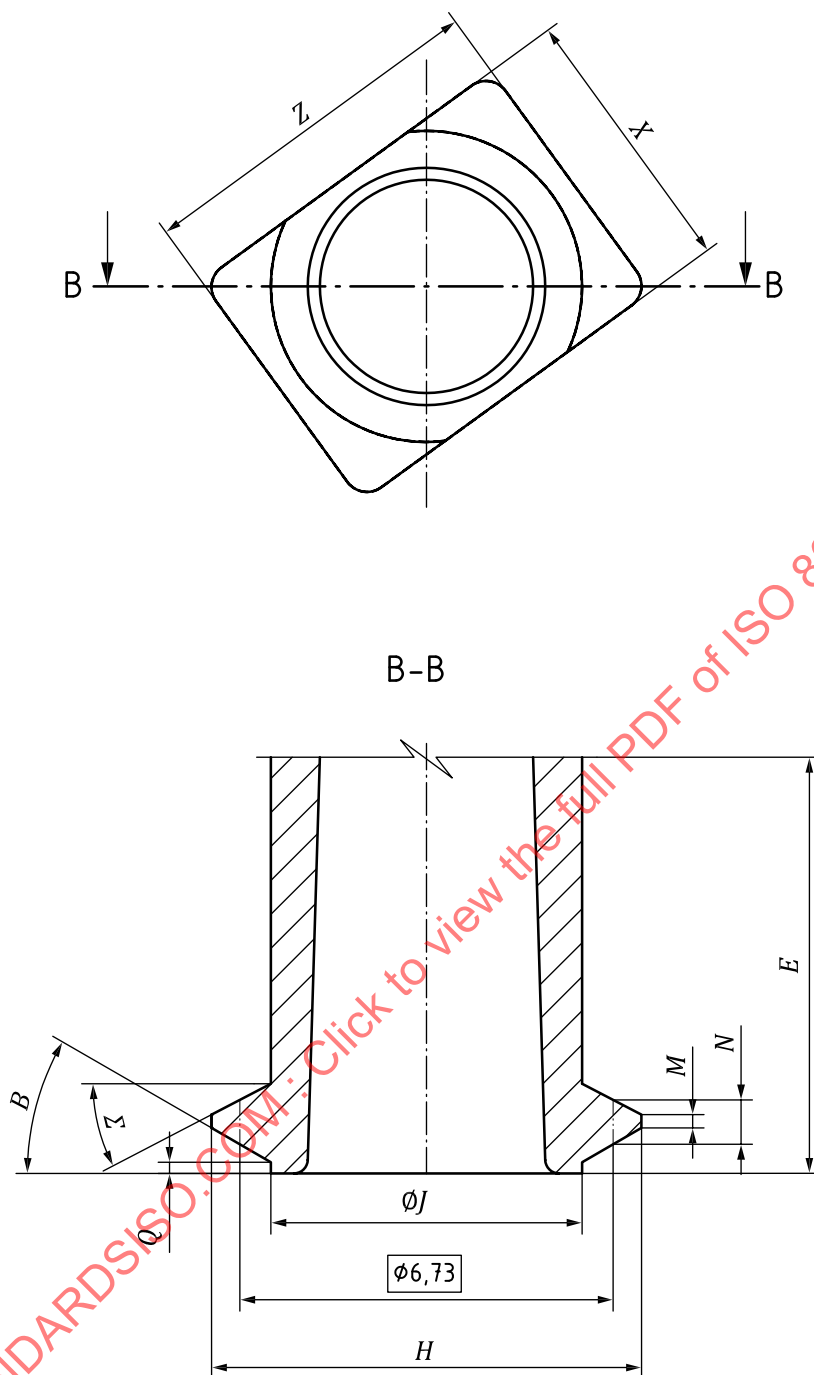


Table B.7 contains the dimensions for this figure. This variant is only intended for use in the design of *rigid material connectors*.

Figure B.7 — Female Luer lock connector with lugs at right angle to axis (L2), variant B

Table B.7 — Female Luer lock connector dimensions (L2), variant B

Dimensions in millimetres unless otherwise indicated

Auxiliary dimensions are in parenthesis

Female Luer lock connector (L2), variant B				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
<i>B</i>	Angle of the external lug profile on the non-bearing surface against separation (degrees)	0,0°	—	—
<i>E</i>	Depth of the female taper ^a	7,500	—	10,500
<i>H</i>	Major outside lug diagonal (diagonal at the lug crest)	7,700	—	7,800
$\emptyset J$	Minor outside lug diameter (diameter at the lug root) This diameter shall not be increased above the maximum for a distance from the hub face of 5,5 mm.	5,515	—	5,700
<i>M</i>	Width of the lug profile at the crest	—	—	0,270
<i>N</i>	Width of the lug profile at a diameter corresponding to 6,730	—	—	1,300
<i>Q</i>	Distance from the face of the <i>connector</i> to the base of the lug	—	—	0,300
Σ	Angle of the external lug profile on the bearing surface against separation (degrees)	25,0°	—	30,0°
<i>X</i>	Chord length at the base of the lug in a plane at a right angle to the axis of the <i>connector</i> , to be measured on a chord of a circle, the diameter of which is 7,000	—	—	5,000
<i>Z</i>	Width across the lugs in a plane at a right angle to axis of the <i>connector</i>	6,400	—	6,500
The design and dimensions of the thread profile (Σ, <i>B</i> and <i>M</i>) may vary from those designated provided the <i>connector</i> meets the performance requirements of Clause 6. The female Luer lock connector with external lugs shall include the dimensions and tolerances of the female Luer slip connector as specified in Figure B.2 and Table B.2 except as indicated in this table. ^a This dimension also defines the extent of the <i>connector</i>.				

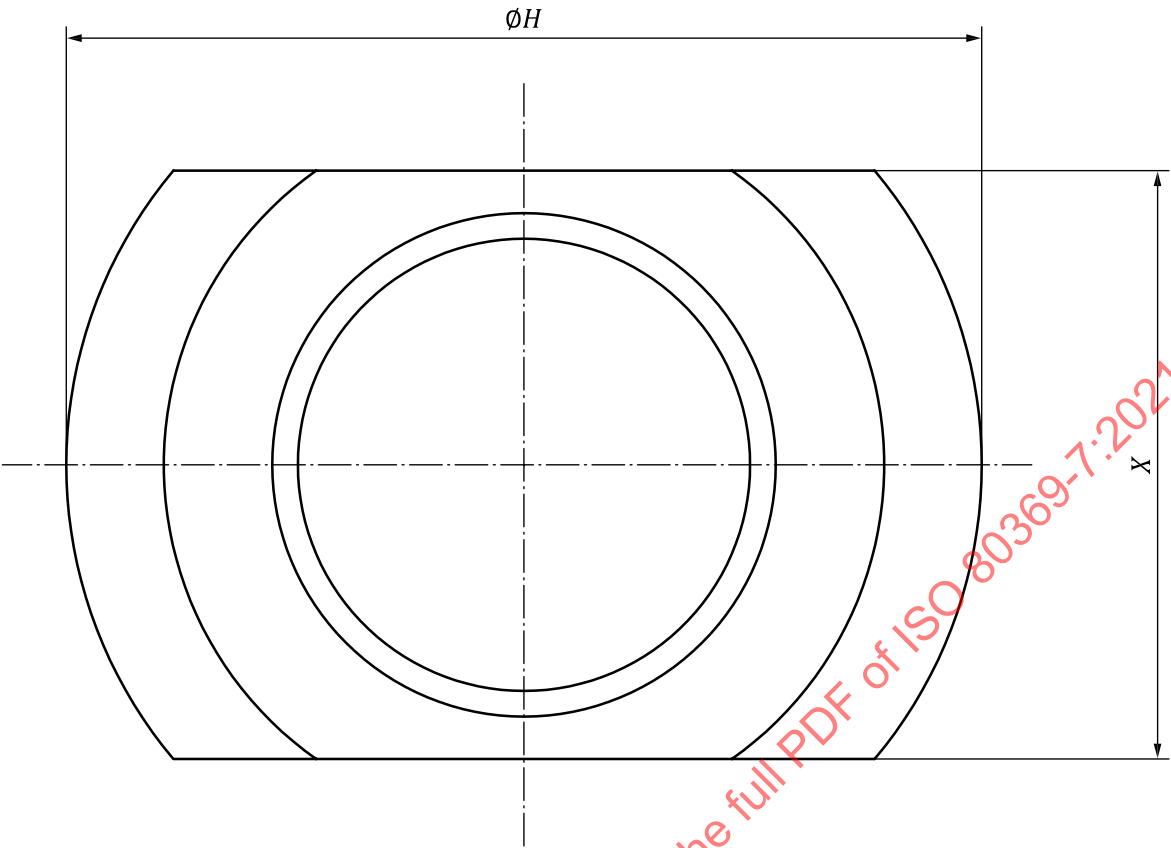


Table B.8 contains the dimensions for this figure. This variant is only intended for use in the design of *rigid material connectors*.

Figure B.8 — Female *Luer lock connector* with lugs at right angle to axis (L2), variant C

Table B.8 — Female *Luer lock connector* dimensions (L2), variant C

Dimensions in millimetres unless otherwise indicated
Auxiliary dimensions are in parenthesis

Female <i>Luer lock connector</i> (L2) with external threads				
Reference	Designation	Dimension		
		Minimum	Nominal	Maximum
$\varnothing H$	Major outside lug diameter (diameter at the lug crest)	7,700	—	7,800
X	Chord length at the base of the lug in a plane at a right angle to the axis of the <i>connector</i> , to be measured on a chord of a circle, the diameter of which is 7,000	—	—	5,000
The female <i>Luer lock connector</i> with external lugs shall include the dimensions and tolerances of the female <i>Luer slip connector</i> as specified in Figure B.2 and Table B.2 as well as Section B-B of Figure B.7 and Table B.7 except as indicated in this table.				

Annex C (normative)

Reference *connectors*

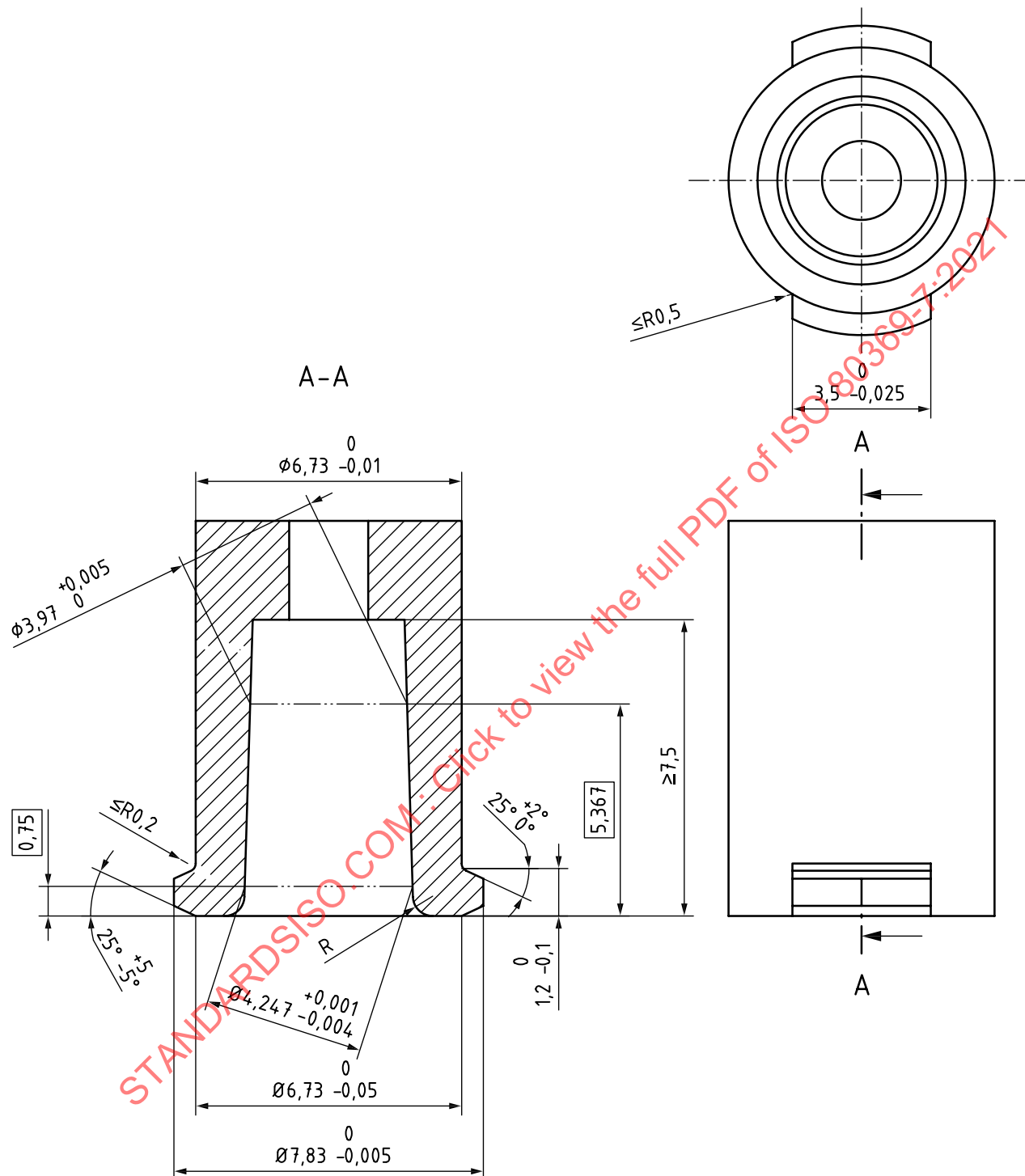
C.1 General requirements for reference *connectors*

Reference *connectors* shall be manufactured from corrosion-resistant *rigid materials* with a surface roughness value, R_a , [3] not exceeding 0,8 μm on critical surfaces.

NOTE Reference *connectors* made to the tolerances of Annex C of ISO 80369-7:2016 are considered to conform to the following figures.

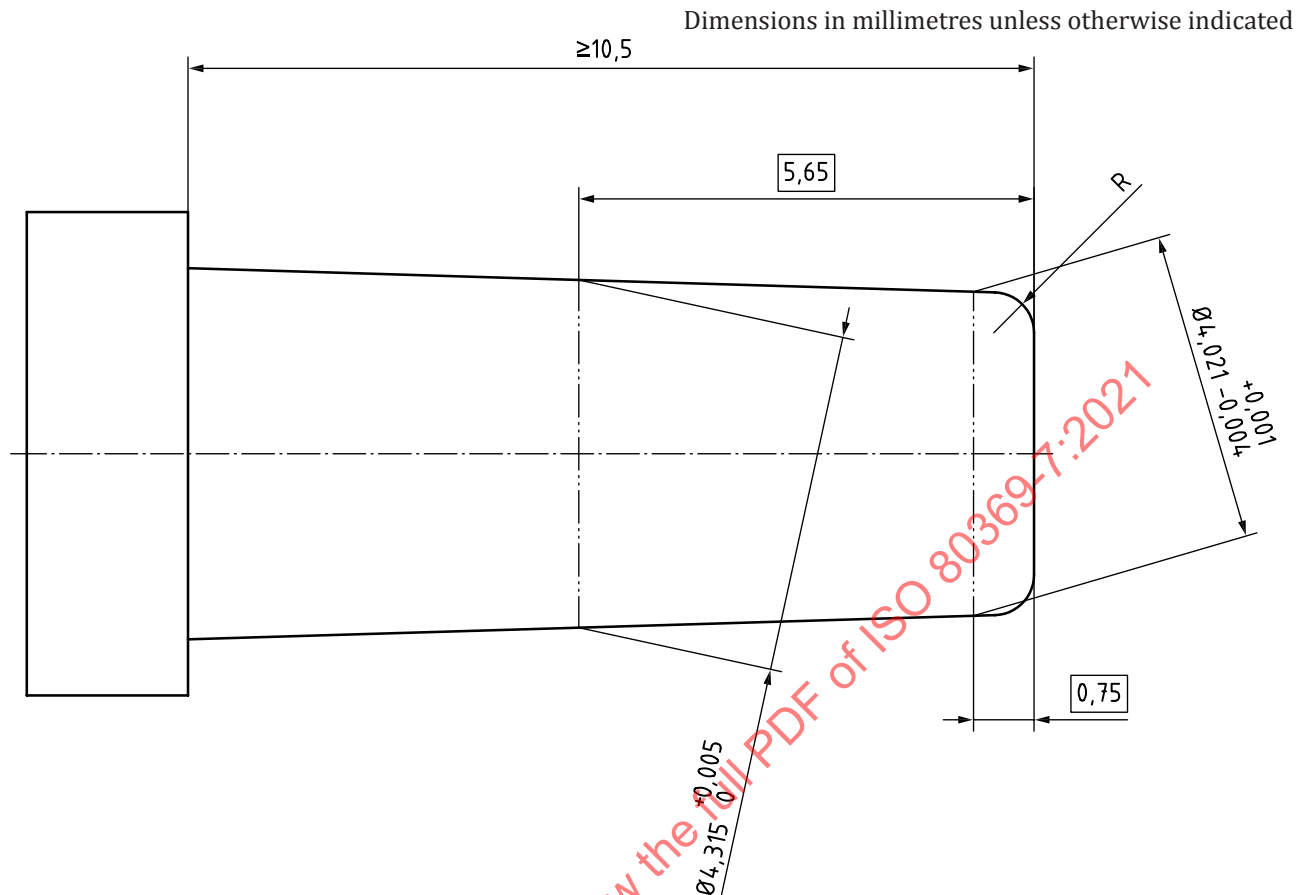
C.2 Reference connectors

Dimensions in millimetres unless otherwise indicated



In [Figure C.1](#), all outside edges of lug or thread form shall have a radius between 0,15 mm and 0,20 mm (unless otherwise specified). R is a radius or chamfer not to exceed 0,5 mm.

Figure C.1 — Female reference *Luer lock* connector for testing male *Luer* connectors for leakage, separation from unscrewing, stress cracking and *non-interconnectable* characteristics



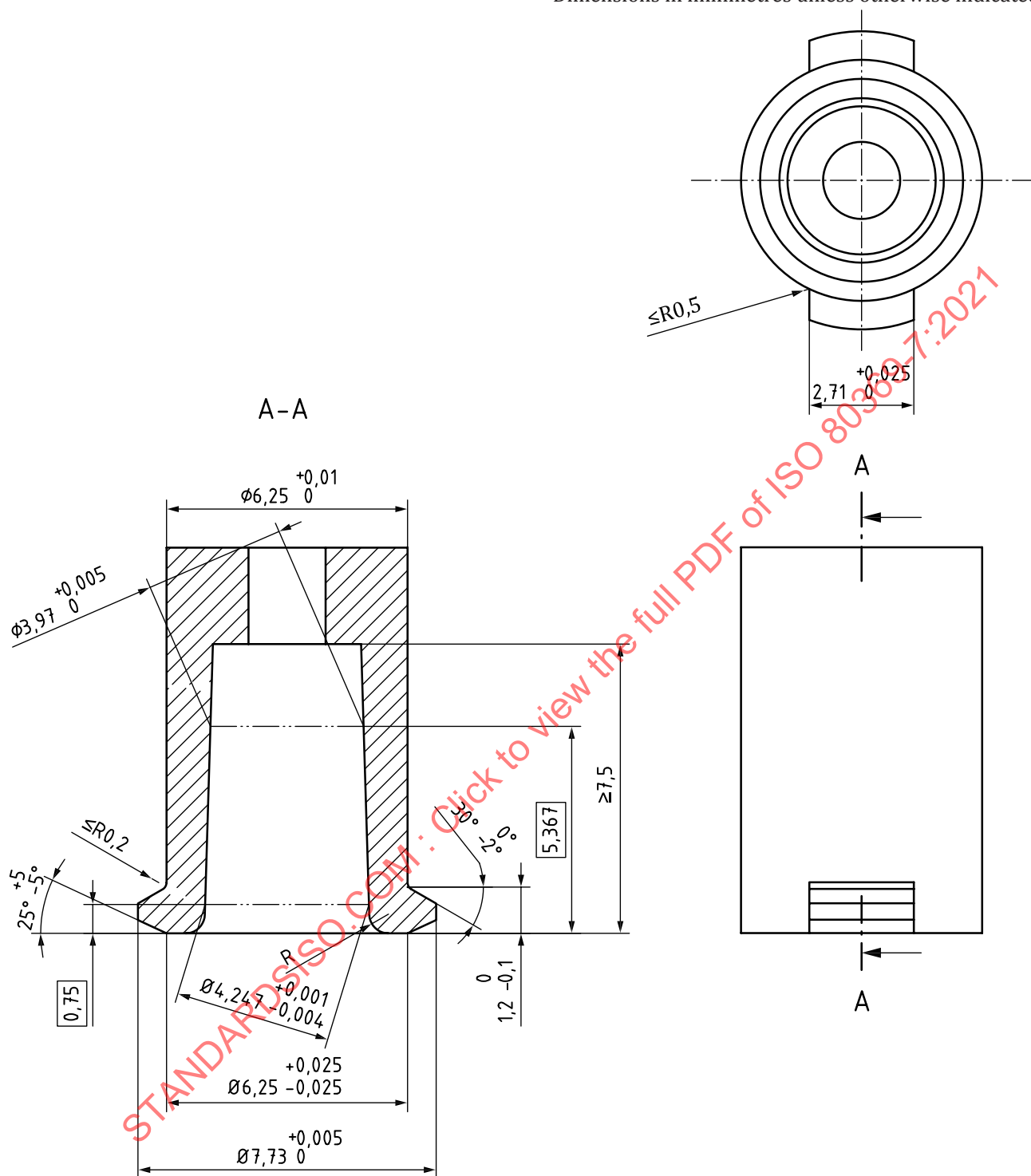
R is a radius or chamfer not to exceed 0,5 mm

The minimum length of the male taper of 10,5 mm is required for testing *non-interconnectable* characteristics. A minimum length of the male taper of 7,5 mm may be used for the performance tests of [Clause 6](#).

NOTE Cone taper (0,06:1).

Figure C.2 — Male reference *Luer slip* connector for testing female *Luer* connectors for leakage, separation from axial load, stress cracking and *non-interconnectable* characteristics

Dimensions in millimetres unless otherwise indicated



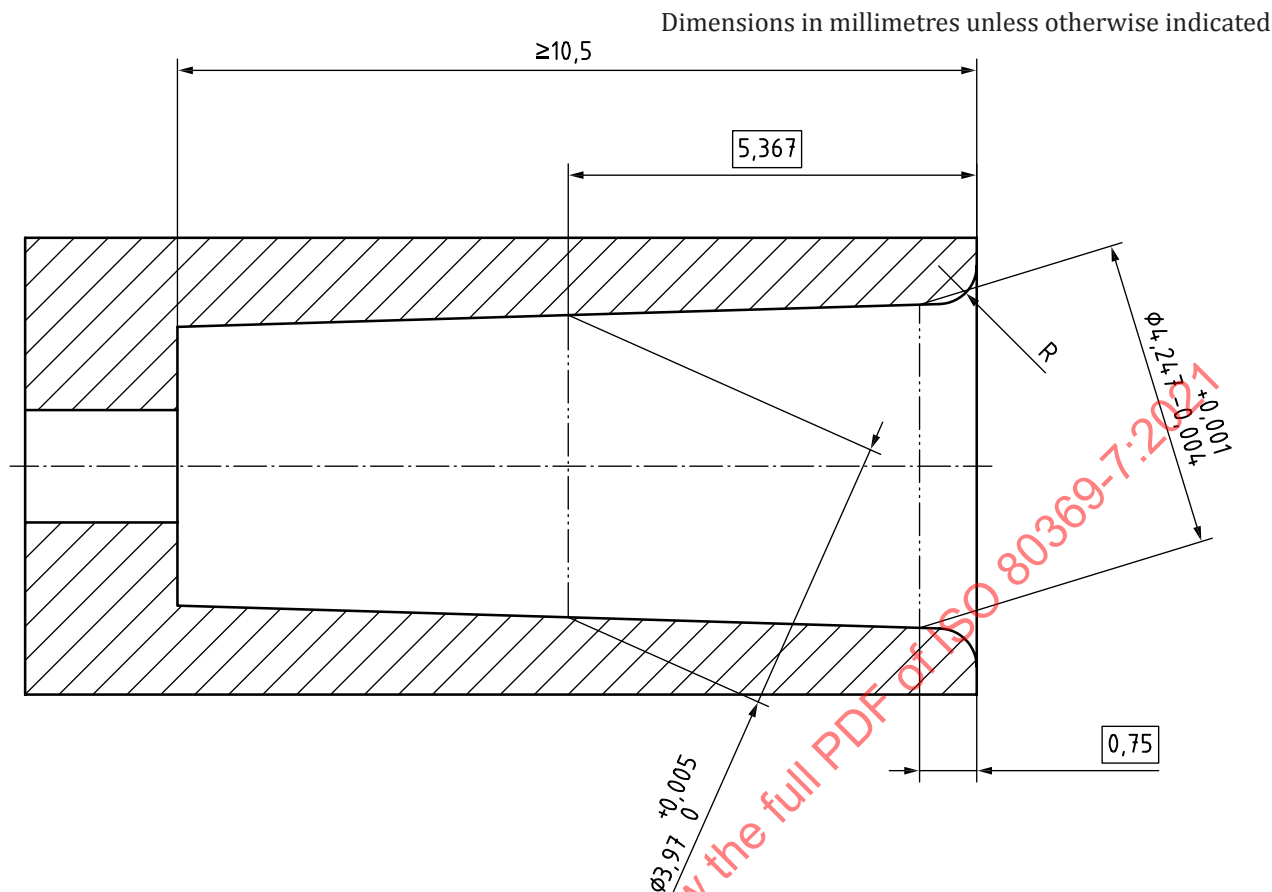
In [Figure C.3](#), all outside edges of lug or thread form shall have a radius between 0,15 mm and 0,20 mm (unless otherwise specified). R is a radius or chamfer not to exceed 0,5 mm.

Figure C.3 — Female reference *Luer lock* connector for testing male *Luer lock* connector for separation from axial load and resistance to overriding



- NOTE This reference *connector* cannot be used for the test of *non-interconnectable* characteristics against its collar outside diameter because its corresponding defined range ($\emptyset w$) is wide and one single reference *connector* is not representative.

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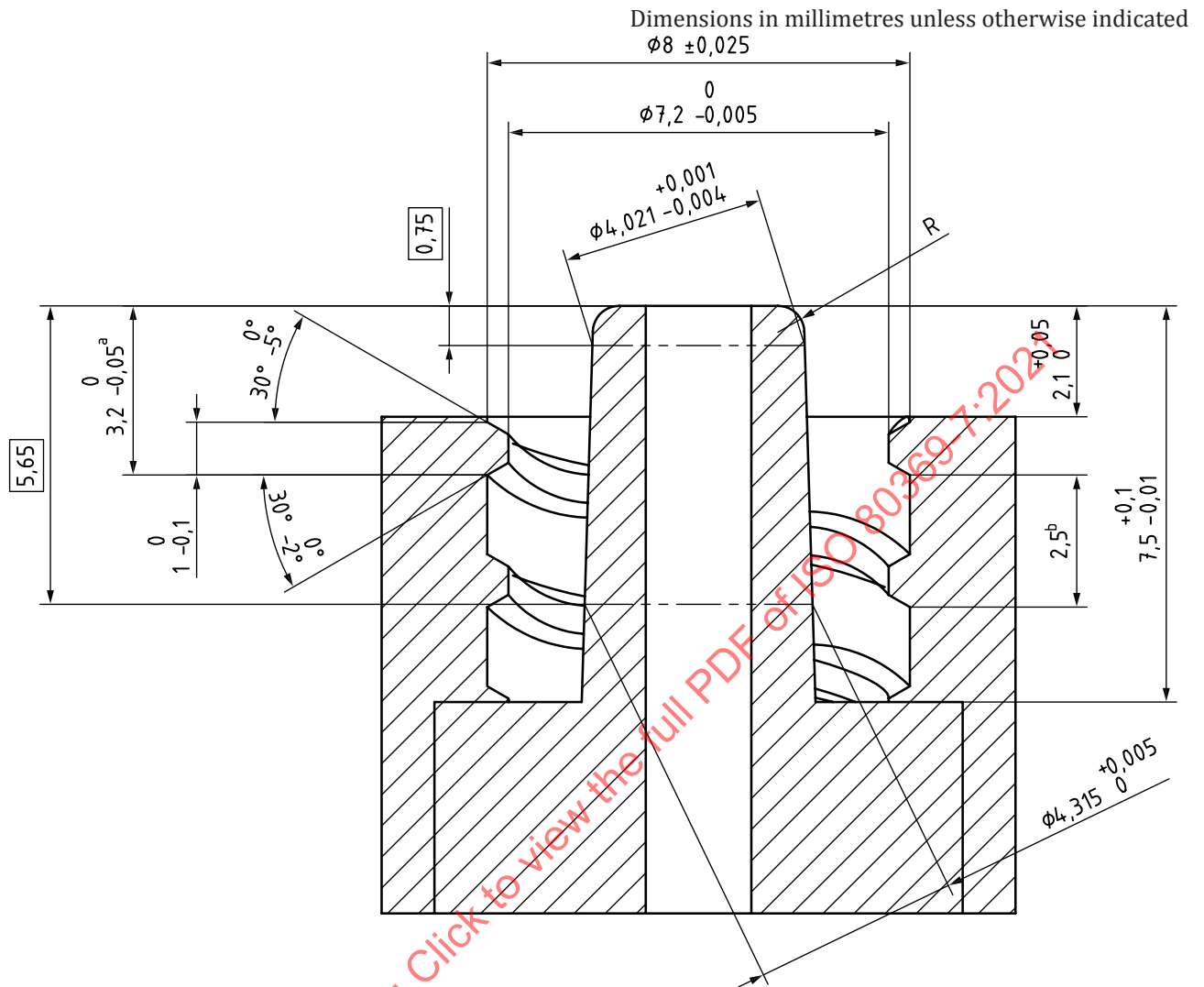
R is a radius or chamfer not to exceed 0,5 mm.

The minimum length of the male taper of 10,5 mm is required for testing *non-interconnectable* characteristics. A minimum length of the male taper of 7,5 mm can be used for the performance tests of [Clause 6](#).

NOTE 1 Cone taper (0,06:1).

NOTE 2 This reference *connector* cannot be used for the test of *non-interconnectable* characteristics against its collar outside diameter because its corresponding defined range (ØJ) is wide and one single reference *connector* is not representative.

Figure C.5 — Female reference *Luer slip* connector for testing male *Luer* connectors for leakage, separation from axial load, stress cracking and *non-interconnectable* characteristics



Key

- ^a Maximum distance from tip of male *Luer lock connector* to the first complete profile of the internal thread (see [Table B.3](#), dimension *t*).
- ^b Double-start, right-hand thread of 2,5 mm pitch.
R is a radius or chamfer not to exceed 0,5 mm.

Figure C.6 — Male reference connector for testing female *Luer lock connector* for separation from axial load and resistance to overriding

Annex D (informative)

Assessment of *medical devices* and their attributes with *connections* within this application

[Table D.1](#) contains examples of *medical devices* and *accessories* within intravascular or hypodermic applications. The table contains an assessment by the working group of the important attributes of *medical devices* and *accessories* as they relate to the intended *connection*. Each *connection* is assessed according to the following index or subgroups:

- a) syringe *connections*;
- b) needle *connections*;
- c) IV tubing set *connections*;
- d) IV tubing set port *connections*;
- e) retention mechanism (e.g. balloon) *connections* used to hold invasive *medical devices* in place;
- f) IV catheter *connections*;
- g) IV catheter port *connections*;
- h) stopcock *connections*;
- i) adaptor *connections*; and
- j) medication compounding adaptor *connections*.

Table D.1 — Examples of medical devices with connections within this application and their attributes

Part/component to which the connector is applied	Index	Flowrate range ml/min	Type of fluid		Type of connection		Therapy disruption	patient haemorrhage from fluid loss	Disrupted sample collection	Infection control	Functionality		
			Air	Liquid	Connection	Dis-connection					Locking needed	Slip needed	Flowrate control needed
Syringe	1	0 to 1 200	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
Needle	2	0 to 1 200	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
IV tubing set	3	0 to 1 200	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
IV tubing set port	4	0 to 1 200	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes
Retention mechanism (e.g. balloon) connections used to hold invasive medical devices in place	5	0 to 1 200	yes	yes	yes	yes	yes	no	no	no	yes	yes	yes
IV catheter	6	0 to 1 200	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
IV catheter port	7	0 to 1 200	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Stopcock	8	0 to 1 200	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes
Adaptor	9	0 to 1 200	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Medication compounding adaptor	10	0 to 1 200	yes	yes	yes	yes	yes	no	no	yes	yes	yes	yes

Annex E (informative)

Summary of the usability requirements for Luer connectors for intravascular or hypodermic applications

E.1 User profile

The *user profile* is a summary of the mental, physical and demographic traits of an intended *user* population, as well as any special characteristics that can have a bearing on design decisions, such as occupational skills and job requirements.

Users of Luer connectors for intravascular or hypodermic applications are comprised of the clinical, laboratory, or non-clinical persons using, i.e. operating or handling, the *medical device*, including, but not limited to, cleaners, maintainers and installers, *patients*, or other laypersons. *Users* are expected to perform an intended action in an *intended use* of a *medical device*, *accessory*, *process* or *service* in accordance with the specifications, instructions and information provided by the *manufacturer*.

Users include the following:

- a) clinical *users*, such as
 - 1) physicians who specialize in anaesthesiology, neuro-radiology, paediatrics, oncology, haematology/nursing, emergency room, medicine, interventional radiology, or as a physician assistant,
 - 2) nurses, at all levels, including Certified Registered Nurse Anaesthetist (CRNA) etc.,
 - 3) emergency medical technicians, and
 - 4) homecare providers, visiting nurses, relatives;
- b) non-clinical *users*, such as cleaners, maintainers and installers; and
- c) *in vitro* diagnostics laboratory and pharmacy *users*, responsible for mixing of drugs, filling syringes and reservoirs, storage and dispensing of drugs.

The *user profile* is summarized in [Table E.1](#).

Table E.1 — User profile

	<i>Patients as users</i>	<i>Clinical users</i>	<i>Non-clinical users</i>	<i>In vitro diagnostic laboratory and pharmacy users</i>
<i>User skills:</i>	No training	Extensive clinical training	Limited clinical training	Bioengineers, central processing
<i>Patient contact:</i>	Direct <i>patient</i> contact	Direct <i>patient</i> contact	Direct <i>patient</i> contact	No <i>patient</i> contact

E.2 Use scenarios

Use scenarios for *Luer connectors* for intravascular or hypodermic *applications* can differ by *user* group, and are comprised of the multitude of sub-*applications* of the *connectors* within different sub-specialities.

A summary of use scenarios by *user* group is summarized in [Table E.2](#).

Table E.2 — Use scenarios

Subspecialty use scenario	<i>Patients as users</i>	<i>Clinical users</i>	<i>Non-clinical users</i>	<i>In vitro diagnostic laboratory and pharmacy users</i>
1. Parenteral				
— Chemo	X	X	X	X
— Insulin, subcutaneous	X	X	X	—
— Infusion, IV catheter placements	—	X	X	X
— Medication preparation	X	X	X	X
— Injections	X	X	X	X
— Parenteral nutrition, including TPN (Total parenteral nutrition)	X	X	X	X
2. Extracorporeal				
— Dialysis	—	—	—	—
— Peritoneal Dialysis	X	X	X	X
— Haemodialysis	X	X	X	—
— ECMO (extracorporeal membrane oxygenation)	—	X	—	—
— Invasive pressure monitoring	—	X	—	—
— ICP Intracranial pressure	—	X	—	—
— IABP Intra-aortic balloon pump	—	X	—	—
— VAD Ventricular assist device	—	X	—	—
— Cardio-pulmonary bypass	—	X	—	—
— Cardiac catheters	—	X	—	—
— Rapid infusers	—	X	—	—
— Radiological marker pressure infusers	—	X	—	X
3. Irrigation				
— Wound care	X	X	X	—
— Aspiration	X	X	X	—
— Sample collection	X	X	X	—
4. Retention mechanism (e.g. balloon) (both gas or liquids)				
— Foley catheters	X	X	X	—
— Rectal catheters	X	X	X	—
— PEGs (percutaneous endoscopic gastrostomy)	X	X	X	—
— Tracheal tubes	—	X	—	—
— Laryngeal Mask Airways	—	X	—	—
— Tracheostomy tubes	X	X	X	—
5. Ports				
— Subdermal	X	X	X	X
— Pain management	X	X	X	X
— Gastric Lapbands	X	X	X	—
— Implant inflation	—	X	X	—
6. Blood				
— Sample collection	X	X	X	X

Table E.2 (continued)

Subspecialty use scenario	<i>Patients as users</i>	<i>Clinical users</i>	<i>Non-clinical users</i>	<i>In vitro diagnostic laboratory and pharmacy users</i>
— Transfusion	X	X	X	—
— Donation/Phlebotomy	X	X	X	—
7. Medication preparation				
— Add-mixture	X	X	X	X
— Compounding	X	X	X	X
8. Other				
— Thermodilution catheters	—	X	—	

E.3 Use environments

E.3.1 Facilities

Facilities include: hospitals, surgery suites, *patient* rooms, home, labour and delivery, intensive care units, doctors' offices, pain clinics, pharmacy, field hospitals, transport systems, infusion clinics, home assisted care, emergency medical services.

E.3.2 Use temperature

The following temperature environments are expected for *Luer connectors*:

- ambient temperature, $-40\text{ }^{\circ}\text{C}$ to $+60\text{ }^{\circ}\text{C}$ (for field use in emergency medical services);
- body temperature, to $42\text{ }^{\circ}\text{C}$;
- hypothermia treatment, $10\text{ }^{\circ}\text{C}$ (for therapeutic cooling of spinal cord injuries);
- hypo/normo/hyperthermia treatments, $10\text{ }^{\circ}\text{C}$ to $43\text{ }^{\circ}\text{C}$ (for ECMO treatments).

E.4 Other attributes

The following other attributes are expected for *Luer connectors*:

- usability under stress (ignoring labels, attempting force-fit);
- proximity of liquids, use of gloves;
- proximity of other *connector*-bearing equipment (e.g. sphygmomanometers, gas measurement).

E.5 Generic user needs

The following *user* needs attributes are expected for *Luer connectors*:

- minimal pan-healthcare *user* training on the use of *connectors*;
- easy to manipulate without the use of tools;
- ease of assembly/disassembly with finger-tip control, especially in wet environment or with the use of gloves;
- does not misconnect to other *small-bore connectors* not intended for the same purpose in the environment of use (ISO 80369-1);
- does not leak under *normal use*;

- f) security/integrity of *connection*, cannot unintentionally self-disconnect;
 - g) low dead space;
 - h) ease of fluid passage
 - 1) rate limiting factors;
 - 2) maximum flowrate
 - i) cardiovascular equipment, diluted blood: 4 l/min, at 300 kPa with a dynamic viscosity of 6,89 mPa/s to prevent haemolysis,
 - ii) dialysis equipment, blood: 600 ml/min at 400 mmHg below atmospheric pressure, and
 - iii) IV pump, aqueous solutions: 1 200 ml/min at 300 mmHg pressure;
 - 3) Viscosity of solutions
 - i) aqueous,
 - ii) chemotherapy,
 - iii) steroids, and
 - iv) hyperbaric local anaesthetics;
 - i) needle-through-needle techniques, needle stylets (guide wires, peripheral catheters, etc.);
- NOTE Lumen diameter requirements are *medical device* specific and can require a *medical device-specific risk assessment* to provide for different capabilities.
- j) compatible with disinfection, decontamination, sterilization, reprocessing environments;
 - k) *Luer slip connectors* are required to address several *user* needs, such as
 - 1) need to align the syringe with the 3-way stopcock,
 - 2) need to prevent movement of needle orientation during *connection*,
 - 3) cognitive distinction between *Luer slip connectors* and *Luer lock connectors* to prevent a misperception that the *Luer slip connector* is locked,
 - 4) lightweight and unobtrusive needle hub,
 - 5) little additional cost (making/purchasing), and
 - 6) consider the need for visible fluid paths in specific *medical devices*.