BS ISO 16380:2014

BSI Standards Publication

Road vehicles — Blended fuels refuelling connector

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National foreword

This British Standard is the UK implementation of ISO 16380:2014.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Road vehicles — Blended fuels refuelling connector

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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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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 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 22, *Road vehicles*, Subcommittee SC 25, *Vehicles using gaseous fuel.*

Introduction

A nozzle certified to this International Standard will be functionally compatible from a safety and performance perspective with all listed receptacles of compatible profile and system pressure. Similarly, a receptacle certified to this International Standard will be functionally compatible from a safety and performance perspective with all listed nozzles of compatible profile and system pressure.

As there can eventually be many different kinds of nozzles and receptacles available from a variety of manufacturers which, for safety reasons, shall all be compatible with each other, this International Standard specifies a series of receptacle profiles. These standard profiles incorporate the design specifications (mating materials, geometry, and tolerances) which can be considered in the certification of a submitted nozzle or receptacle.

The construction and performance of nozzles and receptacles are based on the observation that four main parameters affect user safety and system compatibility.

Road vehicles — Blended fuels refuelling connector

1 Scope

This International Standard applies to compressed blended fuels vehicle nozzles and receptacles hereinafter referred to as devices, constructed entirely of new, unused parts and materials. Compressed blended fuels fuelling connection nozzles consist of the following components, as applicable:

a) Receptacle and protective cap (mounted on vehicle) (see Clause 7);

b) Nozzle (mounted on dispenser side) (see Clause 5).

This International Standard applies to devices which have a service pressure of 20 MPa, 25 MPa, and 35 MPa hereinafter referred to in this International Standard as [see 9.1 c)]:

— size 1: M200, M250, and M350;

— size 2: N200 and N250.

This International Standard refers to service pressures of 20 MPa, 25 MPa, and 35 MPa for size 1 and 20 MPa and 25 MPa for size 2.

This International Standard applies to devices with standardised mating components (see 5.8 and 7.7).

This International Standard applies to connectors which

a) prevent blended fuels vehicles from being fuelled by dispenser stations with working pressures higher than the vehicle fuel system working pressure,

b) allow blended fuels vehicles to be fuelled by dispenser stations with working pressures equal to or lower than the vehicle fuel system working pressure,

c) allow blended fuels vehicles to be fuelled by dispenser stations for compressed natural gas,

d) allow blended fuels vehicles to be fuelled by compressed natural gas dispenser stations with working pressures equal to or lower than the vehicle fuel system working pressure,

e) prevent blended fuels vehicles size 1 being refuelled on blended fuels dispenser stations equipped with a size 2 nozzle and vice versa,

f) prevent natural gas vehicles from being fuelled by blended fuels station, and dispensers, and

g) prevent pure hydrogen vehicles from being fuelled by blended fuels station dispensers.

This International Standard is applicable to mixtures of hydrogen from 2 % to 30 % in volume and compressed natural gas containing:

a) natural gas in accordance with ISO 15403-1 and ISO 15403-2;

b) pure hydrogen in accordance with ISO 14687-1 or ISO/TS 14687-2.

All references to pressures (MPa) throughout this International Standard are to be considered gauge pressures unless otherwise specified.

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 1431-1, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static and dynamic strain testing*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

ISO 11114-4, *Transportable gas cylinders — Compatibility of cylinder and valve materials with gas contents — Part 4: Test methods for selecting metallic materials resistant to hydrogen embrittlement*

ISO 14175, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*

ISO 14687-1, *Hydrogen fuel — Product specification — Part 1: All applications except proton exchange membrane (PEM) fuel cell for road vehicles*

ISO/TS 14687-2, *Hydrogen Fuel — Product Specification — Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles*

ISO 15500-2:2012, *Compressed natural gas (CNG) fuel system components — Part 2: Performance and general test methods*

ISO 15403-1, *Natural gas — Natural gas for use as a compressed fuel for vehicles — Part 1: Designation of the quality*

ISO/TR 15403-2, *Natural gas — Natural gas for use as a compressed fuel for vehicles — Part 2: Specification of the quality*

EN 10204, *Metallic products — Types of inspection documents*

3 Terms and definitions

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

3.1
air, dry
air with moisture content such that the dew point of the air at the required test pressure is at least 11 °C below the ambient test temperature

3.2
hydrostatic pressure
pressure to which a component is tested to verify the structural strength of the component

3.3
working pressure
maximum pressure that the blended fuels refuelling connector can be expected to withstand in actual service (calculatory base: service pressure times 1,25)

3.4
service pressure
settled pressure of 20 MPa, 25 MPa, and 35 MPa at a uniform gas temperature of 15 °C

3.5
positive locking means
feature which requires actuation of an interlocking mechanism to allow connection/disconnection of the nozzle from the receptacle

3.6
compressed blended fuels refuelling nozzle
device which permits quick connection and disconnection of fuel supply hose to the compressed blended fuels receptacle in a safe manner, hereafter referred to as compressed blended fuels nozzle

3.7
compressed blended fuels refuelling receptacle
device connected to a vehicle or storage system which receives the compressed blended fuels nozzle and permits safe transfer of fuel, hereafter referred to as receptacle

3.8
compressed blended fuels refuelling connector
joint assembly of compressed blended fuels nozzle and receptacle, hereafter referred to as connector

3.9
hydrogen embrittlement
process by which various metals, most importantly high-strength steel, become brittle and crack following exposure to hydrogen

3.10
compressed blended fuels
blended fuel is a mixture out of hydrogen from 2 % to 30 % in volume and natural gas which is used as a vehicular fuel at a specified pressure as in the Introduction point 2

3.11
leak test gas
gas used for leak testing purposes

3.12
cycle life
connections and disconnections to a nozzle

3.13
service life
operations of the check valve

4 General construction requirements

a) There are two different sizes of refuelling systems, size 1 and size 2.

Size 1 should suit the need of smaller vehicles with a limited tanks size. Therefore, the flow diameter is limited by the inner front diameter of the receptacle – in this case ⌀ 7,8 mm ± 0,2 mm.

Size 2 should suit the need of commercial vehicles like busses and trucks. Therefore, the flow diameter is limited by the inner front diameter of the receptacle – in this case ⌀ 12 mm ± 0 2mm.

Also, the profile of the two different sizes is so different that no cross connection between the sizes is possible.

b) Working pressure (= 1,25 times service pressure). All nozzles and receptacles are designed to have a working pressure of:

Code	Service pressure	Working pressure
Size 1		
M200	20 MPa	25 MPa
M250	25 MPa	31,25 MPa
M350	35 MPa	43,75 MPa
Size 2		
N200	20 MPa	25 MPa
N250	25 MPa	31,25 MPa

c) Design life. Frequency of use is the second parameter to be considered. Since frequency of use will differ with the nozzle/receptacle application (i.e. public sector, fleet employee, and residential), all receptacles will be tested at 10 000 connect/disconnect cycles for compliance with this International Standard. In addition, all nozzles shall be tested according to the following frequency use classifications, as applicable.

— Class A Nozzle - This class specifies high frequency use, with a cycle life of 100 000. This equates to approximately 100 fills per day for three years.

— Class B Nozzle - This class specifies medium frequency use, with a cycle life of 20 000 cycles. This equates to approximately 10 fills per day for five years.

d) Training. Operator. Training required is in accordance with national requirements.

4.1 Compressed blended fuels nozzles and receptacles shall be well fitted and manufactured in accordance with good engineering practice. All construction requirements can be met by either the construction specified in this International Standard or another construction that gives at least equivalent performance.

4.2 Compressed blended fuels nozzles and receptacles shall be:

— designed to minimize the possibility of incorrect assembly;

— designed to be secure against displacement, distortion, warping, or other damage;

— constructed to maintain operational integrity under normal and reasonable conditions of handling and usage.

4.3 Nozzles and receptacles shall be manufactured of materials suitable and compatible for use with compressed blended fuels at the pressure and the temperature ranges to which it will be subjected.

4.3.1 The temperature ranges shall be:

Table 1 — Temperature ranges

	Location on board	
	Location a	**Location b**
Cold	−40 °C to 120 °C	−40 °C to 85 °C
Moderate	−20 °C to 120 °C	−20 °C to 85 °C

Location a — Inside the engine compartment in case of internal combustion engine vehicle. The receptacle shall be installed far from either heat or sparking sources and in a vented area.

Location b — Elsewhere in case of internal combustion engine vehicle.

4.4 Compressed blended fuels nozzles and receptacles shall be constructed out of materials which have to be proven for the intent of withstanding a blended fuels mixture at the given pressures, temperatures, and contents of the fuel that can be expected in this system.

4.5 Separate external three-way valves shall be constructed and marked so as to indicate clearly the open, shut, and vent positions.

4.6 Compressed blended fuels nozzles and receptacles shall be operated either to connect or disconnect without the use of tools.

4.7 Jointing components shall provide gas tight sealing performance.

Unless otherwise specified, all tests shall be conducted using dry hydrogen, helium, or blends of nitrogen with a minimum 5 % of hydrogen. Test shall be performed by qualified personnel and appropriate safety measures shall be taken. The dew point of the test gas at the test pressure shall be at the temperature at which there is no icing, or hydrate or liquid formation. The dew point of the test gas at the test pressure shall be at the temperature at which there is no icing, or hydrate or liquid formation.

5 Nozzles

5.1 Nozzles shall be one of three types as described in a) to c). (See also Annex A)

a) Type 1, which is a nozzle for use with dispensing hoses that remain fully pressurized at dispenser shutdown. The nozzle shall not allow gas to flow until a positive connection has been achieved. The nozzle shall be equipped with an integral valve or valves, incorporating an operating mechanism which first stops the supply of gas and safely vents the trapped gas before allowing the disconnection of the nozzle from the receptacle. The operating mechanism shall ensure the vent valve is in the open position before the release mechanism can be operated and the gas located between the nozzle shut-off valve and the receptacle check valve is safely vented prior to nozzle disconnection (see 10.2).

b) Type 2, which is a nozzle for use with dispensing hoses that remain fully pressurized at dispenser shutdown. A separate three-way valve connected directly, or indirectly, to the inlet of the nozzle is required to safely vent trapped gas prior to nozzle disconnection. The nozzle shall not permit the flow of gas if unconnected. Venting is required prior to disconnection of the nozzle (see 10.2).

c) Type 3, which is a nozzle for use with dispensing hoses which are automatically depressurised (0,5 MPa and below) at dispenser shutdown (see 10.2).

In addition, nozzles shall be classified in terms of cycle life as follows:

— Class A - This class specifies high frequency use, with a cycle life of 100 000.

— Class B - This class specifies low frequency use, with a cycle life of 20 000.

5.2 Venting or de-pressurization of all nozzle types is required prior to disconnection. Disconnection of all nozzles shall be capable of being accomplished in accordance with 10.2.

5.3 The method for attaching the nozzle to the fuel dispensing system hose shall not rely on the joint threads between the male and female threads for sealing, such as conical threads.

5.4 The three-way valve vent port of Type 1 and Type 2 nozzles shall be protected from the ingress of foreign particles and fluid which would hamper the operation of the valve. It has to be considered that the vented gas has to be lead into a safe direction.

5.5 The portions of a nozzle which are held by the user for connection or disconnection can be thermally insulated or it shall be ensured that no abnormal dangerous temperatures can be transferred to the user.

5.6 A Type 1 nozzle shall bear a marking in accordance with Clause 9, indicating the direction of the open and shut operation of the actuating mechanism, if necessary.

5.7 The interface surface of the nozzle shall be constructed of material having a hardness > 75 Rockwell B (HRB 75) and shall be non-sparking and conductive (see 10.11.5 and 10.15).

A proof for adequate hardness shall be either a Mill Sheet or an EN 10204-3.1 certificate or a similar acceptable certificate if hardness is mentioned on there.

The exposed surfaces of the nozzles shall be made of non-sparking materials (see 10.11.5 and 10.15).

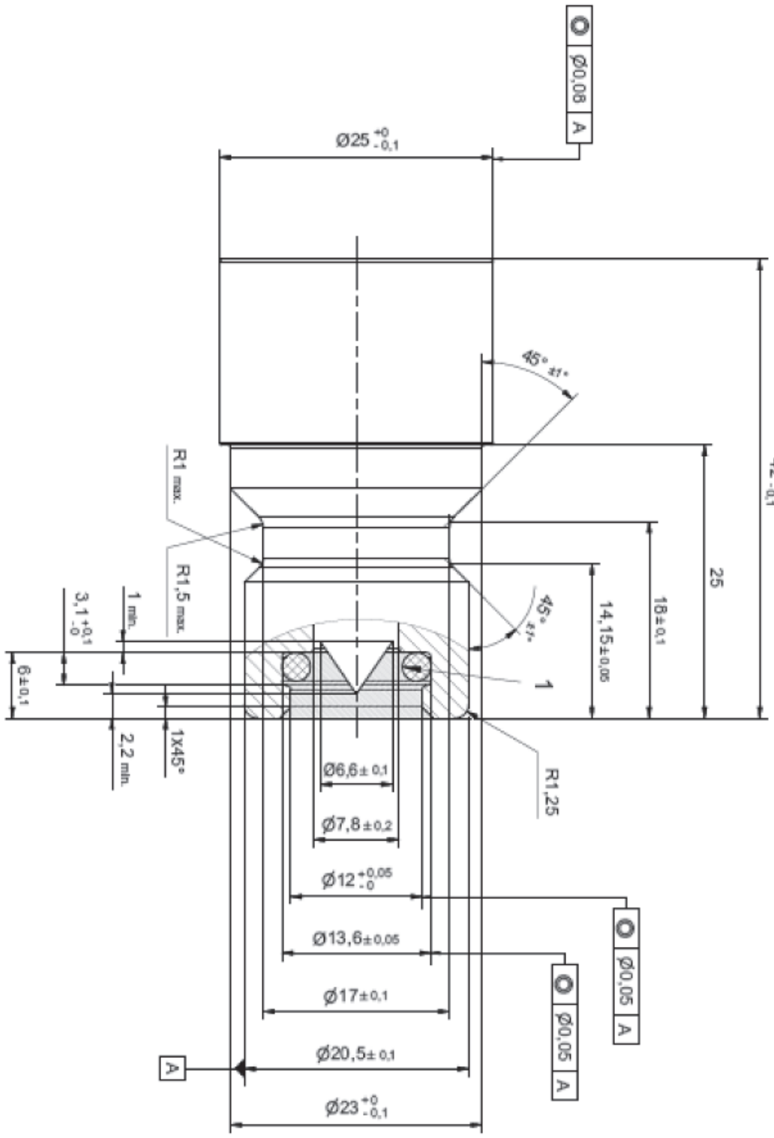
5.8 Nozzles shall comply with the performance requirements of Clause 10 to ensure interchangeability.

5.9 The vent line of Type 1 and Type 2 nozzles must withstand the maximum working pressure at full flow conditions.

6 Standard receptacle dimensions

6.1 Standard receptacle dimensions Size 1 (M200, M250, M350)

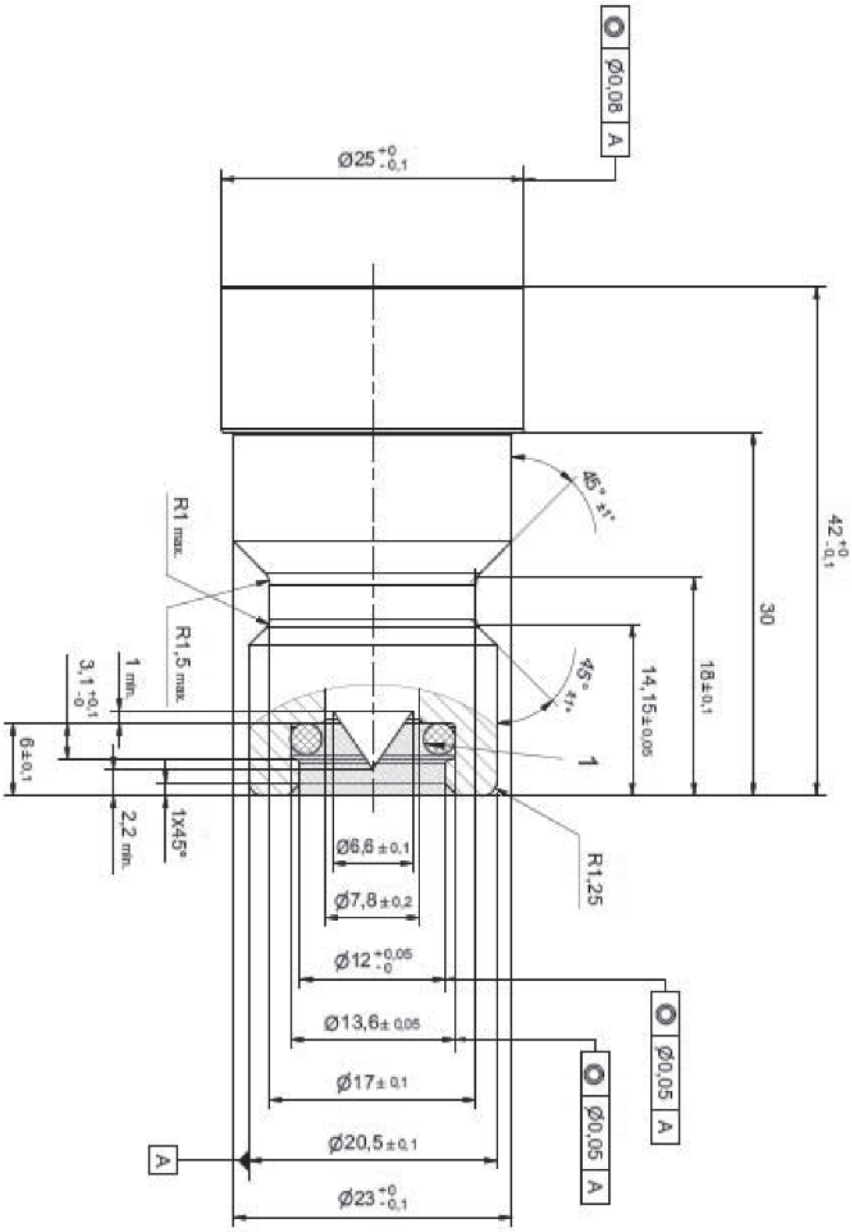
A receptacle size 1 shall comply with the design specifications detailed in Figures 1 to 3.



Key

(shaded area)	this area shall be kept free of all components
1	sealing surface equivalent to No. 110 O-ring of dimensions:
	9,19 mm ± 0, 127 mm ID
	2,62 mm ± 0, 076 mm width
sealing surface finish	0,8 µm to 0, 05 µm
material hardness	75 Rockwell B (HRB 75) minimum

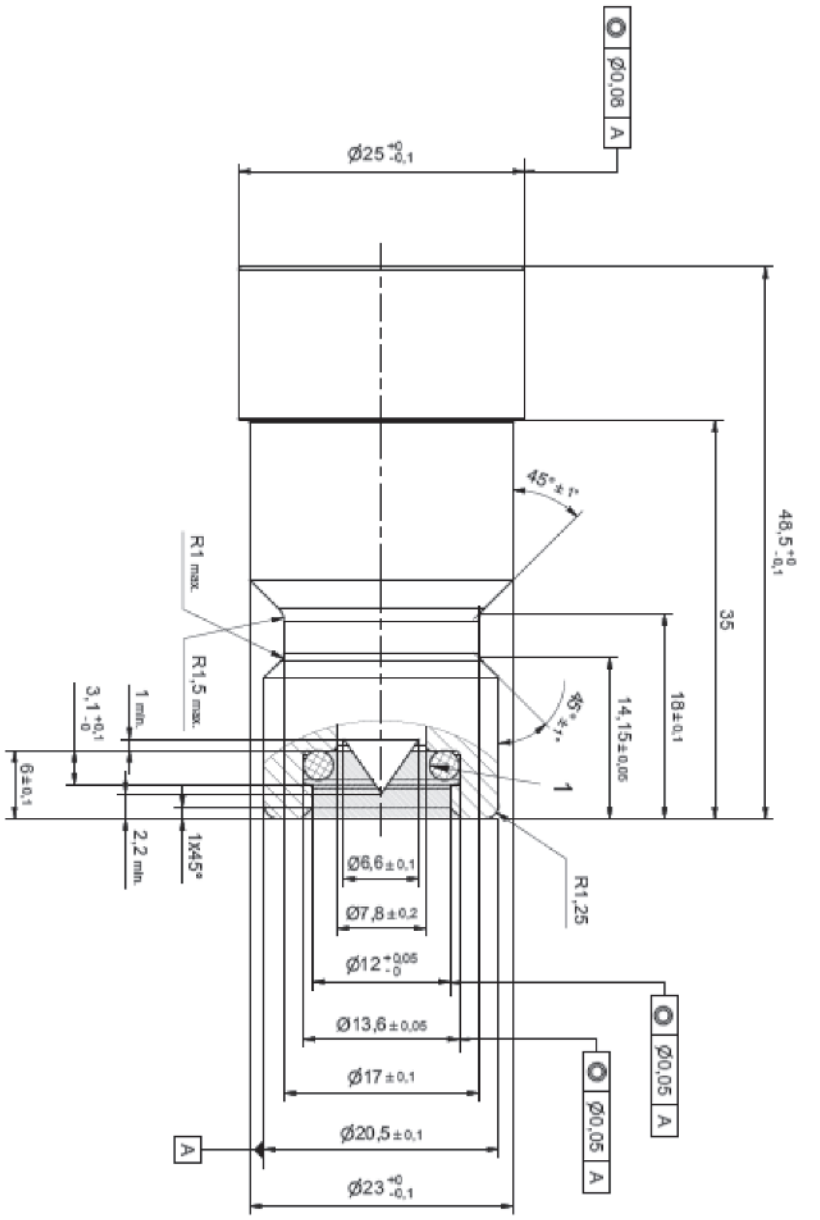
Figure 1 — Size 1 — M200 Receptacle



Key

(shaded area)	this area shall be kept free of all components
1	sealing surface equivalent to No. 110 O-ring of dimensions:
	9,19 mm ± 0, 127 mm ID
	2,62 mm ± 0, 076 mm width
sealing surface finish	0,8 µm to 0, 05 µm
material hardness	75 Rockwell B (HRB 75) minimum

Figure 2 — Size 1 — M250 Receptacle



Key

(shaded area)	this area shall be kept free of all components
1	sealing surface equivalent to No. 110 O-ring of dimensions:
	9,19 mm ± 0, 127 mm ID
	2,62 mm ± 0, 076 mm width
sealing surface finish	0,8 µm to 0, 05 µm
material hardness	75 Rockwell B (HRB 75) minimum

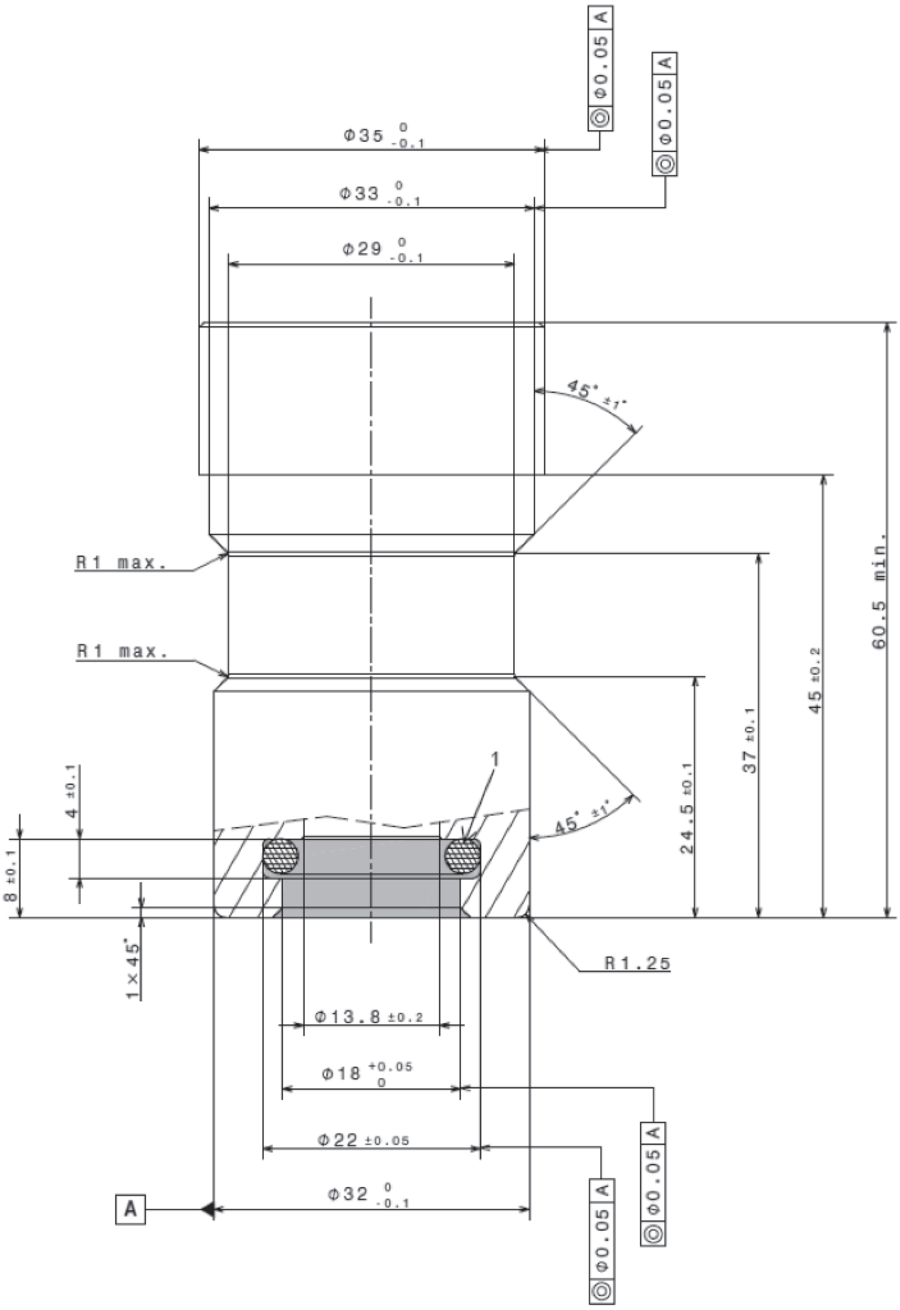
Figure 3 — Size 1 — M350 Receptacle

Depending on the pressure range, M200 and M250 receptacles have to have a minimum length of 42 mm and M350, 48,5 mm which is clear of provisions for attachment of receptacle or protective caps.

NOTE This space can be used from nozzle manufacturers for coding purposes.

6.2 Standard receptacle dimensions size 2 (N200, N250)

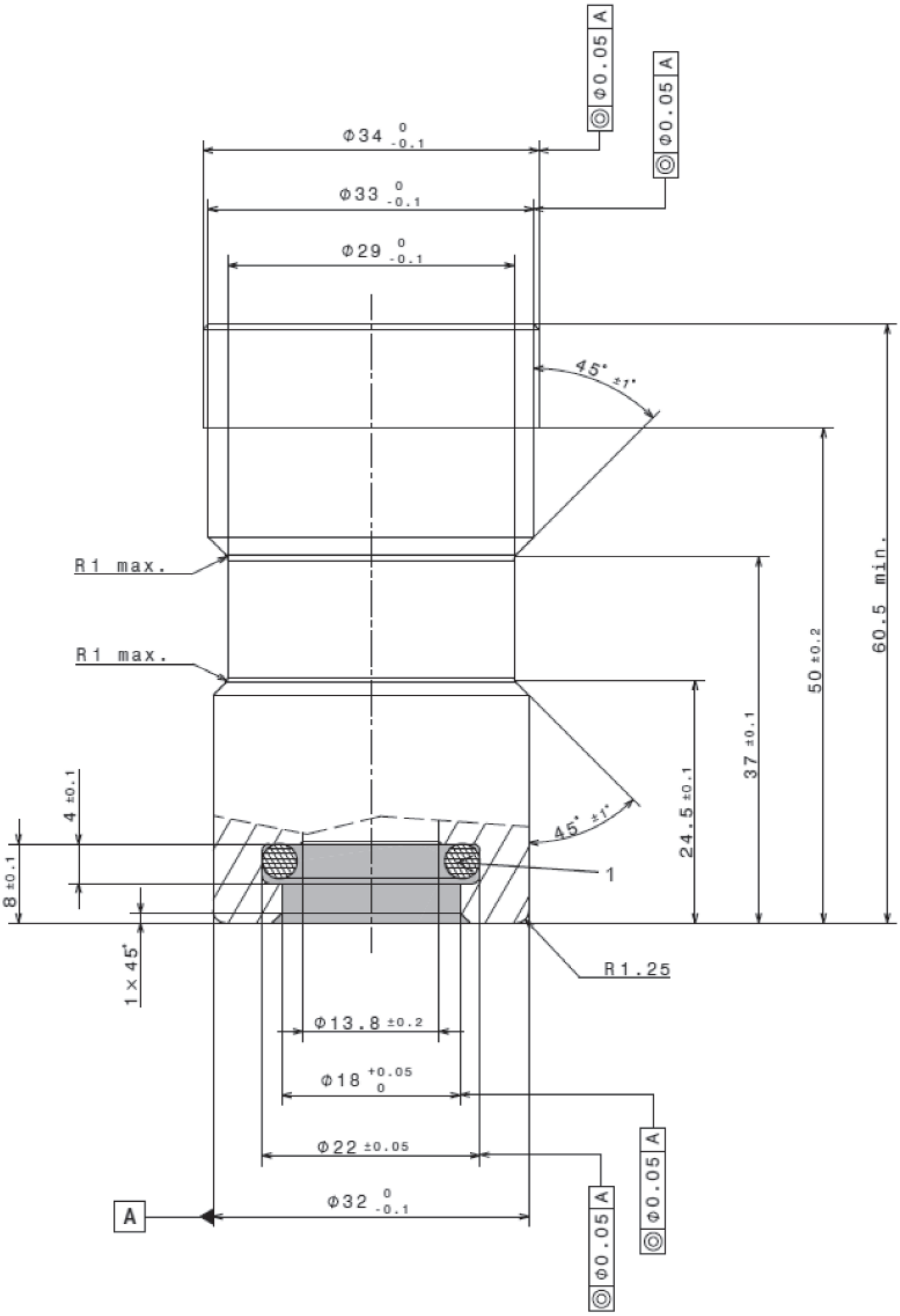
A receptacle size 2 shall comply with the design specifications detailed in Figures 4 to 5.



Key

1	sealing ID = ⌀15,47 ± 0,1 width = ⌀3,53 ± 0,2
[shaded area]	this area shall be kept free of all components
surface roughness	< *Ra* 3,2 µm
sealing surface finish	0,8 µm to 0,05 µm
material hardness	75 Rockwell B (HRB 75) minimum

Figure 4 — Size 2 N200 Receptacle



Key

1	sealing ID = ⌀15,47 ± 0,1 width = ⌀3,53 ± 0,2
(shaded area)	this area shall be kept free of all components
surface roughness	< *Ra* 3,2 µm
sealing surface finish	0,8 µm to 0,05 µm
material hardness	75 Rockwell B (HRB 75) minimum

Figure 5 — Size 2 — N250 Receptacle

Depending on the pressure range, N200 and N250 receptacles have to have a minimum length of 60,5 mm which is clear of provisions for attachment of receptacle or protective caps.

NOTE This space can be used from nozzle manufacturers for coding purposes.

7 Receptacles

7.1 Receptacles shall comply with Clauses 1 to 10 of this International Standard and shall be evaluated with at least two different test nozzles which are already certified to this International Standard – if available in the market - each nozzle representing a different locking technology. If in future other locking mechanisms will be invented the amount of nozzle types tested to shall reflect the actual technology.

The failure of any test conducted with the receptacle and nozzle test samples shall constitute a failure of the submitted receptacle, unless the manufacturer can prove the problem was caused by the test nozzle.

7.2 Receptacle designs which employ means on the position of the back side ring as specified in Figures 1 to 3 to accommodate mounting, or for mounting accessories or marking purposes, shall not have such means extend beyond the back diameter dimensions of the profile as specified in Figures 1 to 3, as applicable. Acceptable means include wrench flats, dust cap anchoring grooves, use of hex stock, undercutting for marking, and threads for pressure tight caps. Receptacle designs shall not compromise the interchangeability requirements specified in Annex C.

7.3 The receptacle shall be equipped with an internal check valve to prevent the escape of gas. The check valve shall be of the non-contact type, opening by differential pressure only.

7.4 The use of threaded connections which rely on the joint between the male and female threads for sealing is prohibited.

7.5 The interfacing surface of the receptacle shall be constructed of material having a hardness >75 Rockwell B (HRB 75) and shall be non-sparking and conductive (see 10.11.5 and 10.15).

The exposed surfaces of devices shall be made of non-sparking materials. (see 10.11.5)

7.6 Receptacles shall have a means to prevent the ingress of fluids and foreign matter.

7.7 The function described in 7.6 can also be met by either a protective cap (see 10.4) or a pressure tight protective cap (see 10.18).

7.8 Additionally a filter of adequate size should be integrated.

7.9 The receptacle shall have provisions to be firmly attached to the vehicle and shall comply with applicable abnormal load tests (see 10.7).

7.10 Receptacles shall have a cycle life of >10 000 cycles but a service life of >100 000 cycles.

8 Instructions

Information required under this section for instructions and provisions specified are required to be in an easily understood form.

Special tools required for connection of receptacles to tubing and assembly and disassembly of three-way valve parts shall be clearly identified in the instructions.

Manufacturers of receptacles, nozzles, and three-way valves shall provide clear and concise printed instruction and diagrams in a form that can be easily understood and adequate for

a) proper field assembly,

b) installation,

c) maintenance,

d) replacement of components as appropriate,

e) safe operation by all users,

f) suitability and use, and

g) storage and handling.

9 Marking

Information required under this section for marking, provisions specified are required to be in a form easily understood. Marking should be embossed, cast, stamped or otherwise formed in the part. This includes markings baked into an enamelled surface.

9.1 Nozzles and receptacles shall bear the following information.

a) The manufacturer's or dealer's name, trademark or symbol.

b) The model designation.

c) M200 or M250 or M350 or N200 or N250.

d) The applicable Type and Class (see 5.1).

e) If required, a certification mark.

Marking shall remain legible for the life of the component and shall not be removable without destroying or defacing the marking. Permanent adhesive labels are permissible, or markings can be etched, stamped, or moulded into the component.

9.2 Nozzles and receptacles shall each bear a date code marking.

The four-digit date code marking shall consist of at least four adjacent digits determined as follows:

a) the first and second digits shall indicate the calendar year in which the nozzle, receptacle or three-way valve was manufactured (e.g. 96 for 1996 and 00 for 2000);

b) the third and fourth digits shall indicate the week in which the nozzle, receptacle or three-way valve was manufactured (e.g. 03 for the third week of the year). For the purpose of this marking, a week shall begin at 00:01 h on Sunday and end at 24:00 h on Saturday.

A date code can be used for more than one week, however, it shall not be used for more than four consecutive weeks, or for more than two weeks into the next calendar year.

When a four digit date code is not practical, the manufacturer shall submit a plan acceptable to the certifying agency which will outline means of establishing the date of manufacture so that it is traceable to the purchaser.

Additional numbers, letters, or symbols can follow the four digit number specified in "a" and "b". If additional numbers are used, they shall be separated from the date code.

9.3 A marking to identify this International Standard shall be provided for each system. This marking can be located on the package or on a notice placed inside the package in which the device is shipped.

10 Tests

10.1 General requirements

A nozzle and receptacle shall be tested with receptacle and nozzle designs specified under Clause 1 through Clause 9.

Unless otherwise stated

a) tests shall be conducted at room temperature (20 ± 5) °C,

b) all pressure tests shall be conducted with dry air or dry nitrogen,

c) all leak tests shall be conducted with 99,996 % Helium (Helium 4.6 according to ISO 14175), and

d) devices shall be conditioned to attain equilibrium conditions.

Type 2 nozzles shall be tested in series with either a three-way valve or some other means to independently pressurize and vent the nozzle. The three-way valve shall not affect temperature, durability, or flow characteristics of the nozzle. Failure of the three-way valve shall not constitute failure of the nozzle. A three-way valve that is supplied for utilization with a Type 2 nozzle, shall be evaluated separately.

Nozzle tests are to be done with the test fixtures, as specified in Annex C, as applicable. A new receptacle test sample shall be used for each nozzle test. The failure of any test conducted with the nozzle and receptacle test sample shall constitute a failure of the nozzle design.

10.2 User interface

The appearance of the nozzle and receptacle shall be such as to clearly suggest the proper method of use.

It shall not be possible to deliver gas using Type 1 nozzles unless the nozzle and receptacle are connected properly and positively locked.

Upon disconnection, Type 1, 2, and 3 nozzles shall stop the flow of gas. No hazardous condition shall result from disconnection. Type 3 nozzles shall be at 0,7 MPa during this test.

When the contained pressure is less than or equal to 0,7 MPa, all nozzles shall be capable of being disconnected with forces or torques not exceeding 225 N or 7 Nm.

The disconnection force/torque shall be applied in a direction that tends to unhook and release the nozzle. The force/torque shall be applied to the unhooking/release actuator. The torque shall be applied through axis rotation of the nozzle handle equal to the exterior handling surface of the nozzle uncoupling mechanism and in such a direction that tends to unhook and release the nozzle.

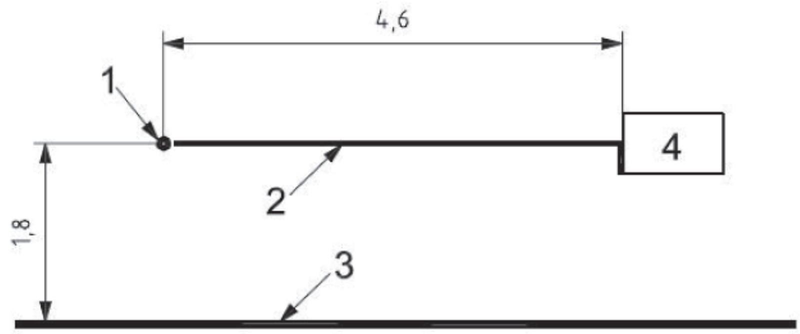
On depressurised devices, the axial force to connect and lock or unlock and disconnect the device shall be less than or equal to 90 N.

On a positive locking device which incorporates a rotary locking means, the torque to lock or unlock the locking means shall not exceed 1 Nm for a device having a diameter of 25,4 mm or smaller and 1,7 Nm for a device having a diameter larger than 25,4 mm.

The minimum force to facilitate disconnection at pressures of 6 25 MPa or more, shall be 2,5 times the force when depressurised (Types 1 and 2) or 7 bar (Type 3). Type 1 nozzles shall be tested with the vent port plugged.

10.3 Impact resistance

A nozzle shall be connected to a 4,6 m length of 9,5 mm (for size 1) and 12 mm (for size 2) internal diameter (ID) refuelling hose, conditioned at −40 °C for 24 h and then dropped 1,8 m onto a concrete floor as shown in Figure 6. The nozzle shall be dropped 10 times, then pressurized to 20 MPa (M200, N200), 25 MPa (M250, N250) and 35 MPa (M350) and subjected to 10 additional drops. Following the above drops, the nozzle shall be capable of normal connection and disconnection to the receptacle. In addition, the nozzle shall comply with all leakage tests specified in this International Standard (see 10.5).



Key

1 suitable support

2 refuelling hose

3 concrete floor

4 nozzle

Figure 6 — Impact resistance test arrangement

10.4 Receptacle protective caps

There shall be no permanent distortion or damage to any receptacle protective cap, when tested as follows:

A solid steel ball with a diameter 50 mm shall be dropped from a height of 300 mm striking the protective cap installed on the receptacle. The test shall be conducted at −40 °C and at 85 °C at least 5 points of impact most likely to cause damage to the receptacle and the protective cap.

10.5 Leakage at room temperature

10.5.1 Nozzle

A nozzle, whether coupled or uncoupled, shall be either bubble free on the leak test for 1 min or have a leak rate less than 20 cm^3(n)/h, when tested as specified herein.

Tests shall be conducted at 0,5 MPa, 30 MPa (M200, N200), 37,5 MPa (M250, N250) and 52,5 MPa (M350), and then 0,5 MPa again.

Pressurized helium shall be applied to the inlet of the coupled (or uncoupled) device. The external body shall then be checked for bubble tight leakage using immersion in room temperature water.

All connectors shall be checked for leakage from the time of connection, through full fuel flow, to the time of disconnection.

The leak rate shall be measured by either a vacuum test using helium gas (global accumulation method) or an equivalent method.

The leak rate less than 20 Ncm^3/h (normal referred to helium) shall be accepted.

10.5.2 Receptacle

The receptacle check valve shall be either bubble free on the leak test for 1 min or have a leak rate less than 20 $cm^3(n)/h$ when tested as specified herein. If leakages are notified they have to be quantified by using adequate technical methods.

Tests shall be conducted at 0,5 MPa, 30 MPa (M200, N200), 35 MPa (M250, N250), 45 MPa (M350), and then 0,5 MPa again.

The receptacle shall be connected to a pressure vessel capable of safely accommodating the specified test pressures. The receptacle and pressure vessel shall then be pressurized. Once the pressure vessel has reached the specified test pressure, the upstream portion of the receptacle shall be quickly depressurised and the receptacle check valve checked for leakage.

10.6 Valve operating handle

If a nozzle is equipped with a valve operating handle, it shall be capable of withstanding two times the manufacturer's specified operating torque or force, without damage to the operating handle or the operating handle stops.

This test with the torque or force applied in both the opening and closing directions shall be

a) performed with the nozzle properly connected to a receptacle, and

b) with the nozzle intentionally misaligned relative to the receptacle.

10.7 Abnormal loads

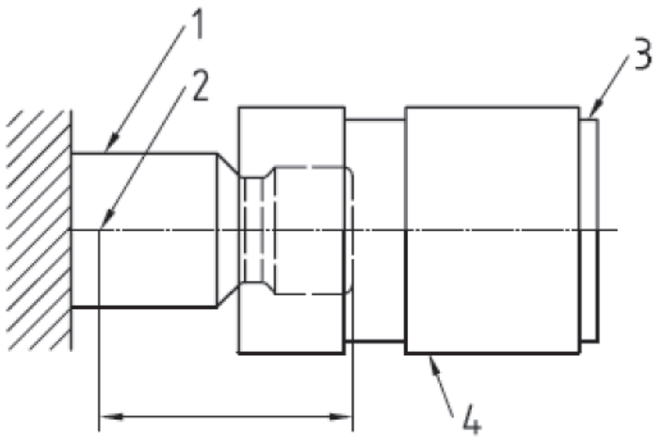
The connected nozzle and receptacle shall be subjected to the following abnormal loads for a period of 5 min in service. These tests are to be conducted separately:

a) pulls "a" along the nozzle or receptacle longitudinal axis;

b) moments "b" applied in a worst case manner.

The nozzle and receptacle shall be able to withstand abnormal loads of ("a" = 1 350 N; "b" = 120 Nm) without distortion or damage and ("a" = 2 700 N; "b" = 240 Nm) without becoming so damaged as to leak. The load and moment arm shall be measured about a point X = 41 mm (for M200, N200, M250, and N250, as applicable) and 48,5 mm (for M350) from the front of the receptacle to the hose inlet of the nozzle (see Figure 7).

After completing these tests, the receptacle shall comply with 10.5.



Key

1 receptacle

2 abnormal load reference

3 moment

4 nozzle

X distance as described (for M = 41 mm; for N = 55 mm)

Figure 7 — Abnormal load test

10.7.1 Test in the unpressurised condition

The receptacle test fixture and nozzle shall not be pressurized during the abnormal load tests.

The receptacle shall be mounted as a cantilever to a supporting member in accordance with the manufacturer's instructions. For the purposes of this test, the supporting member shall be capable of withstanding the specified loads without displacement or deflection.

The loads applied and the ability of the device to resist damage shall be as specified in 10.7. After completing the tests, the receptacle shall comply with 10.5.

10.7.2 Test in the pressurized condition

The receptacle test fixture and nozzle shall be pressurized to 25 MPa (M200, N200), 30 MPa (M250, N250), and 40 MPa (M350) during the abnormal load tests.

The "Loose Fit" test fixture shown in Figure C.1 shall be used for this test, regardless of the working pressure rating of the nozzle. The test fixture shall be mounted as a cantilever to a supporting member. For the purposes of this test, the supporting member shall be capable of withstanding the specified loads without displacement or deflection. The nozzle shall be properly connected to the test fixture.

The loads applied and the devices ability to resist damage shall be as specified in 10.7. After completing the tests, the receptacle shall comply with 10.5.

10.8 Rocking/twisting

The receptacle and its mounting hardware shall not be loosened or damaged when subjected to the following test.

Utilizing the receptacle mounting hardware submitted by the manufacturer, the receptacle shall be mounted on a supporting member in accordance with the manufacturer's instructions. For the purposes of this test, the supporting member shall be capable of withstanding the specified loads without displacement or deflection. The nozzle, attached to a pressurized hose as installed for normal use, shall be properly connected to the receptacle. An alternating 24 Nm moment shall be applied at a point on the nozzle furthest from the receptacle for 2 500 times at a frequency not exceeding one cycle per second.

A 4 Nm torque shall then be applied 10 times to the receptacle in the direction most likely to loosen the mounting hardware.

Following the above tests, the receptacle shall comply with room temperature leakage tests (see 10.5). Following room temperature leakage tests, the receptacle shall comply with hydrostatic strength tests (see 10.12).

10.9 Mounting hardware torque

The receptacle and mounting hardware shall withstand, without damage, a turning force equal to 150 % of the manufacturer's recommended mounting hardware fastening torque.

10.10 Leakage test at low and high temperatures

Prior to conditioning, the devices shall be purged with nitrogen and then sealed from the atmosphere under a pressure of 7 MPa nitrogen or dry air.

All tests shall be conducted while the devices are continuing to be exposed to the specified test temperatures. The outlet of the device shall be plugged and the test pressure shall be applied to the inlet of the device. The device shall be either bubble free on the leak test for a specified time period or have a leak rate less than 20 cm^3 (n)/h.

10.10.1 Leakage test

10.10.1.1 Preconditioning

At each test condition, the devices shall be maintained at the specified temperature for 2 h, then tested in accordance with 10.10.2:

a) the nozzle and receptacle coupled, conditioned at −40 °C and pressurized at 0,5 MPa and 0,6 times working pressure;

b) the nozzle and receptacle coupled, conditioned at 85 °C and pressurized at 1 MPa and 1,25 times working pressure;

c) the receptacle uncoupled, conditioned at −40 °C and pressurized at 0,5 MPa and 0,6 times working pressure;

d) the receptacle uncoupled, conditioned at 85 °C and pressurized at 1 MPa and 1,25 times working pressure;

e) the nozzle uncoupled, conditioned at −40 °C and pressurized at 0,5 MPa and 0,6 times working pressure;

f) the nozzle uncoupled, conditioned at 85 °C and pressurized at 1 MPa and 1,25 times working pressure.

10.10.2 Test

Pressurized helium shall be applied to the test components. The external body shall then be checked for bubble tight leakage using

a) At −40 °C, immersion in a 70 % glycol and 30 % water mixture or another adequate liquid for 2 min, and

b) At 85 °C, immersion in 85 °C water for 1 min.

NOTE Check if materials in the components are compatible to the media used for leak testing.

10.10.3 Requirements

The leak rate shall be measured by either a vacuum test using helium gas (global accumulation method) or an equivalent method.

The leak rate less than 20 Ncm^3/h (normal referred to helium) shall be accepted.

10.10.4 Operation test

The devices shall function normally and deliver gas when tested under the following conditions.

a) The nozzle and receptacle connected and disconnected 10 times when conditioned at −40 °C and pressurized to 0,6 working pressure.

b) The nozzle and receptacle connected and disconnected 10 times when conditioned at 85 °C and 100 % working pressure.

10.11 Durability

10.11.1 Durability cycling

a) Nozzle test

All nozzles shall be capable of withstanding the number of specified operational cycles in Table 2. During the following tests, all nozzles shall be maintained according to the manufacturer's instructions. Requirements for maintenance at intervals less than specified by the manufacturer shall be considered as not complying with this International Standard.

Table 2 — Nozzle frequency of use

Nozzle type	Frequency of use (by class)	
	Class A	Class B
Type 1	100 000	—
Type 2	100 000	20 000
Type 3	100 000	20 000

For the purposes of this test, one cycle of operation shall be

1) properly connecting the nozzle to the test fixture,

2) pressurising the nozzle to working pressure using dry, oil-free air, or nitrogen,

3) depressurising the nozzle, and

4) disconnecting the nozzle.

At each disconnection, the test fixture shall be rotated relative to the nozzle at random or equal degree increments throughout this test. This is to be repeated until 10 000 cycles are completed, after which time the nozzle shall be examined for wear. For a Type 3 nozzle, the pressure shall be reduced to 0,5 MPa during the disconnection phase.

The working pressure shall be maintained on the inlet of each nozzle throughout the test. For a Type 1 nozzle, the working pressure shall be maintained on the inlet. For a Type 2 nozzle, the working pressure shall be maintained on the inlet of the three-way valve.

At 20 % intervals, the nozzle shall comply with 10.5 and 10.10.1. In addition, at these intervals, the nozzle locking mechanism shall be checked at the normal disconnection pressure to ensure it is properly engaged on the nozzle.

For a Type 1 nozzle, the vent valve operating mechanism shall be manually operated 10 times at both high and low temperatures at each of the cycle intervals prior to checking for leakage.

The test fixture shall be replaced at 10 000 cycle intervals. The test fixture shall be selected from the following Table 3. The worn test fixtures resulting from cycling the test nozzle shall not be in excess of wear patterns shown in Figures 8 to 12. In addition, following completion of the required number of cycles, the test nozzle shall comply with 10.5 and 10.12 when tested with the receptacle test piece of Figures 8 to 12, as applicable. Failure to comply with any of these tests specified in this paragraph shall be deemed as a failure of the test nozzle. The replacement of nozzle(s) seals shall be acceptable at intervals of 40 % of the total number cycles.

Table 3 — Test fixture selection for nozzle durability

Cycle numbers	Figures	Replacement frequencies
0 to 50 000	C.1	Every 10 000 cycles
50 001 to 100 000	C.2	Every 10 000 cycles

NOTE There are five different drawings: C.1 M200, C.1 M250, C.1 M350, C.1. N200, and C.1 N250.

There are five different drawings: C.2 M200, C.2 M250, C.2 M350, C.2 N200, and C.2 N250.

For Class A devices, seal(s) can be replaced at 40 000 and 80 000 cycles if the manufacturer's instructions clearly state that this is recommended practice.

b) Receptacle check valve test

The receptacle check valve shall be bubble free on the leak test for 1 min and be capable of withstanding 100 000 cycles of operation and 24 h of the flow conditions that cause the most severe chatter.

The receptacle shall be connected to a nozzle test fixture. Working pressure shall be applied to the nozzle and receptacle. Pressure shall then be vented from the upstream side of the receptacle check valve. Pressure on the downstream side of the receptacle check valve shall be lowered to between 0 and a maximum of 0,5 times working pressure prior to the next cycle.

Following 100 000 cycles of operation, the receptacle check valve shall then be subjected to 24 h of flow at the inlet/outlet flow conditions that cause the most severe chatter. The receptacle shall then be tested for compliance with 10.5 and 10.10.1.

c) Nozzle check valve test

Without being connected to the receptacle, the nozzle check valve (which prevents the flow of gas unless properly connected) shall be capable of withstanding 500 cycles of the application of working pressure. Following this test, the nozzle check valve shall be bubble free on the leak test for 1 min when tested, in accordance with 10.5 and 10.10.1.

d) Receptacle test

A receptacle shall be capable of withstanding 10 000 cycles of operation as specified in the following test.

One cycle of operation consists of

1) properly connecting the nozzle to the receptacle,

2) pressurising the devices to working pressure using dry, oil-free air, or nitrogen,

3) depressurising the devices, and

4) disconnecting the nozzle.

After every 100 cycles, a 20 Nm torque shall be applied around the longitudinal axis of the pressurized nozzle, through a maximum rotation of 30 degrees and then the test will continue as before. Following this test, the receptacle shall pass the test in 10.5.

e) Receptacle full flow test

The receptacle shall be capable of withstanding full flow condition as specified in the following test.

The receptacle shall be connected to a nozzle. The outlet of the receptacle shall be open to atmospheric pressure. The supply port of the nozzle shall be connected to a system which shall supply sufficient compressed dry air or nitrogen.

Each receptacle shall be cycled for 30 cycles. Each cycle shall consist of the full flow of gas with the supply pressure starting at 0,88 times working pressure. A cycle shall be 2 s in length and the supply pressure shall not fall below 0,8 times working pressure at the end of each cycle. The test system shall not limit the flow during this test.

Following this test, the receptacle shall pass the test in 10.5.

10.11.2 Ozone ageing

Sealing materials shall be listed and rated by the manufacturer as being resistant to ozone ageing. Otherwise, they shall not crack or show visible evidence of deterioration subsequent to ozone ageing as specified herein.

The test shall be in compliance with ISO 1431-1.

The test piece, which has to be stressed to 20 per cent elongation, shall be exposed to air at 40°C with an ozone concentration of 50 parts per hundred million during 120 h.

No cracking of the test piece is allowed.

10.11.3 Seal material compatibility

Sealing materials shall be listed and rated by the manufacturer for this application. Otherwise, they shall not show excessive volume change or loss of weight when tested in accordance with the following test.

a) Representative sample(s) of seal materials shall be prepared, measured and weighed. The samples shall then be immersed in a hydrogen/natural gas mixture representative for the fuel that the component should be used with at the given working pressure for 144 h. Following this time period, the test pressure shall be rapidly reduced to atmospheric pressure, after which the test samples shall not exhibit evidence of shredding (explosive decompression). In addition, the samples shall not swell more than 25 %, shrink more than 5 %, and incur a weight loss in excess of 10 %. See ISO 1817 for determination of the effect of liquids.

b) To evaluate the possible deleterious effects of compressor oils on any seal material, the material shall also be immersed for a period of 144 h in each of petroleum based and synthetic compressor oil. The use of ester oils shall be considered too. Following these time periods, observations shall be made as to the condition of the material.

c) Seal materials shall pass the following test procedure, with 100 % helium, using one sample only, while maintained at the specified temperature for 8 h and at working pressure: −40 °C and 85 °C, using the following test:

The test sample pressure shall not fall below the initial 200 bar (250 bar or 350 bar) setting. The test sample shall be bubble tight (<20 cm^3 (n)/h) at the noted test temperature. Upon completion of all tests, the test sample shall be disassembled and the seal material interface checked to ensure that the samples did not swell more than 25 %, shrink more than 1 %, change more than ± 5° Shore D, or incur a weight loss in excess of 10 %.

10.11.4 Ten day moist ammonia-air stress cracking

After being subjected to the conditions described below, a brass part containing more than 15 % zinc shall show no evidence of cracking when examined using 25 × magnification.

Each test sample shall be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Such stresses shall be applied to the sample prior to and maintained during the test. Samples with threads, intended to be used for installing the product in the field, shall have the threads engaged and tightened to the torque specified by the manufacturer. Polytetrafluorethylene (PTFE) tape or pipe compound shall not be used on the threads.

Three samples shall be degreased and then continuously exposed in a set position for 10 days to a moist ammonia-air mixture maintained in a glass chamber approximately 3 l having a glass cover.

Approximately, 0,6 l of aqueous ammonia having a specific gravity of 0,94 shall be maintained at the bottom of the glass chamber below the samples. The samples are to be positioned each 40 mm above the aqueous ammonia solution and supported by an inert tray. The moist ammonia-air mixture in the chamber shall be maintained at atmospheric pressure and at a temperature of 34 °C ± 2 °C.

10.11.5 Electrical resistance

The electrical resistance of the connected receptacle and nozzle shall not be greater than 0,1 Ω in the pressurized and unpressurised state. Tests shall be conducted prior to and after durability cycling (see 10.11.1).

10.12 Hydrostatic strength

Because the hydrostatic strength test is a terminal test, do not use the test samples for any other testing.

An uncoupled nozzle, uncoupled receptacle and coupled nozzle and receptacle shall not rupture when subjected to the following test. Positive function after this test is not required. If there is a leak before break, this is considered to be adequate. In this case, a FEM calculation is the basis for acceptance.

NOTE If tested connected, the seal interface between the receptacle and the nozzle must withstand the burst pressure.

Outlet openings of the uncoupled or coupled connector shall be plugged and valve seats or internal blocks made to assume the open position. A hydrostatic pressure of 2,5 times working pressure shall be applied to the inlet of the nozzle or outlet of the receptacle for a period of at least 3 min.

10.13 Corrosion resistance

Nozzles and receptacles shall not sustain corrosion or loss of protective coatings, and shall be capable of performing safely subsequent to the following test.

Previously untested samples shall be used. Protective caps shall be in place. Vent holes shall not be plugged.

10.13.1 Nozzles

The devices shall be supported in a horizontal position. The devices shall be exposed for 96 h to a salt spray in accordance with ISO 9227.

Throughout the test, the temperature within the test chamber shall be maintained at between 33 °C and 36 °C. The salt spray solution shall consist of 5 % sodium chloride and 95 % distilled water (mass fraction).

A pressure of 0,5 MPa (5 bar) air shall also be continuously applied to the inlet of the nozzle. The nozzle shall be operated once an hour to dispense air to the atmosphere through a dummy receptacle during the first 8 h test period.

After being rinsed and gently cleaned of salt deposits, the nozzle shall then comply with room temperature leakage tests (see 10.5).

10.13.2 Receptacles

The devices shall be subjected to the corrosion resistance test of ISO 15500-2:2012, (Clause 10) except that the leakage and hydrostatic strength test shall be in accordance with 10.5 and 10.12 of this International Standard.

10.14 Deformation

Connectors shall be capable of withstanding a turning effort of 150 % of the manufacturer's recommended assembly torque, without significant deformation, breakage or leakage.

A sample not previously tested to hydrostatic strength tests shall be used.

Straight thread o-ring seals shall be lubricated with ISO 1817 oil number 1. Connectors shall be connected and assembled to the applicable torque specified above in a worst case manner in accordance with good assembly practices. While still connected and assembled, the assembly shall comply with 10.5 and 10.10.1 and then the hydrostatic strength test according to 10.12.

10.15 Non-igniting evaluation

Materials which have been demonstrated to be non-sparking, as determined by a notified body, shall be deemed as being non-igniting (Stainless steels with an alloy content of more than 22 % chromium and nickel is generally considered to be non-sparking). Otherwise, they shall be subjected to the following test:

Each sample material shall be held against a coarse emery grinding wheel (Grit Size 36) rotating with a surface speed of approximately 26 m/s. Contact with the grinding wheel shall be maintained for 30 s with a force of 22,0 N ± 4,4 N. The material removed from each sample by the grinding wheel shall be directed onto a 1,5 cm × 1,5 cm × 0,4 cm pad of cotton batting located directly beneath and within 1,5 cm of the point of contact between the sample and the grinding wheel. The fresh cotton pad shall be saturated with gasoline immediately prior to each test. Each sample is tested with gasoline to determine if the material removed by the grinding wheel will cause ignition. This test shall be repeated a) using a stoichiometric mixture of natural gas and air and b) a mixture of hydrogen, natural gas and air (mixture as intended to use as a fuel). The mixture shall be directed into the path of the removed particles at the point most likely to cause ignition.

No ignition means the test passed.

10.16 Vibration resistance

Receptacles shall remain undamaged, continue to operate, and comply with 10.5 after 6 h of vibration in accordance with the following test method:

The receptacle shall be secured in an apparatus and vibrated for 2 h at 17 Hz with an amplitude of 1,5 mm (0,06 in.) in each of the three orientation axes. On completion of 6 h, the receptacle shall comply with the leak test at room temperature (10.5)

10.17 Hydrogen embrittlement

It shall be proven that if steel is used for gas wetted parts that the material is not suspicious for hydrogen embrittlement. This shall be certified according to ISO 11114-4 either the disk method or the "C" -method.

10.18 Pressure tight protective cap (PTPC)

Pressure tight protective caps herein will be referred to as PTPC or device. All receptacles referred to in the subsequent subclauses are to be in accordance with the profile shown in Figure 1, and shall be tested without the internal check valve mechanism.

NOTE It must be ensured that in case of a leakage, the trapped gas between the receptacle check valve and the PTPC will not cause a dangerous situation when the PTPC is disconnected from the receptacle and the gas is released.

10.18.1 Leakage

A PTPC / receptacle assembly shall be bubble tight for 5 min on the leakage tests over the range of test conditions specified in the following test method.

A new PTPC / receptacle sample shall be used for this test.

Helium shall be used as the test gas and pressure source.

All leakage tests shall be conducted at both the manufacturer's maximum and minimum specified installation forces or torques.

The PTPC shall be attached onto the test fixture receptacle.

This test shall be conducted at all of the pressure and temperature conditions specified in Table 4.

The test sample shall be conditioned at the specified test temperature for at least 2 h. The PTPC shall be removed and reinstalled using the manufacturer's maximum specified installation torque. (To minimize temperature deviation, this removal/installation cycle shall be accomplished within two minutes following removal of the device from the temperature chamber).

The test sample shall be exposed to the pressure and temperature conditions in Table 4. The test sample shall not leak over the complete test range measured during the first five minute period of each test.

NOTE The manufacturer has the option of performing this test once only, upon completion of all tests in 10.18.5.

Table 4 — Pressure and temperature test conditions

Pressure	**Temperatures**		
in MPa	**- 40 °C or −20 °C as applicable**	**Room**	**+85 °C or +120 °C as applicable**
1	—	—	X
Working pressure	—	X	X
0,5	X	X	
0,75 × Working pressure	X	—	—

10.18.2 Durability cycling

A PTPC shall comply with 10 000 cycles of durability testing as outlined in the following test method. Following the durability test, the test sample shall comply with 10.18.1 with an o-ring that has been cycled through 2 000 cycles of durability.

The PTPC shall not be pressurized during this test.

One cycle shall be defined as

a) attaching the PTPC onto a test fixture receptacle in accordance with the manufacturer's specified force or torque, and

2) removing the PTPC until it is fully disengaged.

This shall be repeated for 2 000 cycles. Temperature of the PTPC shall be monitored during the first 100 cycles to ensure that the frequency and frictional effects of the test do not interfere with the integrity of durability testing.

The above cycling operation shall be repeated at 2 000 cycle intervals for a total of 10 000 cycles. Room temperature leak test shall be conducted at 2 000, 6 000, and 10 000 cycles as specified in 10.5.1. O-ring seals in the PTPC shall be replaced according to manufacturer's instructions after the leakage tests following every 2 000 cycles.

Failure of any leak test during durability cycling, or failure of the PTPC to operate at the manufacturer's specified forces, or forces defined in 10.2, shall constitute a failure of the device.

10.18.3 Abuse

A PTPC shall be capable of being safely removed from the receptacle in the event of a leak in the receptacle check valve under extreme load conditions.

The following test shall be conducted at pressures of working pressure and 0,5 times working pressure. Test samples and o-rings previously cycled under the durability test shall be used.

Nitrogen shall be used as the test gas and pressure source.

The PTPC shall be attached using the maximum and minimum forces/torques in accordance with the manufacturer's instructions.

The test fixture receptacle shall be connected to a vessel having an internal volume of 27 ml.

The assembly shall be pressurized to working pressure. While the assembly remains pressurized, the PTPC shall be vented in accordance with the manufacturer's instructions. The pressure in the vessel shall drop to a maximum of 0,15 MPa within 3 s.

10.18.4 Impact resistance

A PTPC shall be capable of withstanding an impact as described in the following test.

The PTPC test fixture receptacle assembly shall be rigidly mounted to a test bench horizontally. A solid steel ball with a diameter 50 mm shall be dropped from a height of 300 mm striking the PTPC. The ball shall impact at a point on the PTPC which is furthest from the receptacle.

Following one drop, a room temperature leak test as specified in Table 4, shall be conducted to confirm seal integrity.

If bubble-tight for 5 min, the receptacle shall be vented, the PTPC removed and reattached in accordance with the manufacturer's instructions, and the leakage test as specified in 10.18.1 shall be repeated.

10.18.5 Corrosion resistance

A PTPC shall be capable of being attached and removed at operating force/torque less than or equal to the manufacturer's maximum specified force/torque, after the completion of the following test.

A new PTPC/receptacle sample shall be used for this test.

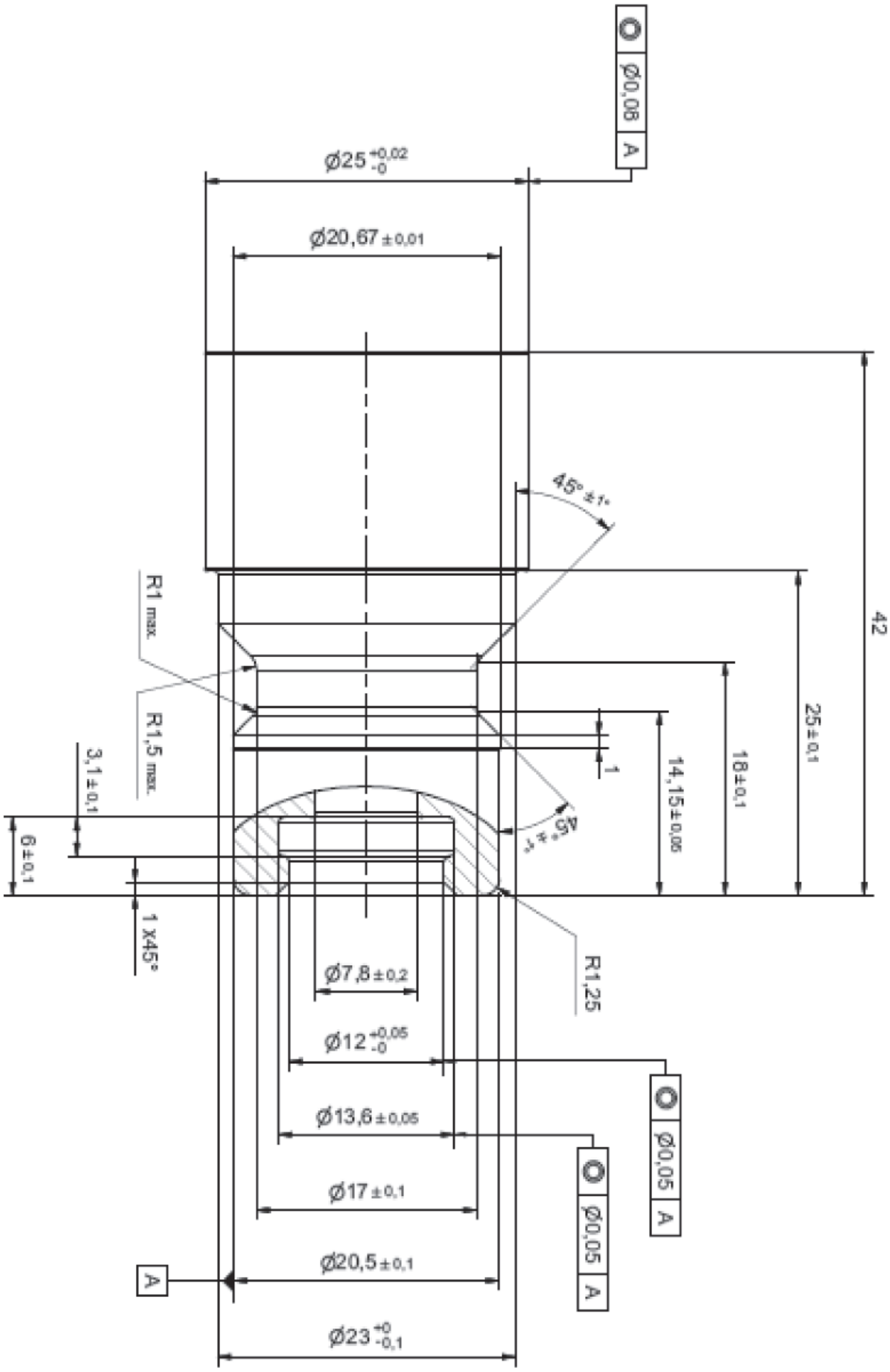
The outlet of the test fixture receptacle shall be plugged using a suitable leak-proof device. The PTPC shall be attached to the receptacle and tightened, using manufacturer's maximum specified force or torque.

The assembly shall be exposed to salt spray for 1 000 h as specified in ISO 9227.

Upon completion, the assembly shall be cleaned of all external salt deposits. Without loosening the PTPC, the assembly shall comply with 10.18.1. The force or torque required to remove the PTPC shall not cause the loosening of the receptacle or the receptacle housing body.

10.18.6 Hydrostatic strength

A PTPC/receptacle test fixture assembly shall be hydrostatically tested without a check valve. Sufficient force or torque shall be applied to prevent leakage. The PTPC's outlet openings and/or venting feature shall be plugged and/or restricted to prevent leakage. A pressure of 2,5 times the working pressure shall be applied for a minimum of 3 min without rupture.

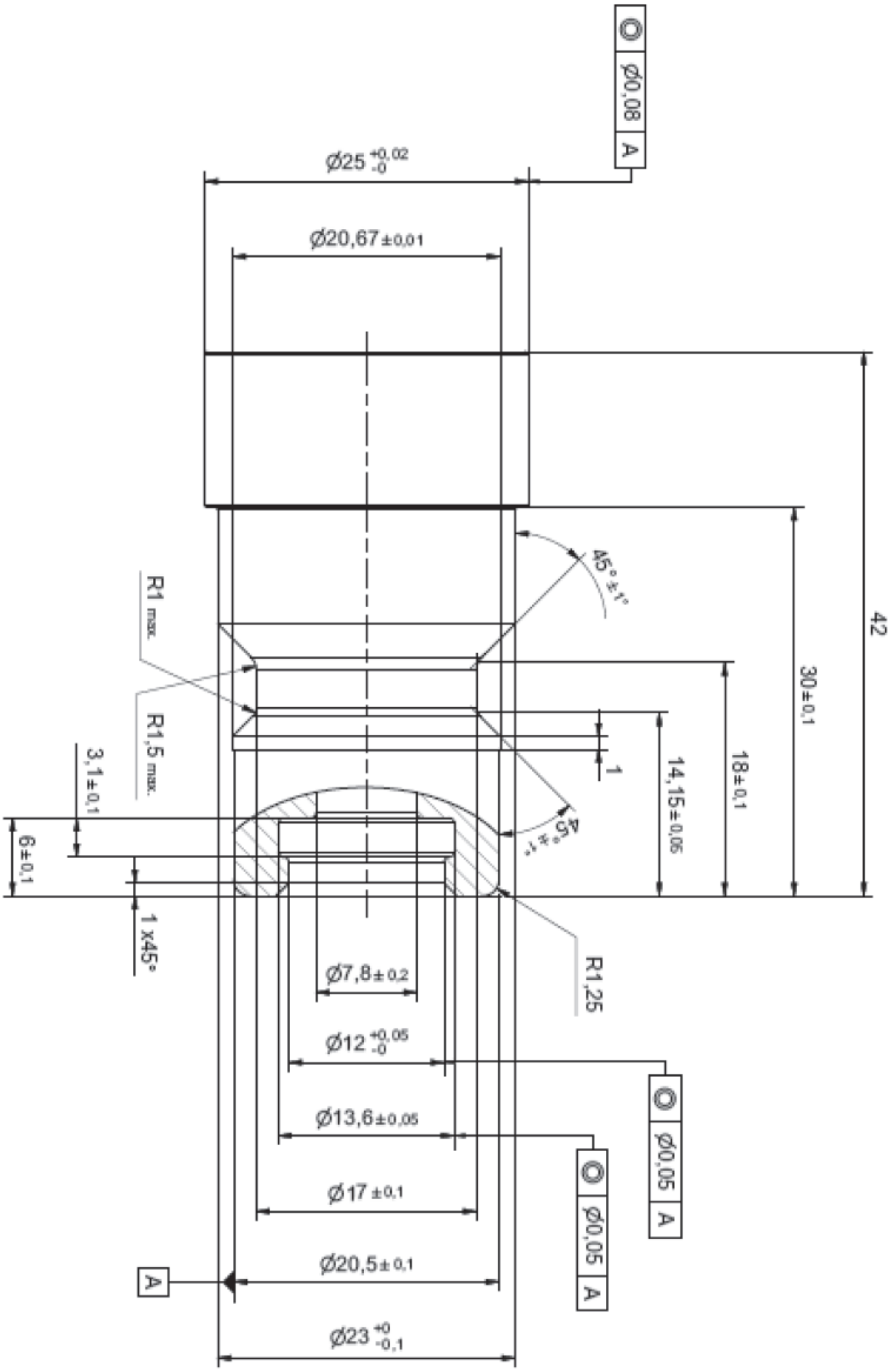


Key

material hardness 75 Rockwell B (HRB 75) min

surface roughness ≤ *Ra* 3,2 µm

Figure 8 — M200 — Worn receptacle test fixture



Key

material hardness 75 Rockwell B (HRB 75) min

surface roughness ≤ *Ra* 3,2 μm

Figure 9 — M250 — Worn receptacle test fixture

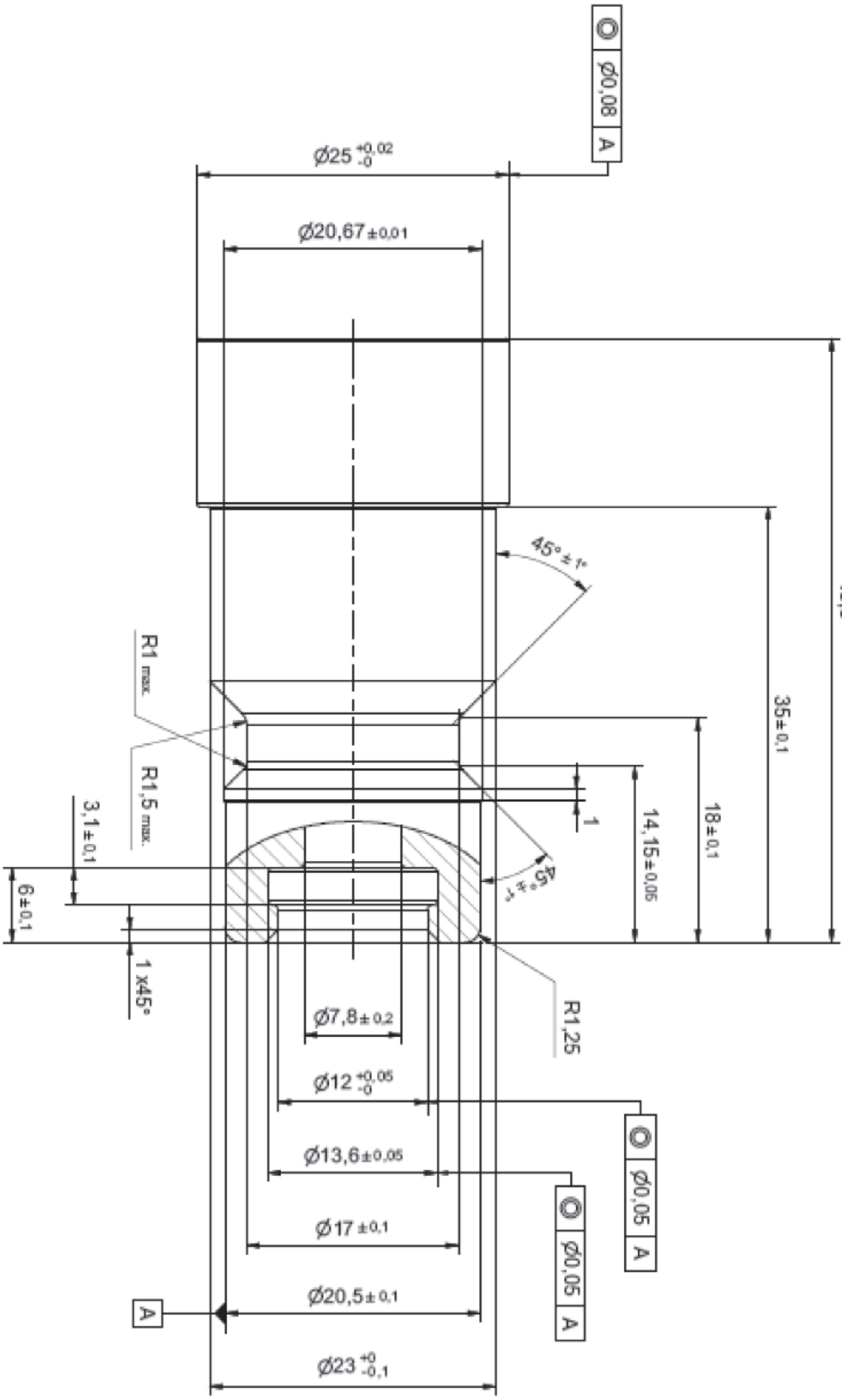
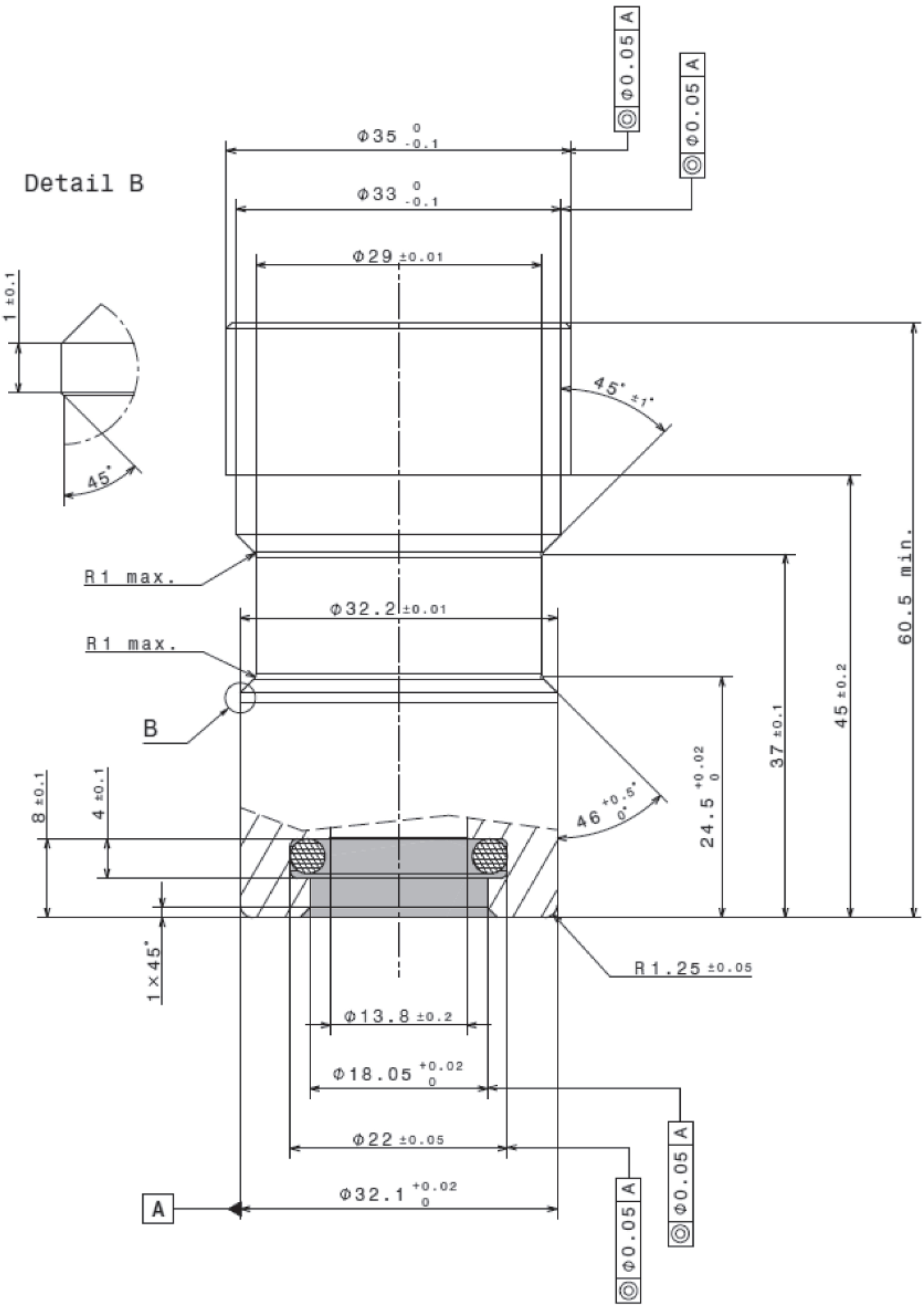


Figure 10 — M350 — Worn receptacle test fixture

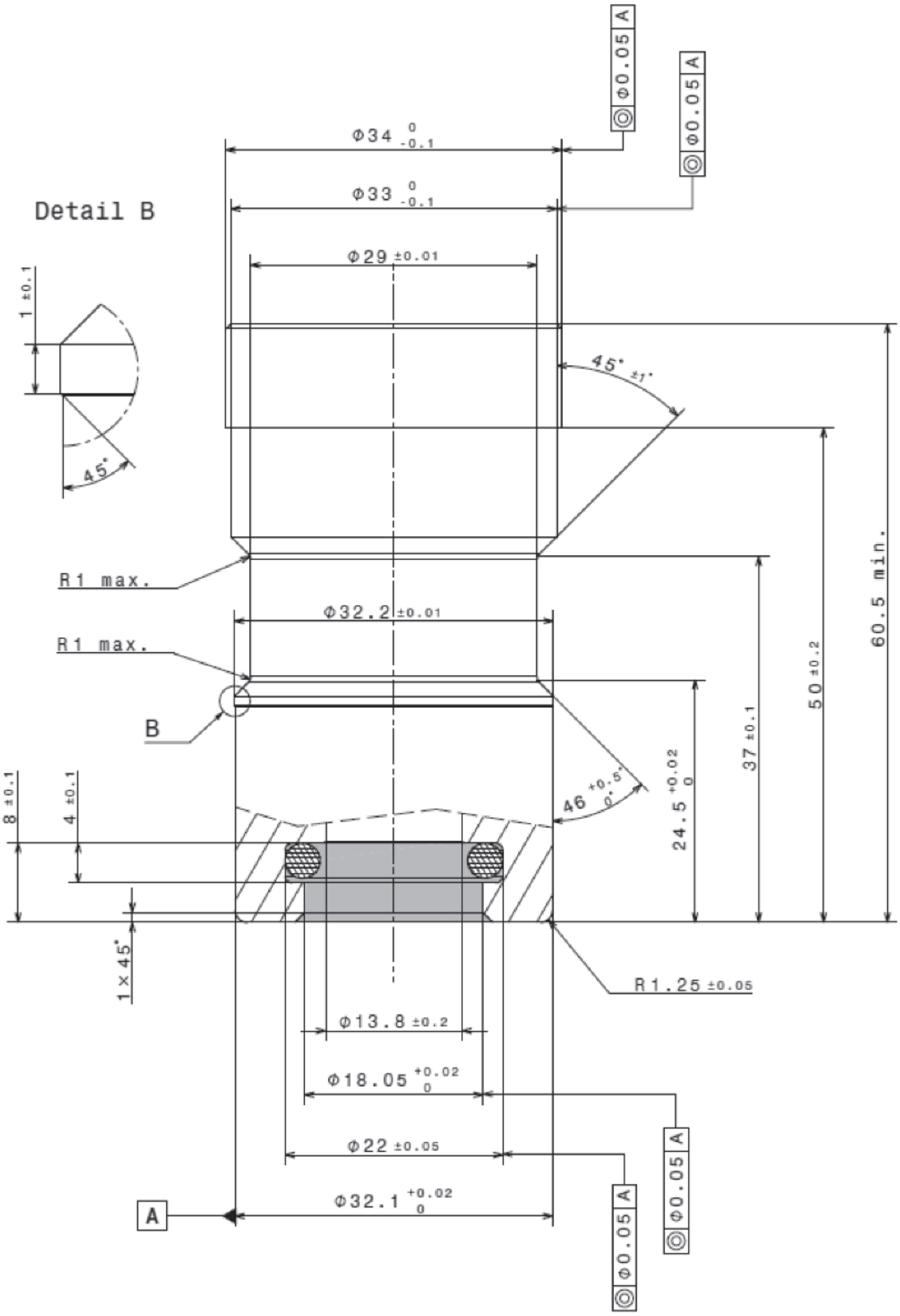


Key

material hardness 75 Rockwell B (HRB 75) min

surface roughness ≤ *Ra* 3,2 µm

Figure 11 — N200 — Worn receptacle test fixture



Key

material hardness 75 Rockwell B (HRB 75) min

surface roughness ≤ *Ra* 3,2 µm

Figure 12 — N250 — Worn receptacle test fixture

Annex A
(informative)

Table of nozzle characteristics

Table A.1 — Table of nozzle characteristics

Characteristics	Nozzle type		
	1	2	3
Tamper resistance	X	X	X
No catching parts (clothing)	X	X	X
Redundant interlock	X	—	—
Safe venting	X	—	—
Integral valve	X	—	—

Annex B
(informative)

Manufacturing and production test plan

B.1 Acceptance of the manufacturing and production plan

The manufacturer shall submit a plan to the certifying agency. The plan shall be mutually acceptable to the manufacturer and the agency. It shall describe the programs and test fixtures specified in C.1, C.2, and C.3. It shall also list which records the manufacturer shall keep and maintain.

B.2 Qualification

The manufacturer shall use a program to qualify raw materials, parts, assemblies, and purchased components and provide traceability of all components (manufactured or purchased) used in the production of compressed natural gas vehicle (compressed blended fuels) refuelling connectors.

B.3 Leakage test

The manufacturer shall test each device covered by this International Standard for leakage at room temperature.

B.4 Additional tests

Using a sampling plan, completely assembled refuelling connectors shall be subjected to the following tests:

a) disconnect / locking feature;

b) strength tests including hydrostatic, deformation and impact resistance;

c) leakage at low and high temperatures;

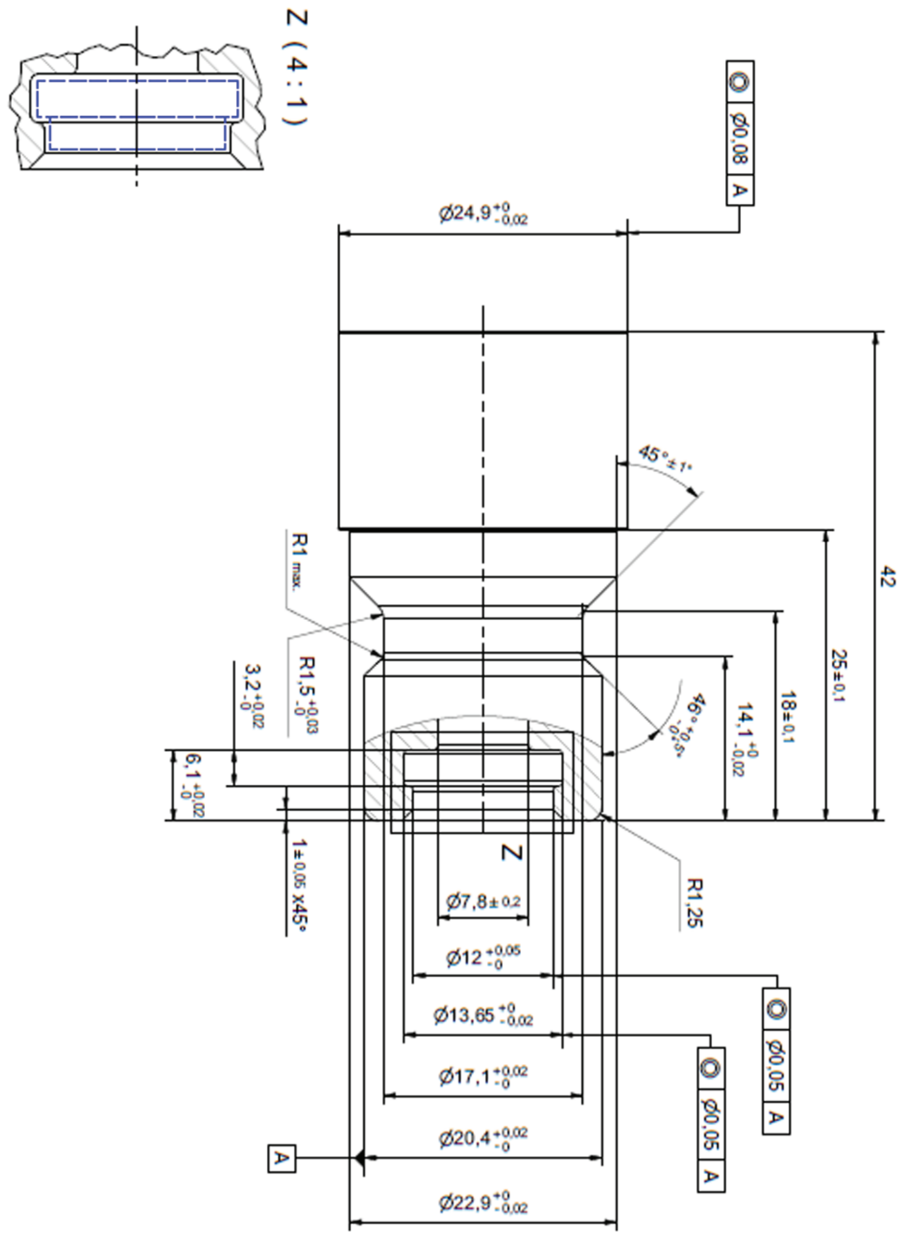
d) durability.

B.5 Evaluation

The manufacturer's test method(s) shall be capable of relating back to the test(s) specified in this International Standard.

Annex C
(informative)

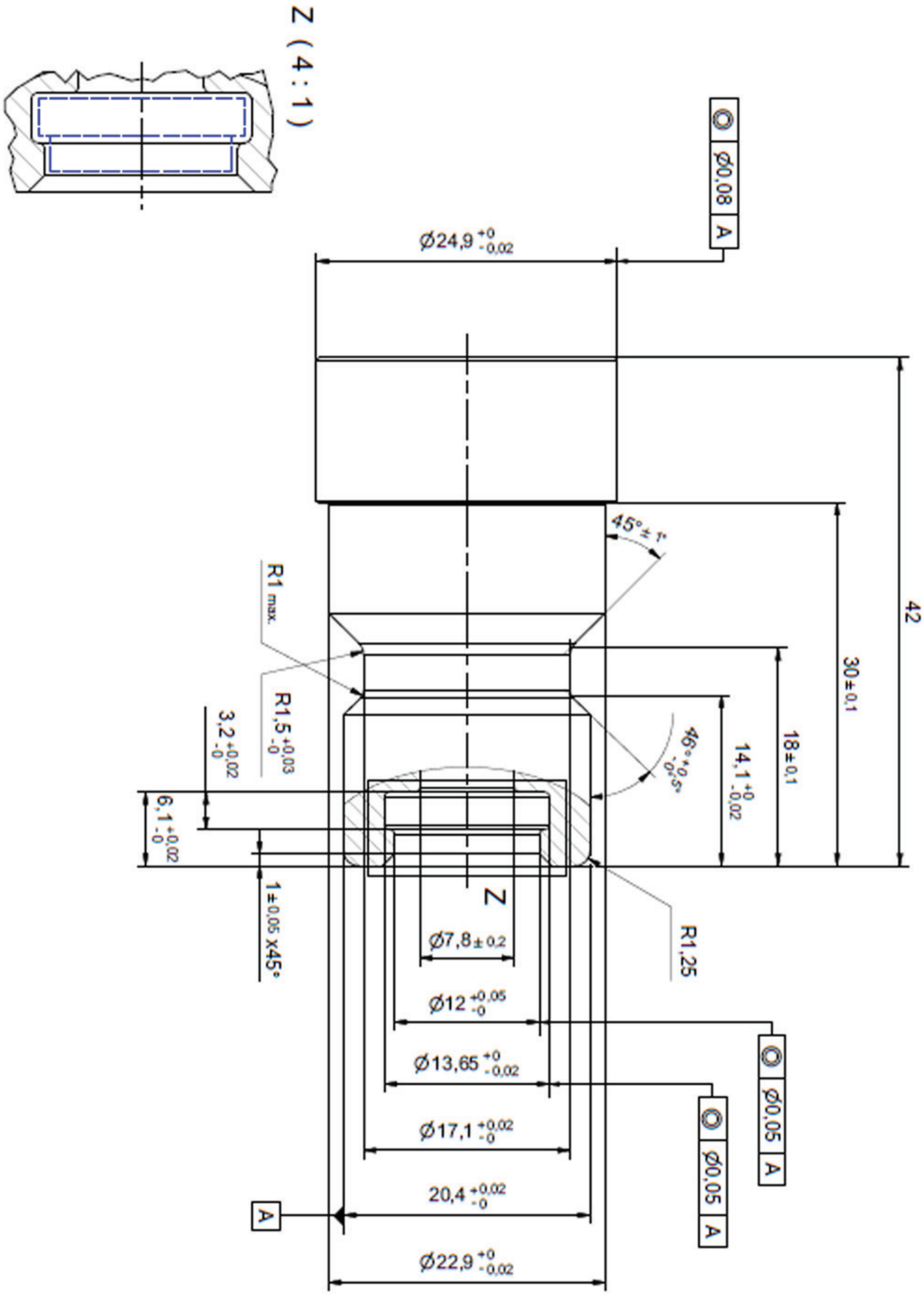
Receptacle test fixture



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

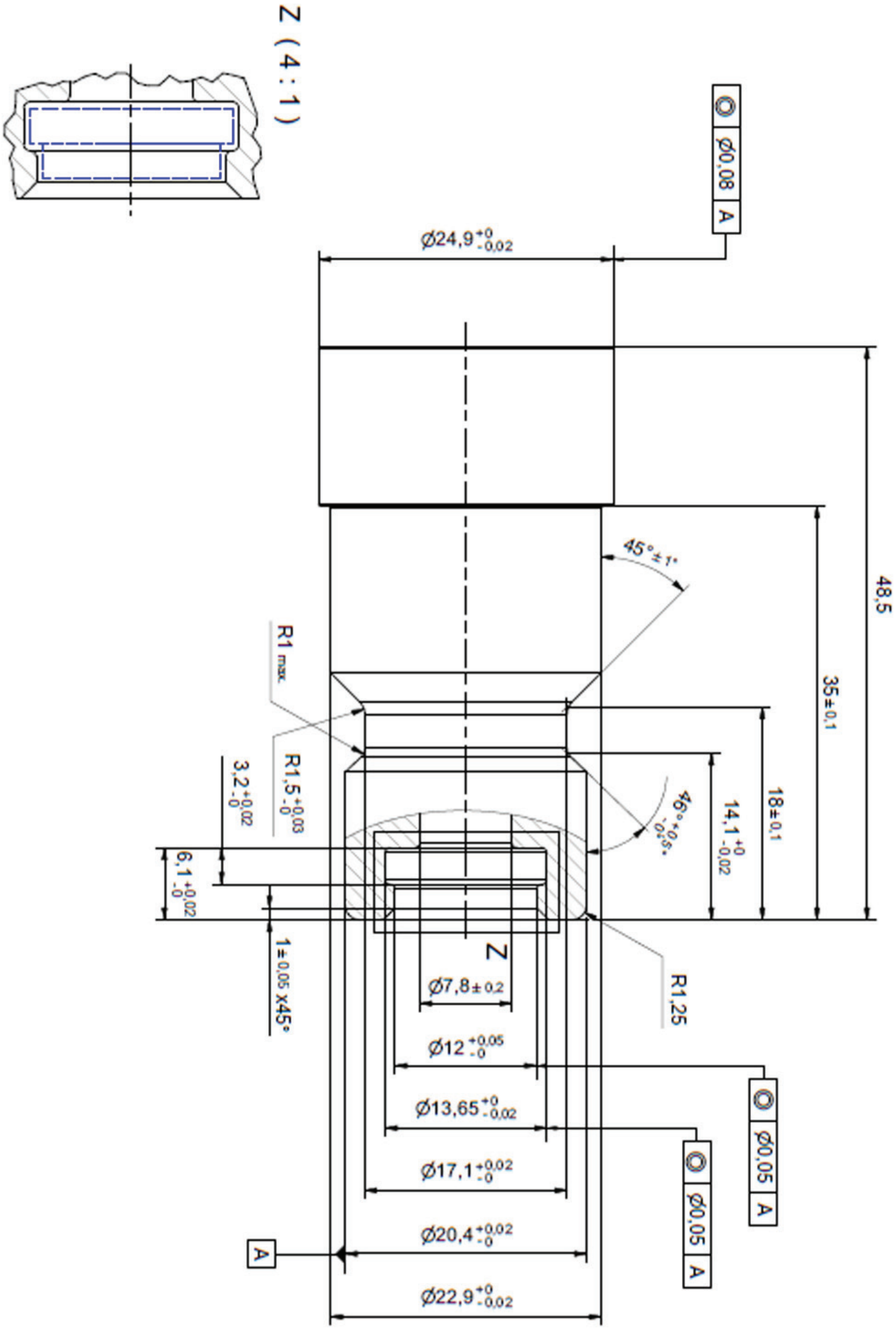
Figure C.1 — M200 — "Loose fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

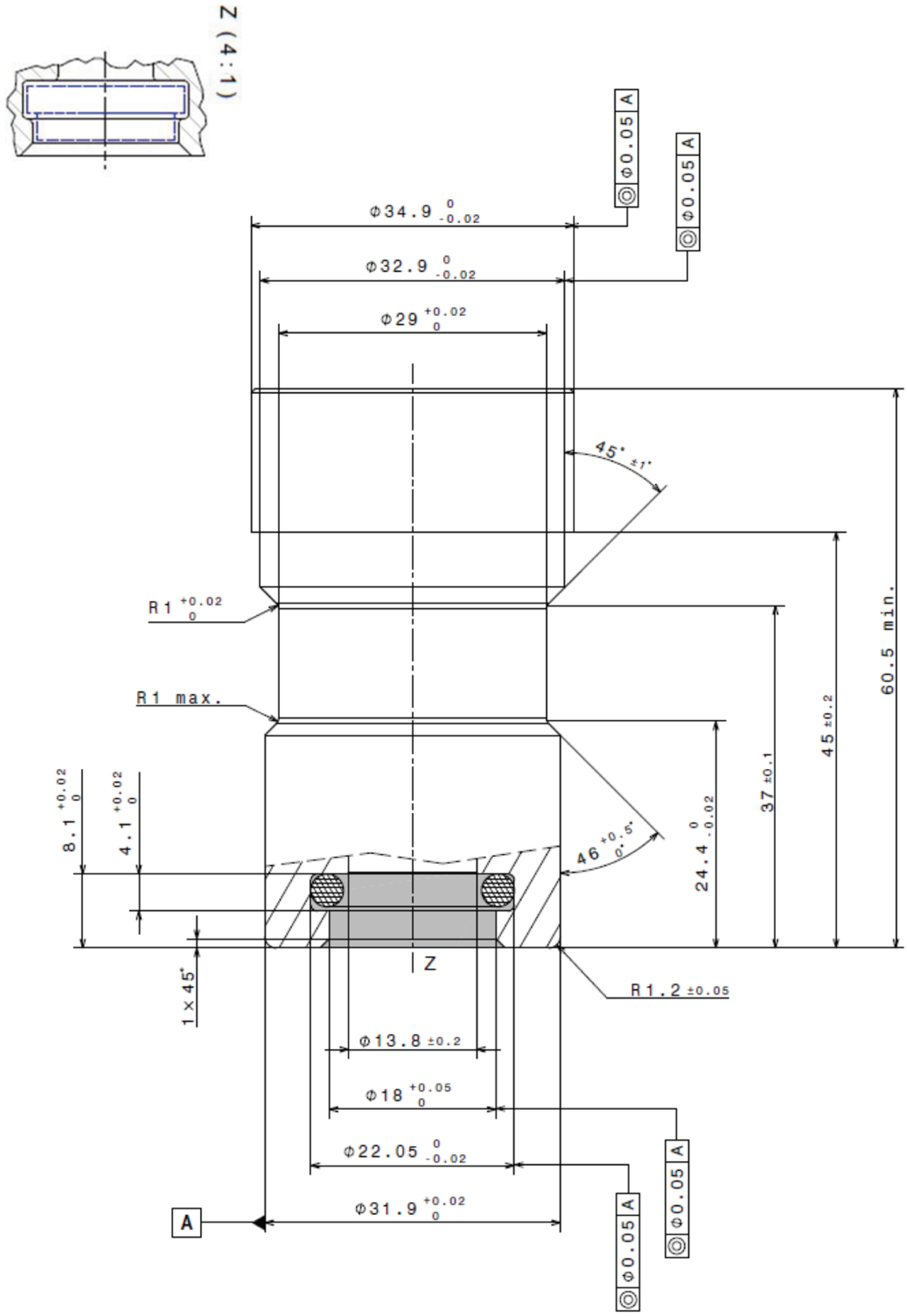
Figure C.2 — M250 — "Loose fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

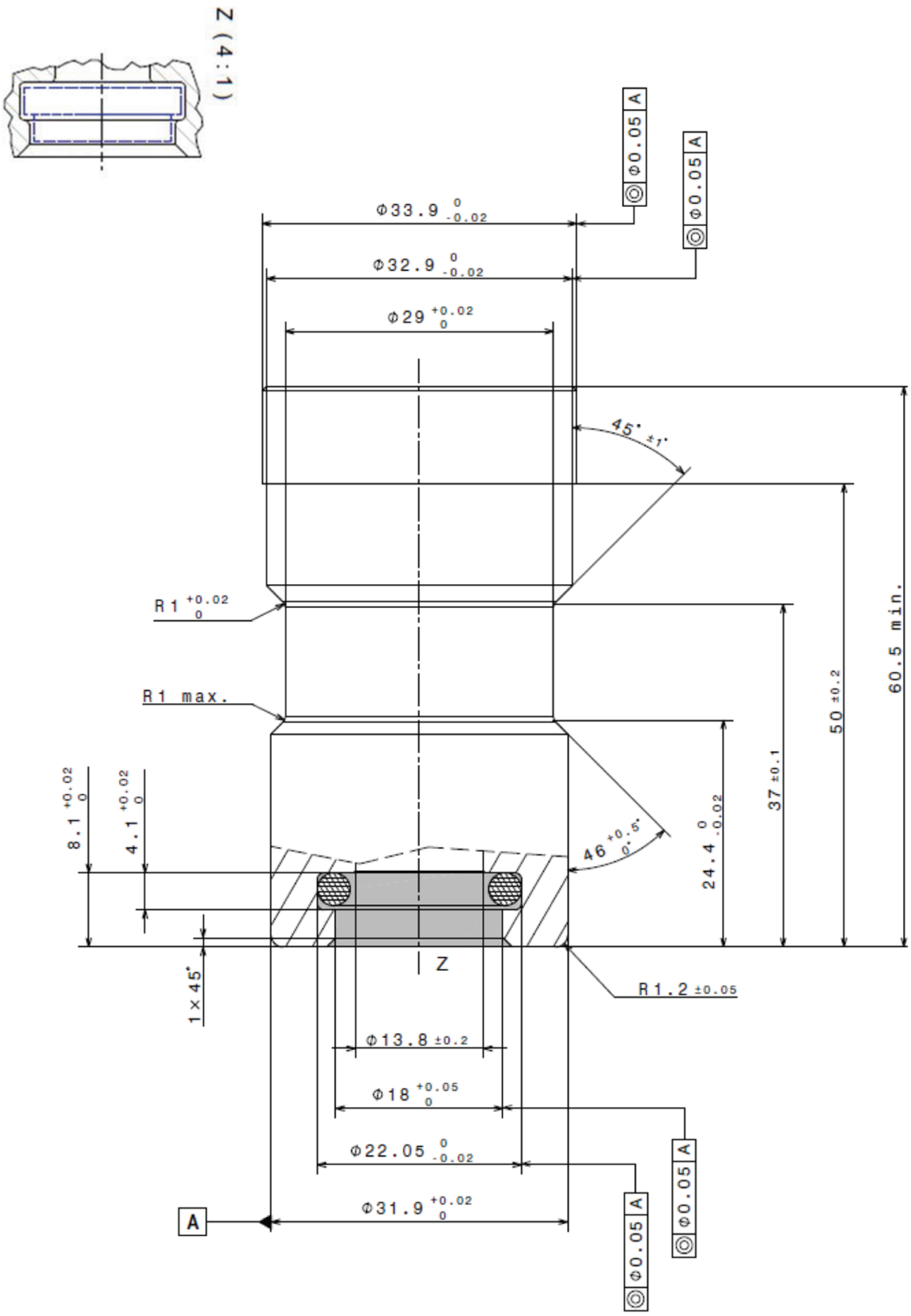
Figure C.3 — M350 — “Loose fit” tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

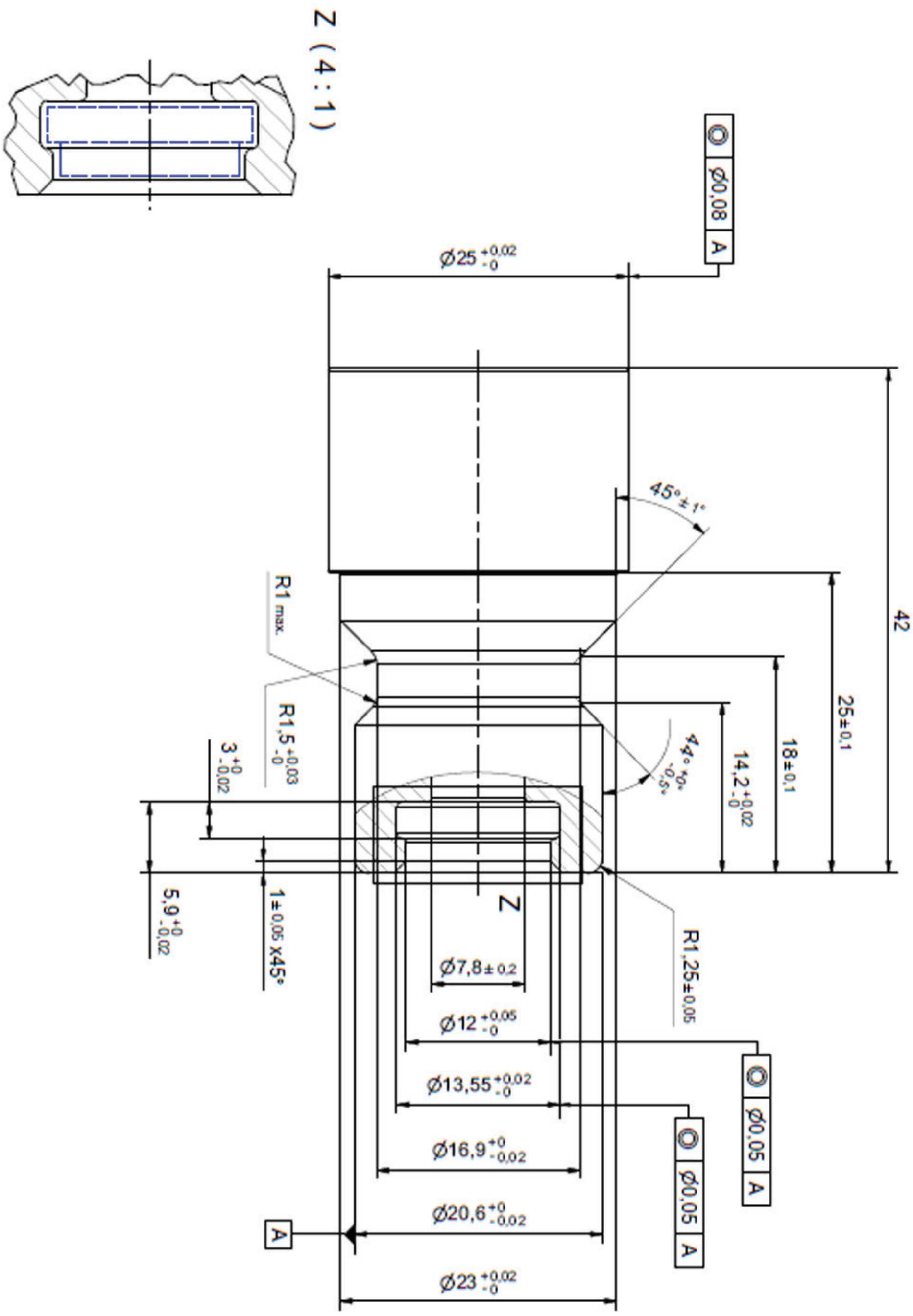
Figure C.4 — N200 — "Loose fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

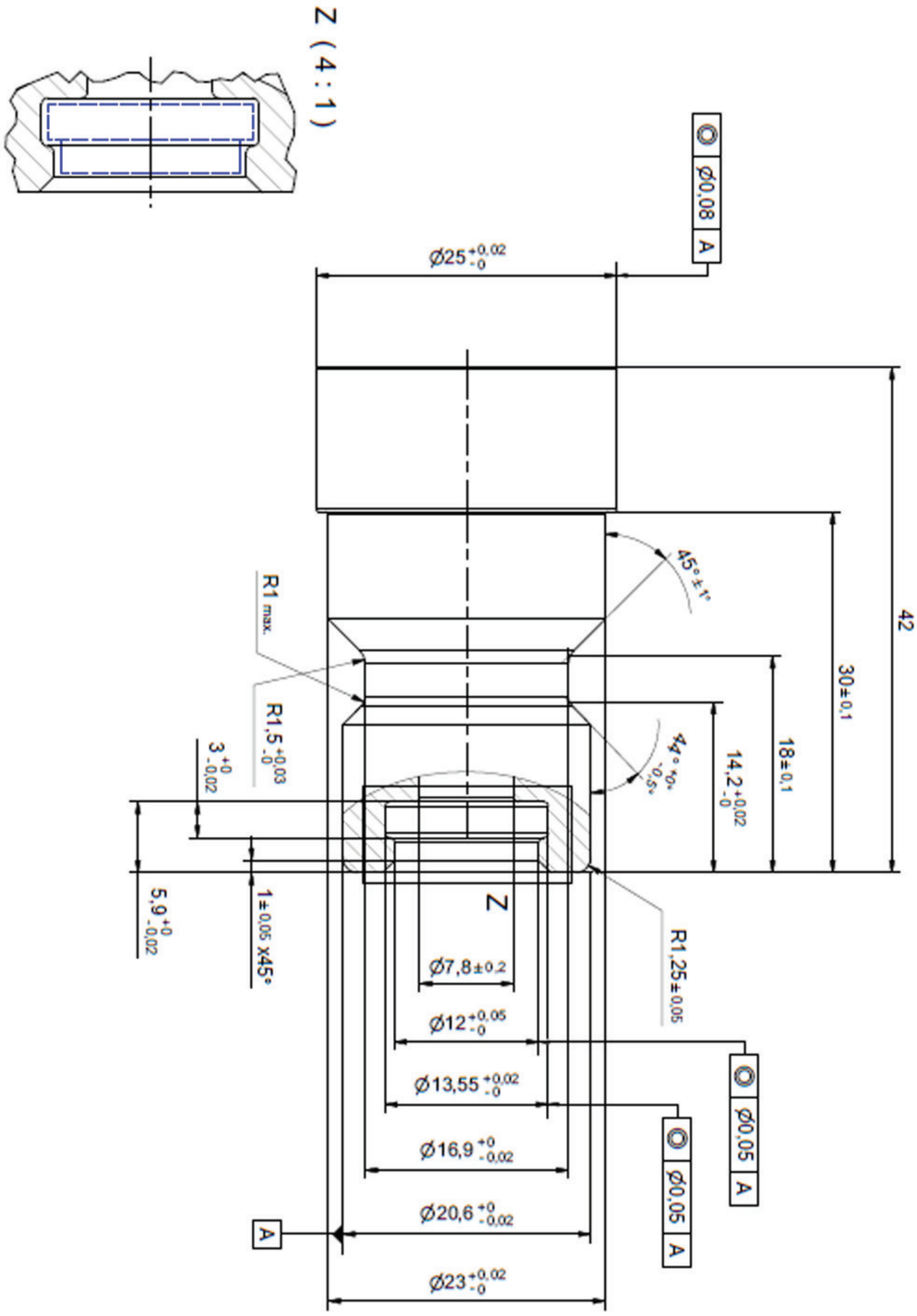
Figure C.5 — N250 — "Loose fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

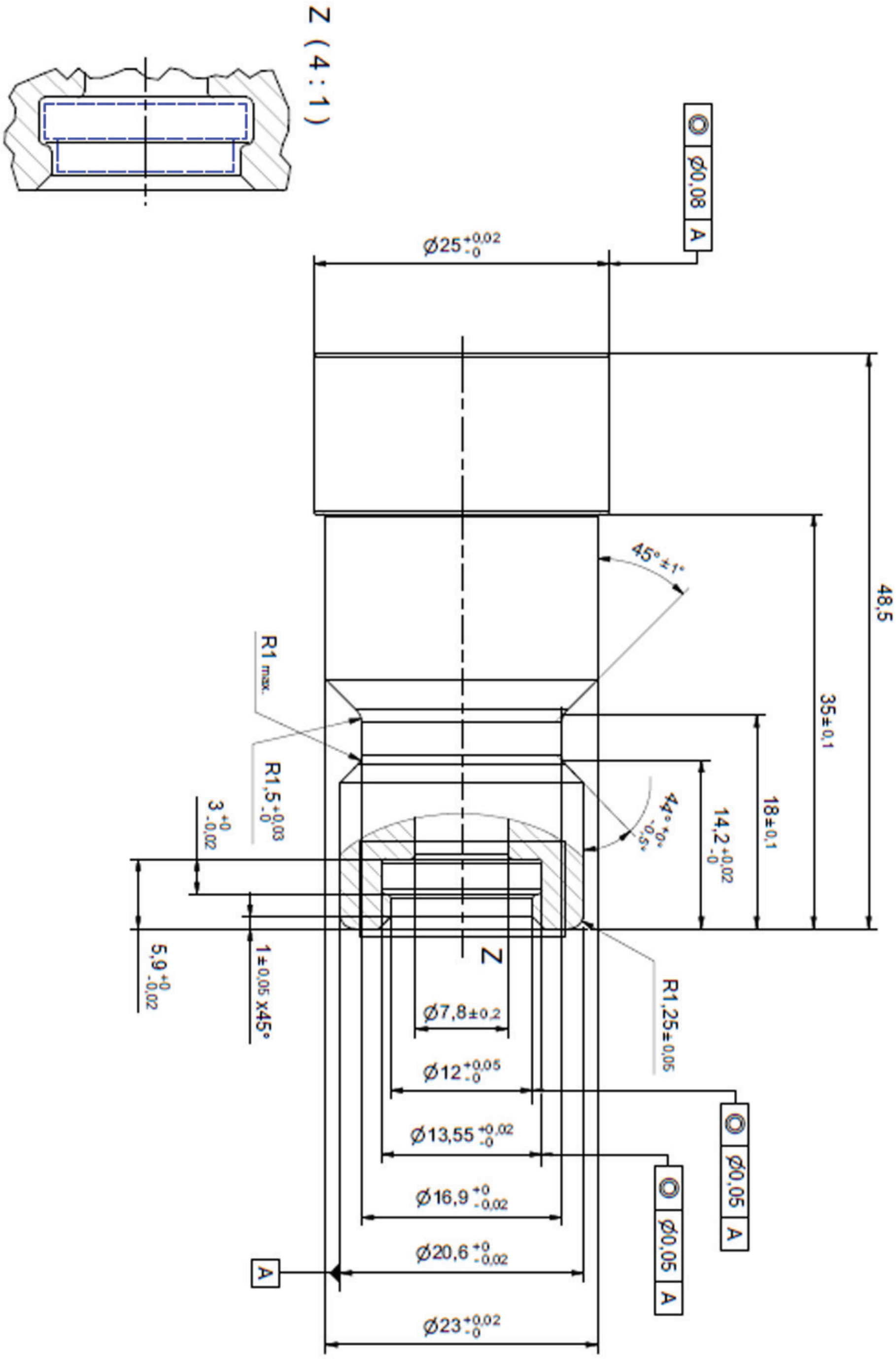
Figure C.6 — M200 — "Tight fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

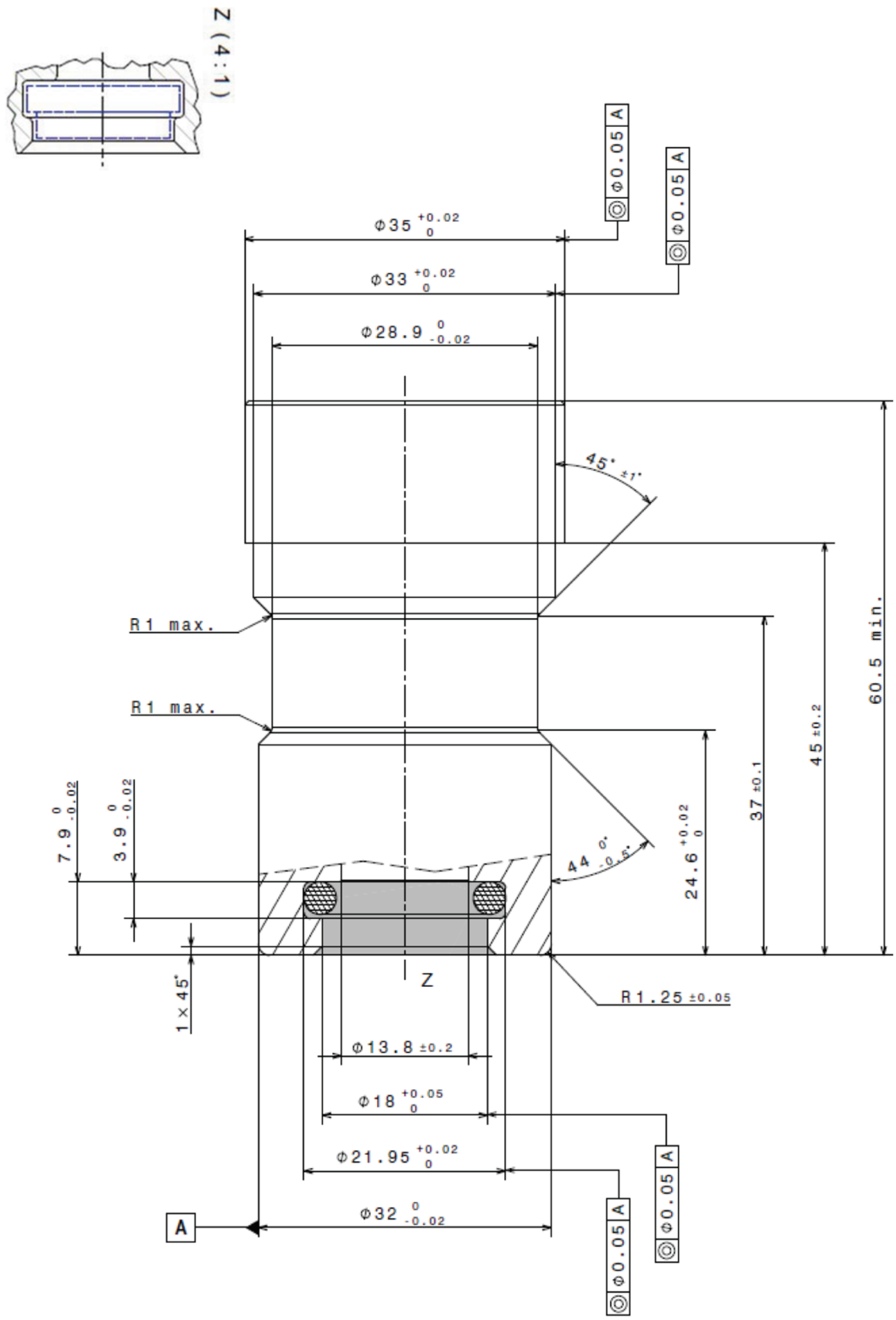
Figure C.7 — M250 — "Tight fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 μm to 0,05 μm
surface roughness	≤ *Ra* 3,2 μm

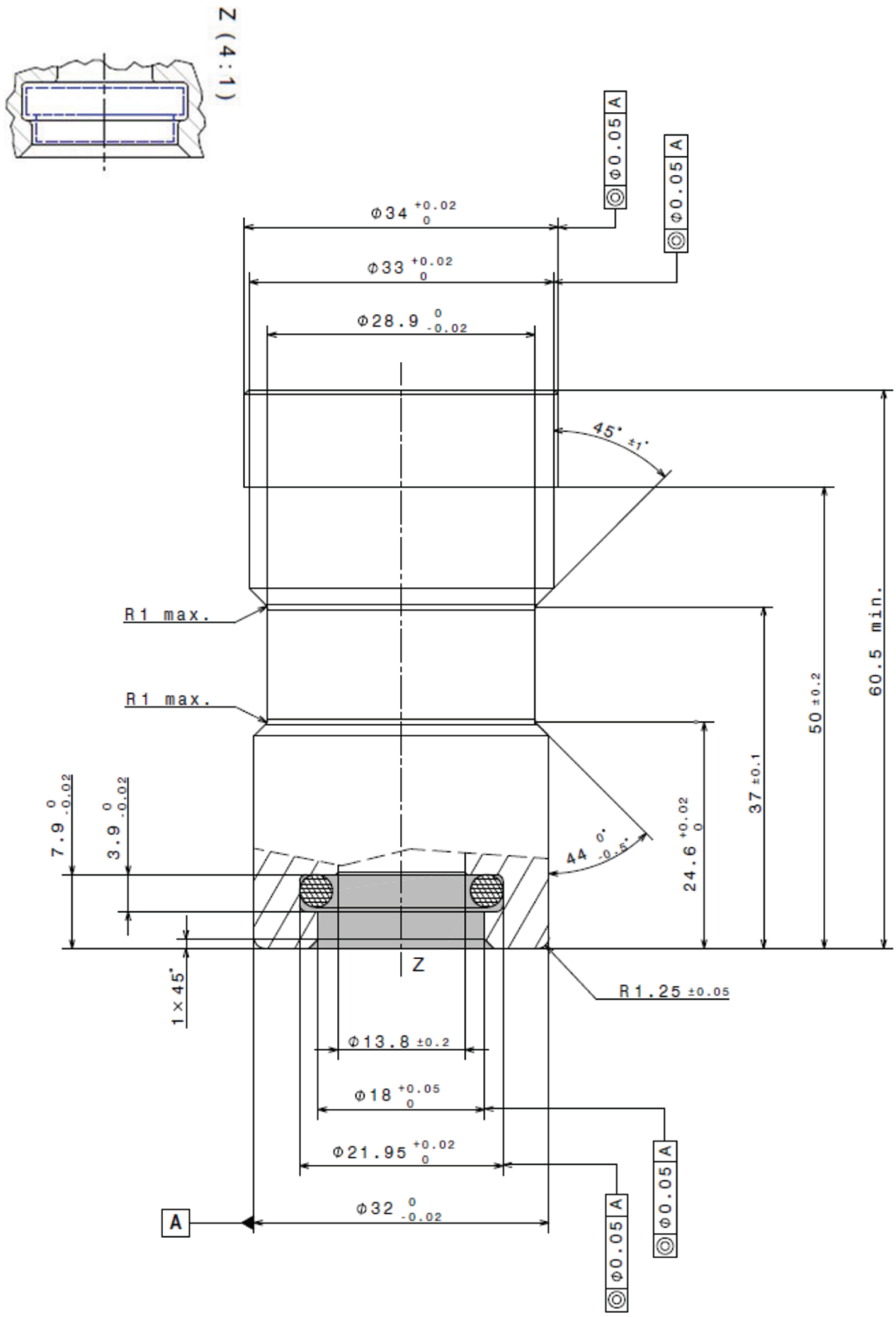
Figure C.8 — M350 — "Tight fit" tolerances



Key

material	CA360 brass
in area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
surface roughness	≤ *Ra* 3,2 µm

Figure C.9 — N200 — "Tight fit" tolerances



Key

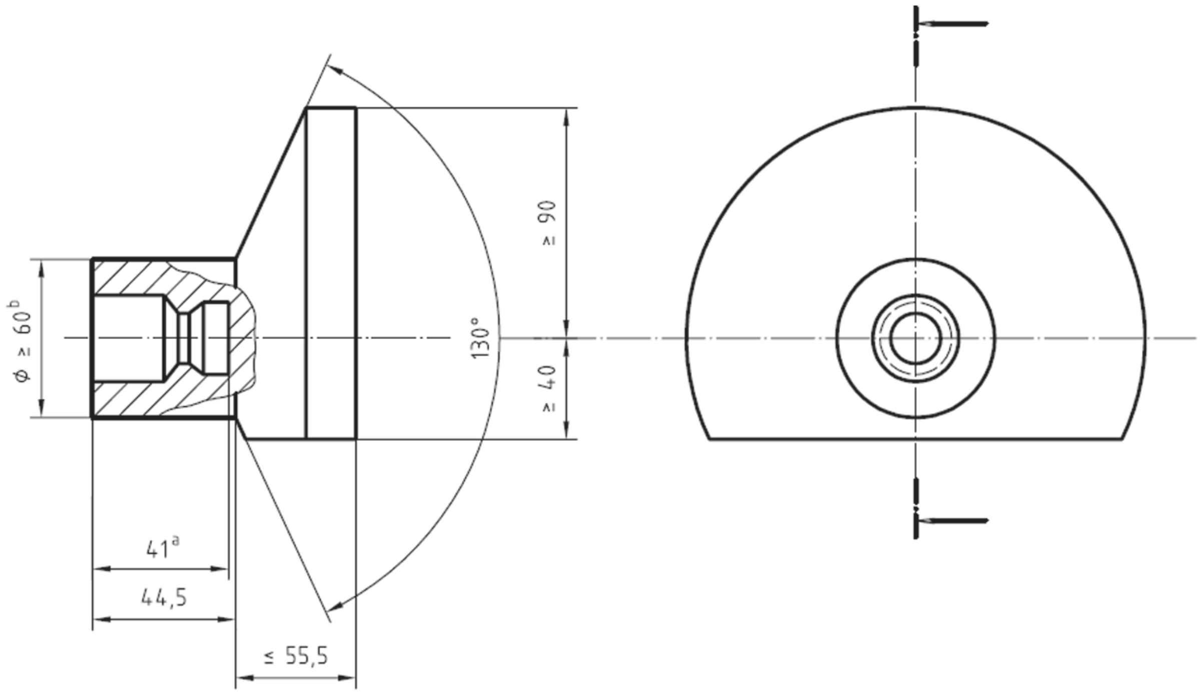
Material	CA360 brass
In area of detail X,	surface roughness *Ra* shall be 0,8 µm to 0,05 µm
Surface roughness	≤ *Ra* 3,2 µm

Figure C.10 — N250 — "Tight fit" tolerances

Annex D
(informative)

Nozzle clearance dimensions

The nozzle should match the clearance dimension around the receptacle accordingly to Figure D1.



Key

a Minimum length of the receptacle clear of provision for attachment of receptacle or protective cap.

b For minimum coupling clearance only. System designers should ensure that the dust- or pressure-tight cap operates freely in the provided space.

Figure D.1 — Receptacle/nozzle interface envelope

NOTE Depending on the vehicle design, the overall depth of the refuelling cavity need not be as large as is indicated here.

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