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New Zealand Standard

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Standards New Zealand

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Committee representation

This standard was prepared by the P3652 Hydrogen Standards Committee. Membership of the committee was approved by the New Zealand Standards Approval Board and appointed by the New Zealand Standards Executive under the Standards and Accreditation Act 2015.

The committee consisted of representatives of the following nominating organisations:

Coregas

Energy Resources Aotearoa

Fabrum

Fonterra Co-operative Group

Gas Appliance Industry

GasNZ

GNS

Hiringa Energy

HW Richardson Group

HyPotential

Methanex

New Zealand Hydrogen Council

PEC

WorkSafe New Zealand − Energy Safety

Z Energy

Acknowledgement

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DZ 17268:2024
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New Zealand Standard

Gaseous hydrogen land vehicle refuelling connection devices

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Preface

The government has a legislated 2050 target of net zero greenhouse gas (GHG) emissions, other than from biogenic methane, and a target under the Paris Agreement to reduce net GHG emissions to 50 per cent below gross 2005 levels by 2030.

Hydrogen is set to play a key role in meeting these targets. (New Zealand has considerable renewable energy resources which could be harnessed to sustainably produce hydrogen for use as a next-generation green fuel source and industrial feedstock.)

To enable the safe integration and novel use of hydrogen in all its forms across New Zealand's energy landscape, a suite of hydrogen-related equipment standards is being adopted.

This standard defines the design, safety, and operation characteristics of gaseous hydrogen land vehicle (GHLV) refuelling connectors. GHLV refuelling connectors consist of the following components, as applicable:

(a) Receptacle and protective cap (mounted on vehicle);
(b) Nozzle;
(c) Communication hardware.

This document is applicable to refuelling connectors which have nominal working pressures or hydrogen service levels up to 70 MPa. It is not applicable to refuelling connectors dispensing blends of hydrogen with natural gas.

This standard was prepared by the P3652 Hydrogen Standards Committee and is identical to and has been reproduced from ISO 17268:2020 *Gaseous hydrogen land vehicle refuelling connection devices*.

As this standard is reproduced from an international standard, the following applies:

(d) In the source text, 'this International Standard' should read 'this New Zealand standard';
(e) A full point substitutes for a comma when referring to a decimal marker.

The terms 'normative' and 'informative' have been used in this standard to define the application of the appendix or annex to which they apply. A 'normative' appendix or annex is an integral part of a standard whereas an 'informative' appendix or annex is for information and guidance.

INTERNATIONAL STANDARD

ISO 17268

Third edition
2020-02

Gaseous hydrogen land vehicle refuelling connection devices

Dispositifs de raccordement pour le ravitaillement des véhicules terrestres en hydrogène gazeux

Reference number
ISO 17268:2020(E)

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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 197, *Hydrogen technologies*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 268, *Cryogenic vessels and specific hydrogen technologies applications*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 17268:2012), which has been technically revised.

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

— Clause 1, Clause 2, 3.1, 4.9. 5.8, 5.9, 5.17, 6.1, 6.9, 7.2, 7.5, 7.7, 7.8, 7.12.2, 7.12.3, 7.12.4, 7.16, 7.22, 7.25, 7.26, 7.27, 7.28, Clause 9, Table 1, Figure 3, Figure 4, Annex A, Annex B, Annex C, Annex D, Annex E and Annex F have been modified.

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.

Gaseous hydrogen land vehicle refuelling connection devices

1 Scope

This document defines the design, safety and operation characteristics of gaseous hydrogen land vehicle (GHLV) refuelling connectors.

GHLV refuelling connectors consist of the following components, as applicable:

— receptacle and protective cap (mounted on vehicle);

— nozzle;

— communication hardware.

This document is applicable to refuelling connectors which have nominal working pressures or hydrogen service levels up to 70 MPa.

This document is not applicable to refuelling connectors dispensing blends of hydrogen with natural gas.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

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

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

ISO 12103-1, *Road vehicles — Test contaminants for filter evaluation — Part 1: Arizona test dust*

ISO 15501-1, *Road vehicles — Compressed natural gas (CNG) fuel systems — Part 1: Safety requirements*

3 Terms and definitions

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

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

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

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

3.1
communication hardware
infrared data association (IrDA) components which are used to transmit signals from the vehicle (*receptacle*) (3.15) to the dispenser (*nozzle*) (3.11) and designed to meet SAE J2799 or equivalent

3.2
component pressure rating
maximum pressure at which it is permissible to operate a component as specified by the manufacturer at a specified temperature

Note 1 to entry: Components designed to the maximum allowable pressure per the European Pressure Equipment Directive (PED) represent the component ratings by the manufacturer that is indicated by the value of "PS."

Note 2 to entry: See Table 1 for required component pressure ratings for various *pressure classes* (3.13) of fuelling *connectors* (3.3).

Note 3 to entry: Further guidance on dispenser pressure terminology is included in ISO 19880-1.

Table 1 — Dispensing system pressure levels and refuelling connector ratings

***NWP* (3.10) of vehicle (*receptacle*) (3.15) or *HSL* (3.7) of dispenser (*nozzle*) (3.11)**	***Pressure class* (3.13)**	***Maximum operating pressure (MOP)* (3.9)**	**Minimum dispenser component pressure rating (PS)**
Equal to NWP of the vehicle storage system per vehicle label		*1,25 × HSL/1,25 × NWP* *Highest fill pressure during normal fuelling*	*1,375 × HSL* *Highest permissible set-point for dispenser pressure protection in ISO 19880-1:—*, 8.2.2.3
11 MPa	H11	13,75 MPa	15,125 MPa
25 MPa	H25	31,25 MPa	34,375 MPa
35 MPa	H35 or H35HF[a]	43,75 MPa	48,125 MPa
70 MPa	H70	87,5 MPa	96,25MPa

[a] High-flow connectors for heavy-duty commercial vehicles.

3.3
connector
joined assembly of *nozzle* (3.11) and *receptacle* (3.15) which permits the transfer of hydrogen

3.4
cycle
process of making a positive connection between the *nozzle* (3.11) and the *receptacle* (3.15), pressurizing to the *maximum operating pressure* (3.9), depressurizing and disconnecting

3.5
dry helium
helium with a dew point adequate to prevent condensation during testing and at least 99 % pure

3.6
dry hydrogen
hydrogen which meets or exceeds the quality level in ISO 14687-2

3.7
hydrogen service level
HSL
pressure level used to characterize the hydrogen service of the dispenser based on the *NWP* (3.10) rating of the vehicle

Note 1 to entry: The numerical value of HSL also matches the number after the "H" in the *pressure class* (3.13).

Note 2 to entry: HSL is expressed in MPa.

3.8
leak test gas
gas for testing leaks that consists of *dry hydrogen* (3.6), or *dry helium* (3.5), or blends of a minimum 10 % of hydrogen or helium with nitrogen

3.9
maximum operating pressure
MOP
highest pressure that is expected for a component or system during normal operation

Note 1 to entry: Further guidance on dispenser pressure terminology is included in ISO 19880-1.

Note 2 to entry: The maximum operating pressure is 125 % of the *nominal working pressure* (3.10) or *hydrogen service level* (3.7), as applicable, for the purpose of testing of *nozzles* (3.11) and *receptacles* (3.15) in this document.

3.10
nominal working pressure
NWP
pressure of a full vehicle compressed hydrogen storage system at a gas temperature of 15 °C

Note 1 to entry: See ECE/TRANS/180/Add. 13 Global Technical Regulation No. 13 clause II-3.37.

Note 2 to entry: See Table 1 for NWPs covered in this document.

Note 3 to entry: Further guidance on pressure terminology is included in ISO 19880-1.

Note 4 to entry: NWP is also known as “settled pressure” in ISO 10286.

3.11
nozzle
device connected to a fuel dispensing system, which permits the quick connect and disconnect of fuel supply to the vehicle or storage system

3.12
positive locking device
device with the feature which requires actuation of an interlocking mechanism to achieve proper connection of the *nozzle* (3.11) to the *receptacle* (3.15) before pressure is applied

3.13
pressure class
non-dimensional rating of components that indicates the components are designed to dispense hydrogen to road vehicles at the required pressure and temperature

Note 1 to entry: See Table 1 for pressure classes of fuelling *connectors* (3.3).

Note 2 to entry: Further guidance on dispenser pressure terminology is included in ISO 19880-1.

3.14
protective cap
means to prevent dirt and other contaminants from getting into the inlet of the vehicle *receptacle* (3.15)

3.15
receptacle
device connected to a vehicle or storage system which receives the *nozzle* (3.11)

Note 1 to entry: This can also be referred to as a fuelling inlet of gas filling port in other documents.

4 General construction requirements

4.1 Nozzles and receptacles shall be designed in accordance with reasonable concepts of safety, durability and maintainability.

4.2 Nozzles and receptacles designed and tested in accordance with this document shall

a) prevent hydrogen fuelled vehicles from being filled by fuelling stations with working pressures and/or flow rates higher than the design values specified for the vehicle;

b) prevent hydrogen fuelled vehicles from being filled by other compressed gas fuelling stations, for example, natural gas and hydrogen-natural gas blends; and

c) prevent other gaseous fuelled vehicles from being filled by hydrogen fuelling stations.

4.3 Nozzles and receptacles shall be well fitted and manufactured in accordance with good engineering practice.

4.4 Nozzles and receptacles shall be

a) designed to minimise the possibility of incorrect assembly;

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

c) constructed to maintain operational integrity under normal and reasonable conditions of handling and usage; and

d) designed with no self-evident means of defeating the safety features.

4.5 Nozzles and receptacles shall be manufactured of materials suitable and compatible for use with compressed hydrogen at the pressure and the temperature ranges to which they will be subjected as specified in 3.2, 5.8 and 6.9. Materials used in the construction of nozzles, receptacles and protective caps shall be non-sparking or spark-reducing. All pressure bearing and wetted components shall also be made from material that is compatible with deionised water. Non-metallic material compatibility shall be documented by the component manufacturer or an independent third party.

4.6 The nozzle shall be connected to or disconnected from the receptacle without the use of tools.

4.7 The H11 and H25 receptacles shall be mounted on the vehicle in compliance with ISO 15501-1. All other receptacles shall be mounted on the vehicle in compliance with the envelope requirements specified in Annex A.

4.8 Protective caps are intended to protect the receptacle from foreign debris and shall not hold pressure. Resistance shall be appropriate to prevent inadvertent dislodging. All protective caps shall have a retainer to attach them to the receptacle or vehicle.

4.9 Communications hardware which is supplied by the manufacturer and permanently integrated into the nozzle shall be attached to the nozzle and subjected to all of the nozzle tests. The communications hardware shall operate correctly upon completion of the all type and quality testing.

4.10 Nozzles and receptacles defined in this document can be used to fuel different types of GHLVs. The refuelling stations for these vehicles may have significantly different process limits and refuelling protocols. The nozzle and receptacle alone may not ensure that a GHLV cannot refuel at an incompatible station. If this occurs, the GHLV may be exposed to conditions outside of its intended limits, such as fuel container overheating. If this is a potential problem, the user and station manufacturer should develop additional controls to mitigate this risk.

4.11 As stated in ECE/TRANS/180/Add. 13 Global Technical Regulation No. 13 (Global technical regulation on hydrogen and fuel cell vehicles — 19 July 2013), “Assurance of capability to sustain multiple occurrences of over-pressurization due to fuelling station failure is provided by the requirement to demonstrate absence of leak in 10 exposures to 150 per cent NWP fuelling.” It is presupposed that nozzles and receptacles defined in this document are tested in this way to accommodate similar fuelling station over-pressurization occurrences.

5 Nozzles

5.1 Nozzles shall be in accordance with the dimensional requirements of 6.1 to ensure proper interchangeability. Nozzles shall couple with receptacles of equal or higher nominal working pressures and they shall be designed so that they will not couple with receptacles of lower nominal working pressures. The nozzle shall extend to within 1 mm of the stop ring for all nominal working pressures. Nozzles shall be designed so that they will not couple with gaseous fuelled vehicles other than GHLV.

5.2 Nozzles shall be one of the following three types.

a) TYPE A — A nozzle for use with dispensing hoses that may 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 connection is open 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.

b) TYPE B — A nozzle for use with dispensing hoses that may remain fully pressurized at dispenser shutdown. A separate three-way valve connected directly, or indirectly, to the inlet of the nozzle shall be used to safely vent trapped gas prior to nozzle disconnection. The nozzle shall not allow gas to flow until a positive connection has been achieved. Venting shall be achieved prior to disconnection of the nozzle. External three-way valves shall be constructed and marked so as to indicate clearly the open, shut and vent positions.

c) TYPE C — A nozzle for use with dispensing hoses which are depressurized (0,5 MPa and below) at dispenser shutdown. The nozzle shall not allow gas to flow until a positive connection has been achieved. The function of preventing flow may be controlled by the dispenser as long as it is receiving a positive connection signal from the nozzle.

5.3 Nozzles shall be designed for a life of 100 000 cycles with manufacturer specified maintenance. The three-way valve used for actuating Type B nozzles shall meet the same number of cycles as the nozzle (i.e. 100 000 cycles).

5.4 The act of venting, or de-pressurizing, of the connection space between all nozzle types and receptacles shall be performed prior to disconnection. A provision shall be made for the venting or de-pressurizing of all nozzle types to be directed to a safe location.

5.5 The means for attaching the nozzle to the fuel dispensing system hose shall not rely on the joint between the male and female threads for sealing, such as tapered pipe threads.

5.6 The H11 and H25 nozzles shall fit within the envelope described in ISO 15501-1. All other nozzles shall fit within the envelope specified in Annex A.

5.7 Nozzles shall have a means to prevent the ingress of solid matter from upstream sources. For example, the requirement shall be deemed met if the nozzle has a filter upstream of adequate size to protect its functionality.

5.8 The nozzle shall be designed to operate at ambient temperatures ranging from −40 °C to 65 °C and at hydrogen gas temperatures ranging from −40 °C to 85 °C.

5.9 The nozzle shall be designed so that it does not freeze on the receptacle for more than 30 s after fuelling.

5.10 The nozzle shall not have any mechanical means of opening the receptacle check valve.

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

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

5.13 It shall not be possible to remove a nozzle when the contained pressure is greater than 1,0 MPa.

5.14 Upon disconnection, all types of nozzles shall stop the flow of gas. No hazardous condition shall result from disconnection.

5.15 Unpressurized nozzles shall require an axial force to connect and lock or unlock and disconnect the device of less than or equal to 90 N. On a secondary positive locking device which incorporates a rotary locking mechanism, the torque to lock or unlock the locking means shall not exceed 1 N·m. On a secondary positive locking device which incorporates an axial locking mechanism, the force to lock or unlock the locking means shall not exceed 90 N.

5.16 Pressurized Type A and B nozzles shall be capable of being disconnected with forces less than 450 N and torques less than 5 N·m.

5.17 Communication hardware which is supplied with the nozzle by the manufacturer shall be attached to the nozzle and subjected to the following design verification tests indicated by the corresponding subclause number:

7.6 Dropping

7.8 Valve operating handle

7.10 Abnormal loads

7.11 Low and high temperatures

7.12 Durability and maintainability

7.17 Corrosion resistance

7.18 Deformation

7.19 Contamination

7.20 Thermal cycle

7.21 Pre-cooled hydrogen exposure

7.25 User abuse

7.26 Freezing

If the communication hardware consists of electrical connectors, wires, covers or infrared (IR) filters, it shall be included as part of the tests.

If the IrDA receiver is replaceable in the field then the nozzle may be tested without the IrDA receiver. If the IrDA receiver is integrated into the nozzle or receptacle and cannot be replaced in the field, it shall be integrated into the nozzle during the tests. The IrDA transmitter may be tested without being integrated into a receptacle.

The communication hardware shall be fully operational upon completion of the above design verification tests as demonstrated by 7.28.

6 Receptacles

6.1 Standard receptacle dimensions: A receptacle shall be in accordance with the design specifications detailed in Annex B.

NOTE The main O-ring seal for all pressure ratings less than 70 MPa is situated at the leading edge of the receptacle. For the 70 MPa receptacle, the main O-ring seal is situated in the bore of the receptacle. The 70 MPa receptacle also includes an O-ring at the leading edge of the receptacle to seal with nozzles having pressure ratings less than 70 MPa.

In order to address freezing issues, the contact surface area between the nozzle and the receptacle on the back diameter (25 mm) may be reduced by modifying the shape of the receptacle body in this area. Annex F shows an example hex design which meets this criterion. The receptacle with the reduced contact area shall be in accordance with this document.

6.2 Receptacles shall be in accordance with this document. The failure of any test conducted with the receptacle and nozzle test samples shall constitute a failure of the receptacle design.

6.3 Receptacles shall be designed for a life of 15 000 cycles and 15 years with manufacturer specified maintenance.

6.4 Receptacle designs, which employ means on the back diameter to accommodate mounting, or for mounting accessories or marking purposes, shall not have such means extend beyond the back diameter dimensions of the profile specified in Annex B, as applicable. Acceptable means shall include wrench flats, protective cap anchoring grooves, use of hex stock, undercutting for marking, and threads for protective caps. Such receptacle designs shall not compromise proper nozzle interchangeability.

6.5 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.

6.6 The means for attaching the receptacle to the vehicle fuel system shall not rely on the joint between the male and female threads for sealing, such as tapered pipe threads.

6.7 Receptacles shall be designed so that they are either tolerant of solid contamination or have a means to protect themselves from said contamination to maintain safe functionality. For example, the requirement shall be deemed met if the receptacle has a filter upstream of adequate size to protect the functionality of the check valve. A receptacle shall have a means to prevent the ingress of fluids and foreign matter when disconnected.

6.8 The receptacle shall have provisions to be firmly attached to the vehicle and shall be in accordance with the applicable abnormal load tests specified in 7.10.

6.9 The receptacle shall be designed to operate at hydrogen gas temperatures ranging from −40 °C to 85 °C.

7 Design verification test procedures

7.1 General requirements

Nozzles and receptacles shall meet the requirements of this document.

7.2 Test conditions

Unless otherwise stated

a) tests shall be conducted at 20 °C ± 5 °C;

b) all pressure tests shall be conducted with leak test gas unless otherwise noted;

c) all leak tests shall be conducted with leak test gas;

d) test fluids and devices shall be at equilibrium conditions with the test environment at the beginning of all tests: and

e) unless otherwise specified, the tolerances for testing temperatures and pressures are:

For low temperatures: T^{0}_{-3} °C

For high temperatures: T^{+3}_{0} °C

For pressures: P^{+3}_{0} % of the stated value

7.3 Nozzle tests

Nozzle tests shall be performed with the test fixtures identified under Annex C, Annex D or Annex E, as applicable. If a test fixture identified under Annex C, Annex D or Annex E is not specified, then receptacles specified under Annex B shall be used. 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.

7.4 Receptacle tests

Receptacles shall be evaluated with nozzle(s) which have met the requirements of this document. The failure of any test conducted with the receptacle and nozzle test samples shall constitute a failure of the receptacle design.

7.5 User — Machine interface

This test shall be performed to verify the connection and disconnection forces and torques of an unpressurized and pressurized device.

The testing shall be performed at room temperature with the minimum temperature as specified in 5.8.

The disconnection forces and torques shall be applied in a direction that tends to disconnect and release the nozzle. The torque shall be applied to the disconnection/release actuator or three-way valve. For example, if there is a handle, the torque shall be applied through axis rotation of the nozzle handle equal to the exterior handling surface of the nozzle mechanism and in such a direction that tends to unhook and release the nozzle.

All nozzle types shall be connected to a receptacle using the tight test fixture specified in Annex D. The gas pressure in the assembly shall be less than 0,1 MPa. The force to connect and lock or unlock shall meet the requirements in 5.15 and 5.16.

All nozzle types shall be connected to a receptacle using the loose test fixture specified in Annex C. The gas pressure in the assembly shall be set to 1,0 MPa. It shall not be possible to remove the nozzle from the receptacle.

A Type A or B nozzle shall be connected to a receptacle using the loose test fixture specified in Annex C. The gas pressure in the assembly shall be set to 7,5 MPa, 50 % and 100 % of the hydrogen service level.

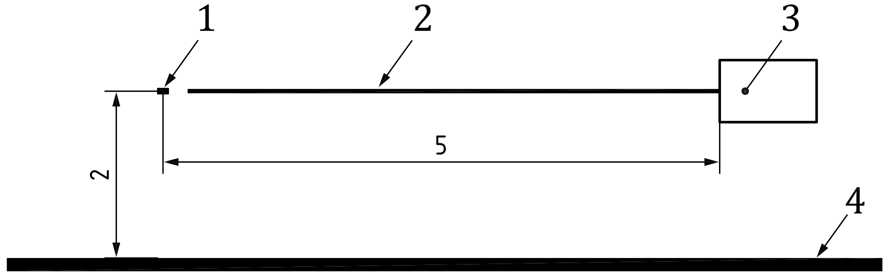
Upon disconnection, all types of nozzles shall stop the flow of gas. No hazardous condition shall result from disconnection.

7.6 Dropping

This test shall be performed to verify that a nozzle can safely withstand a drop of 2 m under −40 °C conditions.

A nozzle conditioned at −40 °C for 24 h shall be connected to a 5 m length of the appropriately rated fuelling hose, and then dropped 2 m onto a concrete floor as shown in Figure 1. The nozzle shall be dropped ten times within 5 min of removal from the conditioning chamber, then pressurized to the maximum operating pressure and subjected to ten additional drops within another 5 min.

Dimensions in metres



Key

1 support

2 11 mm diameter fuelling hose

3 nozzle

4 concrete floor

Figure 1 — Test arrangement for dropping test

Following all drops described previously, the nozzle shall be capable of normal connection to the receptacle. In addition, the nozzle shall meet the requirements of the leakage tests specified in 7.7 and 7.11, as well as the hydrostatic strength test specified in 7.16.

7.7 Leakage at room temperature

These tests shall be performed to verify the leakage rate of nozzle, receptacle, connector and receptacle check valve at room temperature using the loose and tight test fixtures specified in Annexes C and D, respectively.

Tests shall be conducted at 0,5 MPa and 150 % of the nominal working pressure or hydrogen service level, as applicable. All devices shall be checked for leakage from the time of connection, through pressurization, to the time of disconnection.

The pressurized leak test gas shall be applied to the inlet of the connector, the disconnected nozzle and the outlet of the disconnected receptacle, to verify the leakage rate of the nozzle.

To verify the leakage rate of the receptacle check valve, pressurized leak test gas shall be applied to the inlet of the connector. The nozzle shall be quickly disconnected and the receptacle check-valve checked for leakage.

Following the tests described above, the nozzle, receptacle, connector and receptacle check valve shall be bubble free for 1 min. If bubbles are detected, then the leak rate shall be measured by either an external vacuum test using leak test gas (global accumulation test), or an equivalent method to show that the leak rate is less than 20 cm^3/h of hydrogen at 20 °C.

The permitted leakage rate is applicable to tests with 100 % hydrogen only. Permitted leakage rates for other gases or gas mixtures shall be converted to an equivalent leakage rate to that for 100 % hydrogen.

7.8 Valve operating handle

This test shall be performed to verify that nozzles equipped with operating handles can withstand a maximum force without damage.

A 200 N force shall be applied to the valve operating handle at the point furthest away from the axis of rotation in both the opening and closing directions. The test shall be performed with the nozzle properly connected to the loose test fixture specified in Annex C, and with the nozzle intentionally, improperly engaged relative to the receptacle.

Following the tests, the nozzle shall maintain safe operating functionality.

7.9 Receptacle vibration resistance

This test shall be performed to verify receptacle and protective cap resistance to vibration.

The receptacle and protective cap shall be secured in a test apparatus and vibrated at each integer frequency from 5 Hz to 60 Hz for 8 min at each frequency. The amplitude of the vibration shall be at least 1,5 mm from 5 Hz to 20 Hz, 1,2 mm from 20 Hz to 40 Hz, and 1 mm from 40 Hz to 60 Hz. The tests shall be conducted once in the axial direction, and again in the radial direction.

Following the tests, there shall be no visible damage to the receptacle and protective caps. The receptacle shall meet the requirements of all the receptacle leakage tests specified in 7.7 and 7.11, as well as the hydrostatic strength test specified in 7.16.

7.10 Abnormal loads

This test shall be performed to verify that the nozzle and receptacle can withstand abnormal loads in service.

The connected nozzle and receptacle may be subjected to the following abnormal loads in service:

a) pulls along the nozzle or receptacle longitudinal axis;

b) moments applied to the end fitting of the nozzle.

The connected nozzle and receptacle shall be able to withstand abnormal loads of a = 1 000 N, b = 120 N·m without distortion or damage.

Also, the connected nozzle and receptacle shall be able to withstand abnormal loads of a = 2 000 N; b = 240 N·m without leakage. The moment arm shall be measured from the point of attachment of the receptacle to the vehicle body to the hose inlet of the nozzle.

The nozzle and receptacle test fixture shall be tested in the pressurized and non-pressurized condition. During the pressurized test the nozzle and receptacle test fixture shall be pressurized to maximum operating pressure. The appropriate "loose fit" test fixture (see Annex C) shall be used for this test. 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.

Following the tests, the nozzle and connector shall meet the requirements of the appropriate leakage tests specified in 7.7 and 7.11, as well as the hydrostatic strength test specified in 7.16.

7.11 Low and high temperatures

7.11.1 Purpose

These tests shall be performed to verify leakage rate and operation of nozzle, receptacle and connector at low and high temperatures.

7.11.2 General

Prior to conditioning, the devices shall be purged with nitrogen and then sealed from atmosphere under a pressure of 7 MPa leak test gas. 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.

7.11.3 Leakage tests

7.11.3.1 Fuelling connection devices shall be leak tested in accordance with the test conditions listed below after 2 h of conditioning for the components and leak detector (if used):

a) The nozzle and receptacle coupled, conditioned at −40 °C and pressurized at 0,5 MPa and maximum operating pressure.

b) The nozzle and receptacle coupled, conditioned at 50 °C and pressurized at 1 MPa and maximum operating pressure.

c) The receptacle uncoupled, conditioned at −40 °C and pressurized at 0,5 MPa and maximum operating pressure.

d) The receptacle uncoupled, conditioned at 85 °C and pressurized at 1 MPa and maximum operating pressure.

e) The nozzle uncoupled, conditioned at −40 °C and pressurized at 0,5 MPa and maximum operating pressure.

f) The nozzle uncoupled, conditioned at 50 °C and pressurized at 1 MPa and maximum operating pressure.

7.11.3.2 Pressurized leak test gas 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 100 % denatured ethyl alcohol mixture for 1 min; and

b) at 50 °C or 85 °C, immersion in 50 °C or 85 °C water for 1 min.

7.11.3.3 Following the tests, the nozzle, receptacle and connector shall be bubble free for 1 min or have a leak rate less than 20 cm^3/h at 20 °C.

The permitted leakage rate is applicable to tests with 100 % hydrogen only. Permitted leakage rates for other gases or gas mixtures shall be converted to an equivalent leakage rate to that for 100 % hydrogen.

7.11.4 Operation tests

The devices shall function under the following conditions.

a) The nozzle and receptacle connected and disconnected ten times when conditioned at −40 °C and pressurized to maximum operating pressure.

b) The nozzle and receptacle connected and disconnected ten times when conditioned at 85 °C and pressurized to maximum of working pressure.

Following the tests, the devices shall connect and disconnect normally and deliver gas.

7.12 Durability and maintainability

7.12.1 Purpose

These tests shall be performed to verify that the nozzle, receptacle, receptacle check valve and connector can withstand durability cycling.

7.12.2 Nozzle durability test

During the following tests, all devices shall be maintained according to the manufacturer's instructions.

Requirements for maintenance at less cycles than specified by the manufacturer shall be considered not in accordance with this document.

The nozzle shall be capable of withstanding 100 000 cycles. For the purpose of this test, one cycle of operation for Type A, B and C nozzles shall consist of the following:

a) properly connecting the nozzle to the receptacle test fixture;

b) pressurizing the connector to maximum operating pressure using leak test gas;

c) depressurizing the connector;

d) disconnecting the nozzle.

While disconnected the test fixture shall be rotated relative to the nozzle at random or equal degree increments throughout this test.

The receptacle test fixture shall be replaced at 15 000 cycle intervals as specified in Table 2 below.

Table 2 — Test fixture selection for nozzle durability tests

Number of cycles	Figure	Geometry
0 to 15 000	Annex D	Tight fit
15 001 to 30 000	Annex D	Tight fit
30 001 to 45 000	Annex C	Loose fit
45 001 to 60 000	Annex C	Loose fit
60 001 to 75 000	Annex D	Tight fit
75 001 to 90 000	Annex D	Tight fit
90 001 to 100 000	Annex C	Loose fit

Following 100 000 cycles of operation, the nozzle shall be subjected to 10 pressure cycles to 150 % of the hydrogen service level using the appropriate receptacle from Annex B.

After the 10 additional pressure cycles are complete, the nozzle locking mechanism shall be checked at the normal disconnect pressure to ensure it is properly engaged on the receptacle.

The nozzle shall then meet the requirements of 7.5, 7.7, 7.11 (−40 °C conditions only) and 7.15. The nozzle shall meet the requirements of 7.7 when tested with the appropriate simulated wear pattern test fixture shown in Annex E, as applicable.

After 15 000 cycles, the worn receptacle test fixtures shall not be in excess of wear patterns shown in Annex E as applicable and shall meet the requirements of 7.7.

7.12.3 Receptacle check valve durability test

The receptacle check valve shall be capable of withstanding 15 000 operational cycles. For the purposes of this test, one cycle of operation shall consist of the following:

a) properly connecting the receptacle to the nozzle test fixture;

b) pressurizing the connector to the hydrogen service level in 12 pulses using leak test gas;

c) depressurizing the connector by first venting the upstream side of the receptacle check valve and then lowering the pressure on the downstream side of the receptacle check valve to between 0 and a maximum of 0,5 MPa prior to the next cycle.

Following 15 000 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.

Following the test, the receptacle check valve shall meet the requirements of the leakage tests specified in 7.7, 7.11 (−40 °C conditions only) and 7.15.

7.12.4 Receptacle durability test

The receptacle shall be capable of withstanding 15 000 operational cycles. For the purposes of this test, one cycle of operation shall consist of the following:

a) properly connecting the receptacle to the nozzle;

b) pressurizing the connector to the maximum operating pressure using leak test gas;

c) holding the maximum operating pressure for 30 s, minimum;

d) depressurizing the nozzle;

e) disconnecting the nozzle;

f) depressurizing the receptacle.

Following 15 000 cycles of operation, the receptacle shall be subjected to 10 pressure cycles to 150 % of the nominal working pressure.

Following the successful completion of the tests, the receptacle shall then meet the requirements of the leakage tests specified in 7.7, 7.11 (−40 °C conditions only) and 7.15.

7.12.5 Connected nozzle and receptacle durability test

A nozzle test fixture or a receptacle test fixture, as applicable, shall be connected to the device under test. The outlet of the receptacle shall be open to atmospheric pressure. The supply port of the nozzle shall be connected to a supply system which will supply sufficient leak test gas as required below.

Each nozzle and receptacle shall be cycled for 30 cycles. Each cycle shall consist of a total of the full flow of gas with the supply pressure starting at the hydrogen service level. A cycle shall be 2 s in length and the supply pressure shall not fall below 80 % hydrogen service level at the end of each cycle. The test supply system shall not limit the flow during this test.

Following the tests, the connected nozzle and receptacle shall then meet the requirements of the leakage tests specified in 7.7.

7.13 Sealing material aging test

7.13.1 Purpose

These tests shall be performed to verify sealing material resistance to aging.

7.13.2 Oxygen aging test procedure

Sealing materials shall be listed and rated by the manufacturer as being resistant to oxygen aging. Samples of synthetic material parts shall be subjected to 96 h of exposure at 70 °C and at 2 MPa. This test shall be conducted in accordance with ISO 188.

Following the tests, synthetic material parts of fuelling connection devices shall not crack or show visible evidence of deterioration.

7.13.3 Ozone aging test procedure

Sealing materials exposed to the atmosphere without the continuous presence of internal gas pressure (e.g. receptacle face seal O-ring) shall be listed and rated by the manufacturer as being resistant to ozone aging. Samples of synthetic material parts shall be stressed to 20 % elongation and exposed for a period of 120 h to air at 40 °C with a volume fraction of ozone of $5 \times 10^{-7.}$ This test shall be conducted in accordance with ISO 1431-1.

Following the tests, synthetic material parts of fuelling connection devices shall not crack or show visible evidence of deterioration.

7.14 Non-metallic material hydrogen resistance test

This test shall be performed to verify wetted non-metallic material resistance to hydrogen.

Representative samples of wetted non-metallic material shall be prepared, measured and weighed. The samples shall then be immersed in hydrogen at the nominal working pressure, or hydrogen service level, as applicable, for 168 h at 20 °C ± 5 °C. Following this time period, the test pressure shall be reduced to atmospheric pressure in less time than the seals would have to depressurize in actual service, not to exceed 1 s.

Following the tests, the test samples shall not exhibit evidence of explosive decompression damage. In addition, the samples shall not swell more than 25 %, shrink more than 1 % and incur a weight loss in excess of 10 %.

7.15 Electrical resistance

This test shall be performed to verify the electrical resistance of the connector.

The electrical resistance of the connector shall be measured.

The electrical resistance of the connected receptacle and nozzle shall not be greater than 1 000 Ω either in the pressurized or unpressurized state.

7.16 Hydrostatic strength

These tests shall be performed to verify the hydrostatic strength of the nozzle, receptacle and connector using the loose and tight test fixtures specified in Annexes C and D, respectively.

Because the hydrostatic strength test is a terminal test, the test samples shall not be used for any other subsequent testing.

Outlet openings of the uncoupled nozzle, the uncoupled receptacle and the connector shall be plugged and valve seats or internal blocks made to assume the open position. A hydrostatic pressure of 3 times the maximum operating pressure shall be applied to the nozzle, to the receptacle as well as the connector for a period of at least 3 min.

During the test, the uncoupled nozzle, the uncoupled receptacle and the connector shall not leak.

7.17 Corrosion resistance

7.17.1 Purpose

These tests shall be performed to verify nozzle and receptacle resistance to corrosion.

7.17.2 General

New samples shall be used. Protective caps shall be in place. Vent holes in the protective caps shall not be plugged. Process connections may be plugged.

7.17.3 Nozzle test

The nozzle and the receptacle shall be supported in a horizontal position. The nozzle shall be exposed for 96 h to a salt spray as specified in ISO 9227.

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

A pressure of 0,5 MPa of 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 eight-hour test period.

Immediately following the 96 h test the nozzle shall be rinsed and gently cleaned of salt deposits.

The nozzle shall not show evidence of corrosion or loss of protective coatings and shall meet the requirements of the leakage tests specified in 7.7.

7.17.4 Receptacle test

The receptacle shall be supported in a horizontal position and shall be exposed for 1 000 h to a salt spray as specified in ISO 9227. Throughout the test, the temperature within the test chamber shall be maintained between 33 °C and 36 °C. The salt spray solution shall consist of a mass fraction of 5 % sodium chloride and 95 % distilled water.

Immediately following the 1 000 h test, the areas of receptacles protected by the protective caps shall be examined. The receptacle shall then be rinsed and gently cleaned of salt deposits.

The receptacle shall not show evidence of corrosion or loss of protective coatings. The receptacle shall then meet the requirements of the leakage tests specified in 7.7.

7.18 Deformation

This test shall be performed to verify that field connected/assembled parts can withstand a specified installation over-torque.

The nozzle and the receptacle shall be connected and assembled to 150 % of the manufacturer's assembly torque.

While still connected and assembled, the connector shall meet the requirements of the leakage tests specified in 7.7 and the hydrostatic strength test specified in 7.16.

7.19 Contamination test

This test shall be performed to verify that the nozzle and receptacle can withstand contamination.

A tank or vessel shall be filled to a depth of 100 mm ± 5 mm with a solution/suspension having a volume fraction of 5 % salt and sand in accordance with A4 coarse grade test dust of ISO 12103-1, or the equivalent dissolved/suspended in distilled water. The connection end of the nozzle and receptacle shall be dipped into the solution/suspension for 1 s to 5 s and removed. The nozzle and receptacle shall be dipped in a manner that the entire connection area is submerged without touching the bottom.

After dipping both the nozzle and receptacle in the solution/suspension, the receptacle and nozzle shall be connected. The coupled pair shall have leak test gas at the maximum operating pressure blown through for 5 s for 10 consecutive cycles. The nozzle and receptacle shall not be cleaned during the test.

The connector shall be subjected to the leakage test specified in 7.7 after each cycle.

7.20 Thermal cycle test

This test shall be performed to verify that the nozzle and receptacle can withstand thermal cycling.

The nozzle, receptacle, and a connector shall be pressurized to the hydrogen service level. The components shall be subjected to an external temperature of 85 °C within 0,5 h, and soaked at that temperature for 2 h. The components shall then be subjected to an external temperature of −40 °C in less than 1 h and soaked at that temperature for 2 h. Finally, the external temperature shall be returned to 15 °C within 0,5 h to complete the cycle. This cycle shall be repeated 100 times.

The nozzle, receptacle and connector shall meet the requirements of the leakage tests specified in 7.7 and 7.11, as well as the hydrostatic strength test specified in 7.16.

7.21 Pre-cooled hydrogen exposure test

This test shall be performed to verify that the nozzle and receptacle can withstand exposure to pre-cooled hydrogen during fuelling. If the nozzle manufacturer recommends methods to address nozzle freeze-lock, then these methods shall be used for this test.

The connector shall be subjected to pre-cooled hydrogen gas at −40 °C at a flow rate of 30 g/s at 15 °C and 90 % relative humidity for a minimum of 3 min. The nozzle shall be depressurized, then disconnected within 30 s and re-connected to another dry receptacle after a two-minute hold period. This test shall be repeated 10 times.

This test procedure shall be repeated for an additional ten cycles, except that the hold period shall be increased to 15 min.

The nozzle, receptacles and connector shall meet the requirements of the leakage tests specified in 7.7 and 7.11. Failure to disconnect the nozzle within 30 s shall constitute failure of the test.

7.22 Misconnected nozzle test

This test shall be performed to verify that a misconnected Type C nozzle shall not flow gas, leak, or disconnect. A uniform and an asymmetrical load test shall be conducted respectively. The test shall be performed on the following test fixtures (see Table 3):

Table 3 — Misconnected nozzle test configurations

Nozzle	Receptacle fixture			
H35	H35 Nominal	H35 Worn	H70 Nominal	H70 Worn
H70	—	—	H70 Nominal	H70 Worn

The test shall be conducted with all hardware and gases at room temperature. The test fixture may be submerged underwater to detect leaks.

In order to test a uniform load, a series of thin shims of uniform thickness with a 30 mm outside diameter and a 27 mm inside diameter shall be inserted in the space between the nozzle and the stop ring of the receptacle to create a misconnected condition as shown in Figure 2. If it is not possible to manufacture a shim small enough to create a misconnected condition, the receptacle stop ring position shall be adjusted to accommodate the shim (see Figure 3).

In addition, an asymmetrical load test shall be conducted using a series of 90° arc shims with a 30 mm outside diameter and a 27 mm inside diameter. The shims shall be placed in only one arbitrary quadrant.

For both uniform and asymmetrical load tests, the connector shall be subjected to leak test at 10 MPa for 1 min and additional shims shall be continued to be added until the nozzle requires more than 1 000 N to connect or the nozzle does not flow gas.

The nozzle shall not flow gas in the misconnected state.

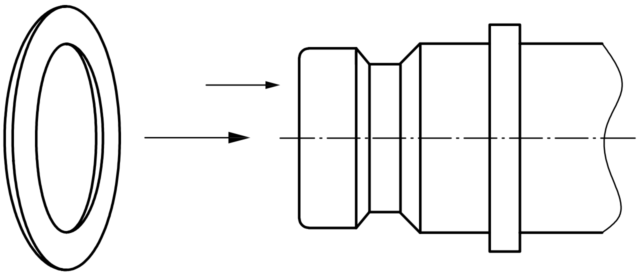
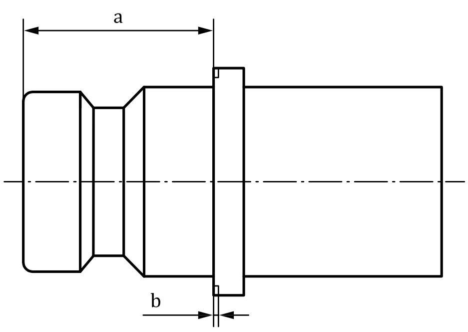


Figure 2 — Use of shims to create a misconnected connector



Key

a 30 mm for 35 MPa and 40 mm for 70 MPa

b adjustment depth

Figure 3 — Adjustment of stop ring position to accommodate a shim

7.23 Upward/downward nozzle compatibility test

7.23.1 General

This test shall be performed to verify that a nozzle shall connect to a receptacle rated to a higher nominal working pressure, and to verify that a nozzle shall not connect to a receptacle rated to a lower nominal working pressure.

7.23.2 Upwards nozzle compatibility test

The nozzle shall be connected to representative receptacles rated to a higher nominal working pressure and pressurized with leak test gas.

The connector shall meet the requirements of the leakage tests specified in 7.7.

7.23.3 Downwards nozzle compatibility test

Attempts shall be made to connect the nozzle to representative receptacles of maximum length tolerance rated to a lower nominal working pressure.

The nozzle shall not connect to representative receptacles rated to a lower nominal working pressure.

7.24 Washout test

This test shall be performed to verify that the main internal O-ring seal of an H70 receptacle does not washout when connected with a nozzle rated to a lower nominal working pressure.

The connector shall be subjected to hydrogen gas at a flow rate of 65 g/s (+2 g/s) and at the maximum operating pressure for a minimum of 10 s. This test shall be repeated 10 times with a delay of at least 5 s between bursts.

The test shall be conducted at temperatures of -40^{+5}_{0} °C and 85^{+5}_{0} °C with the unpressurized connector preconditioned for 30 min at the test temperature.

There shall be no displacement of the internal O-ring seal(s) after the test. The receptacle shall then meet the requirements of the leakage tests specified in 7.7 and 7.11.

7.25 User abuse test

This test shall be performed to verify that the nozzle and receptacle can withstand repeated abnormal loads that may be applied by a user.

The appropriate “loose fit” test fixture (see Annex C) shall be used for this test. 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 nozzle and receptacle test fixture shall be tested in the non-pressurized condition.

Connect the nozzle to the test fixture and suspend a weight of 5 kg to the nozzle to simulate the weight of the fuelling hose. Rotate the nozzle 180° reciprocally for 500 rotations.

Following the test, the nozzle shall be able to be removed from the test fixture, and the nozzle and connector shall meet the requirements of the appropriate leakage tests specified in 7.7 and 7.11.

7.26 Freezing test

This test shall be performed to verify that a nozzle and receptacle do not freeze together for more than 30 s after fuelling.

The test shall be performed with one nozzle and three receptacles (see Figure 4) with the standard dimensions shown in Annex B. If the nozzle manufacturer recommends methods to address nozzle freeze-lock, then these methods shall be used for this test.

a) Throughout the test, the temperature within the test chamber shall be maintained at 30 °C and 95 % relative humidity. The nozzle shall be dried before the test in order to not affect the test results.

b) The nozzle and receptacles with their protective caps attached and accompanying equipment shall be conditioned at 30 °C until they reach an equilibrium temperature. The temperature shall be confirmed by measurement of the surface of the nozzle and receptacles.

c) Connect the nozzle to the first receptacle and simulate the fuelling by passing hydrogen through the interface for 3 min at the following conditions:

   — Gas temperature: -40^{+3}_{0} °C.

   — Gas flow gate: 650 g/min ± 50 g/min.

   The gas temperature shall be measured as close to the nozzle as possible.

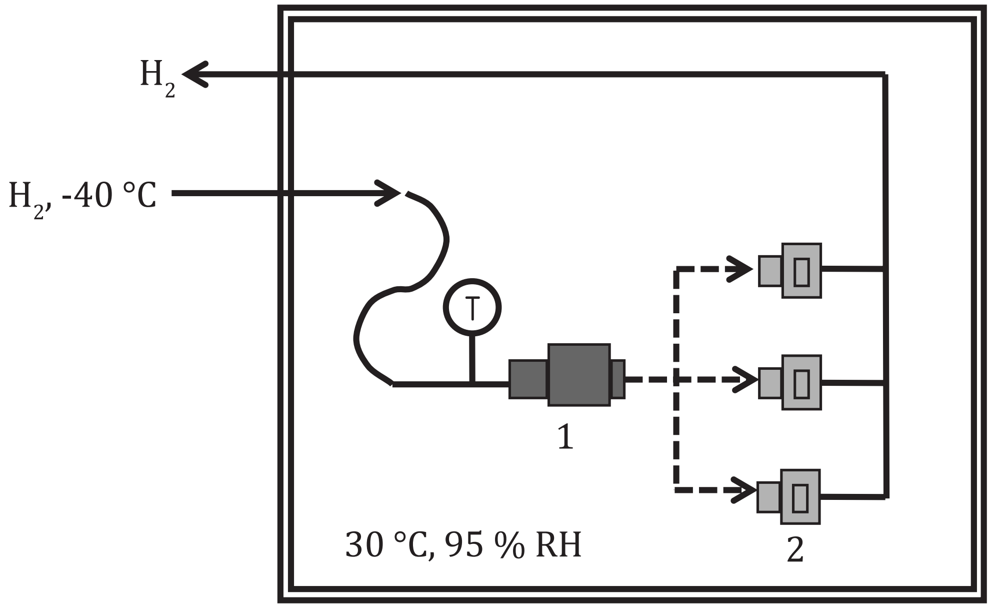
d) Disconnect the nozzle from the first receptacle using the standard procedure, wipe the moisture from the receptacle and replace its protective cap. The forces to disconnect the nozzle shall not exceed the requirements in 7.5.

e) Wait 7 min± 0,1 min and repeat steps c) and d) with the second receptacle.

f) Wait 7 min ± 0,1 min and repeat steps c) and d) with the third receptacle.

g) Repeat steps c) through f) for a total of twelve tests.

h) If at any time the time to release the nozzle from the receptacle exceeds 30 s, then the nozzle is considered frozen and the test shall end. After 12 successful tests, the nozzle shall be deemed to have met the requirements of 5.9.



Key

1 nozzle

2 receptacles

RH relative humidity

T gas temperature

Figure 4 — Example of test setup for freezing test

7.27 Rocking test

This test shall validate that a receptacle and nozzle connection is not damaged after repeated moments applied to the end of the nozzle.

The hardware shall be supported in a horizontal position by a member capable of withstanding the load of this test without displacement or deflection. The nozzle shall be attached to a hose pressurized to the hydrogen service level.

The nozzle shall be capable of withstanding 2 500 cycles at a frequency of less than 1 cycle per second of the following loads:

a) a moment of 24 N·m applied in one direction;

b) a moment of 24 N·m applied in the opposite direction.

Following the test there shall be no visible damage to the receptacle nor any displacement of the receptacle seal(s). Following the tests, the receptacle shall then meet the requirements of the leakage tests specified in 7.7.

7.28 Communication test

This test assumes that the communication hardware used on the nozzle is an IrDA system designed to meet SAE J2799 or equivalent.

This test shall be performed to verify that the communication hardware is operational after completion of the design verification tests listed in 5.17.

After each test listed in 5.17, the IrDA transmitter or receiver shall be tested with a functioning counterpart. If the communication hardware consists of covers or IR filters, it shall be included as part of the test.

The transmitter and receiver shall be positioned 55 mm apart at an orientation of 30° from direct alignment.

The following signals shall be transmitted and correctly received:

— ID=SAE_2799

— VN=01.00

— TV=50.00*

— RT=H70

— FC=Abort

— FC=Dyna

— MP=87.50

— MT=358.15

8 Instructions

Manufacturers of receptacles and nozzles shall provide clear and concise printed instructions and diagrams in a form that can be easily understood and are adequate for:

a) proper field assembly;

b) installation;

c) safe operation by all users, including a statement that end users shall consider the pressure and flow capabilities of the system to which they are installed;

   NOTE See ISO 19880-1 for use of nozzles.

d) suitability and use; and

e) transport, storage and handling.

Special tools required for connection of receptacles to tubing shall be clearly identified in the instructions.

Nozzles that have been subjected to 10 over-pressurization occurrences shall be removed from service.

In addition, the manufacturer shall provide clear instructions on the required maintenance and required periodic inspection of components as well as the expected service life of the receptacle and nozzle including the expected service life of components, if different.

9 Marking

9.1 Markings required by this clause shall be in a legible and easily understandable form. These markings shall be embossed, cast, low stress stamped or otherwise formed in the part or a permanently attached plate. This includes markings baked into an enamelled surface. Permanently attached marking plates shall be securely attached by mechanical means. All markings shall be at least 2,5 mm high.

Nozzles and receptacles shall bear the following information:

a) the manufacturer's or dealer's name, trademark or symbol;

b) the model designation;

c) the appropriate pressure class, H11, H25, H35, H35HF or H70;

d) component pressure rating (nozzles only);

e) the applicable Type A, B or C (nozzles only);

f) in the case of Type A nozzle, the direction of the ON and OFF operation of the actuating mechanism;

g) marking for traceability of receptacles in suitable lots; nozzles shall carry individual serial numbers;

h) a reference to this document, i.e. ISO 17268:2020;

9.2 Nozzles may also bear the following non-mandatory information:

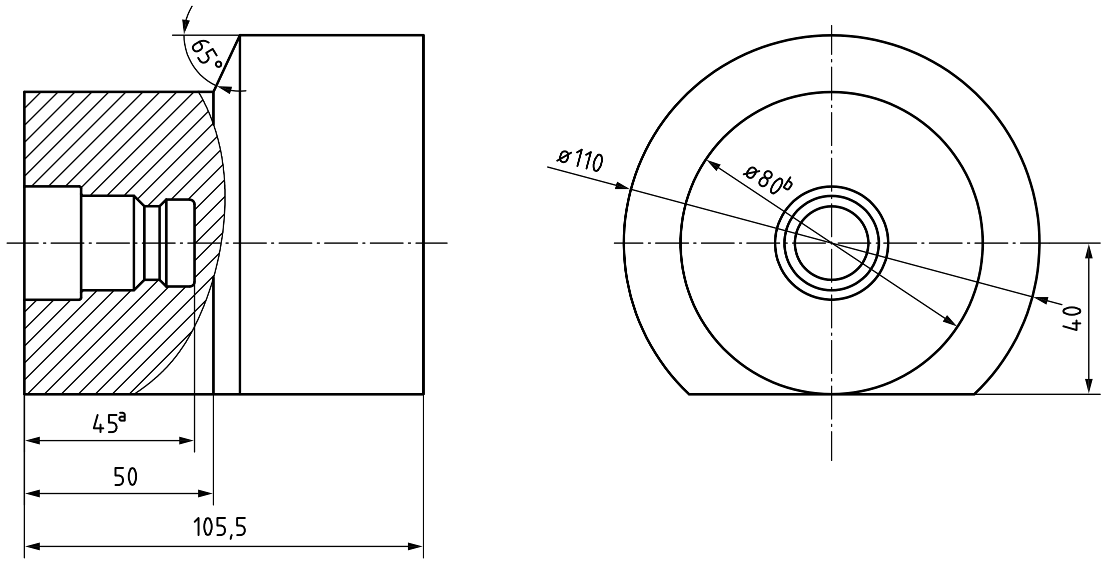
a) the statement: pressure relief valve (PRV) set-point ≤ 1,375 × NWP; or

b) the statement: rated to 1,375 × NWP.

Annex A
(normative)

Receptacle/nozzle interface envelope

Dimensions in millimetres



NOTE Depending on the vehicle design, the overall depth of the fuelling cavity doesn't need to be as large as indicated here.

a Minimum length of the receptacle that shall be clear of provisions for attachment of receptacle or protective cap.

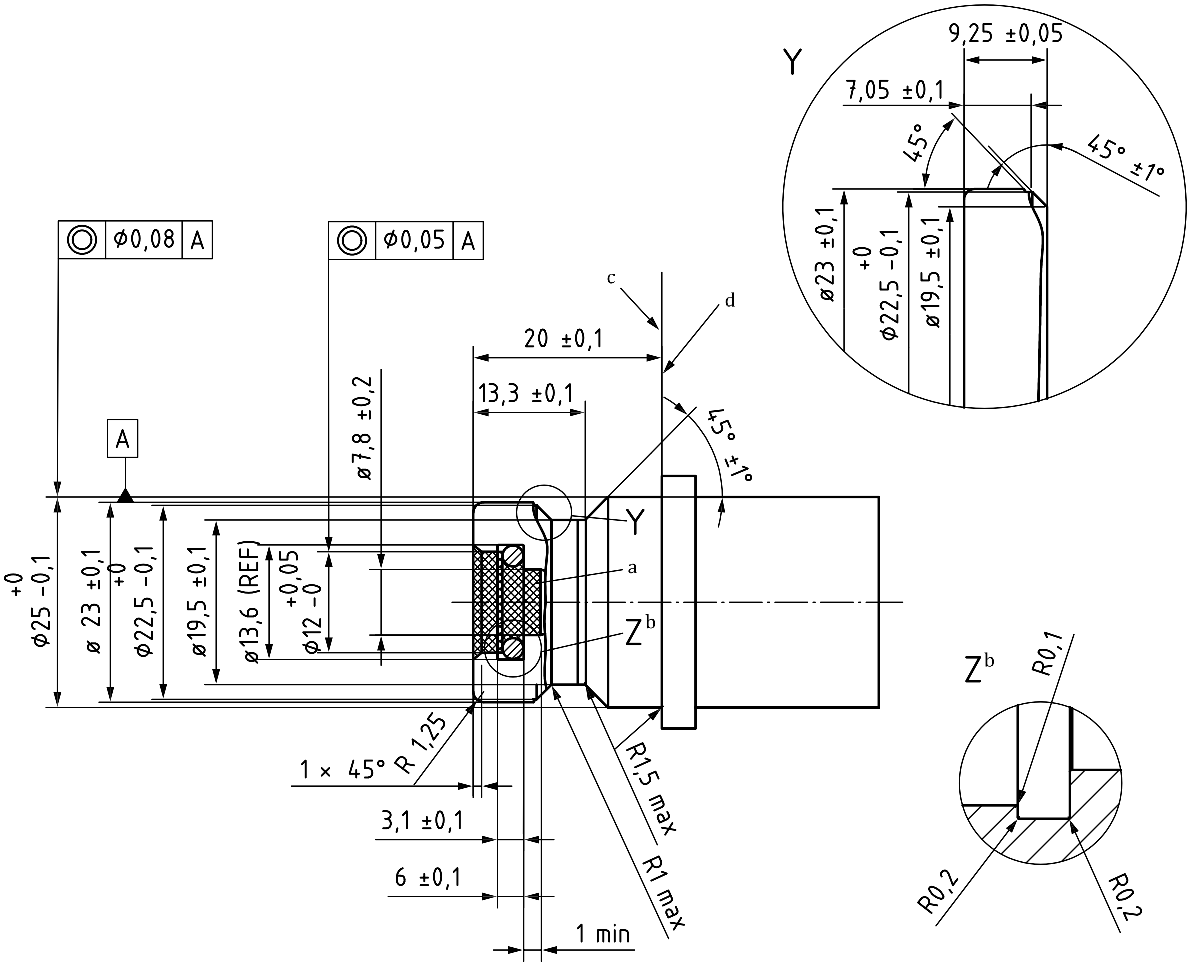
b For minimum coupling clearance only. System designers shall ensure that the dust or protective cap operates freely in the provided space.

Figure A.1 — Receptacle/nozzle interface envelope

Annex B
(normative)

Hydrogen receptacles

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Unless otherwise specified, surface finish roughness average (Ra) shall be 0,4 µm to 3,2 µm.

a Shaded area represents an area, which shall be kept free of all components except for the seal. Surface finish Ra shall be 0,8 µm ± 0,05 µm.

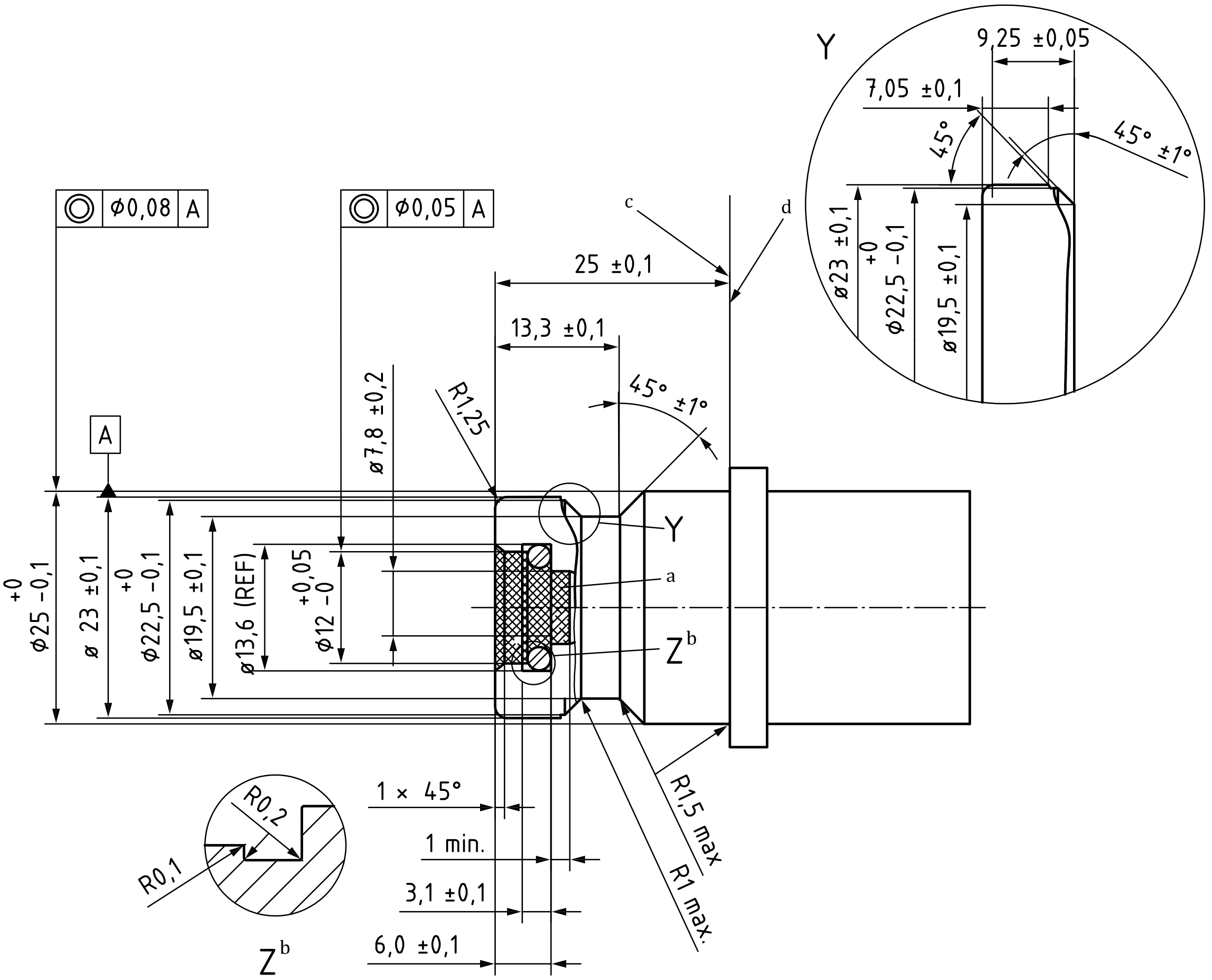
b Reference sealing material surface to a no. 110 O-ring with the following dimensions: internal diameter: 9,19 mm ± 0,13 mm; width: 2,62 mm ± 0,08 mm.

c Nozzle side: No part of the nozzle assembly shall extend beyond the receptacle stop ring.

d Vehicle side: The stop ring shall have a continuous shape that has an effective diameter of 30 mm or more and a thickness greater than 5 mm.

Figure B.1 — H11 hydrogen receptacle

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Unless otherwise specified, surface finish Ra shall be 0,4 µm to 3,2 µm.

[a] Shaded area represents an area, which shall be kept free of all components except for the seal. Surface finish Ra shall be 0,8 µm ± 0,05 µm.

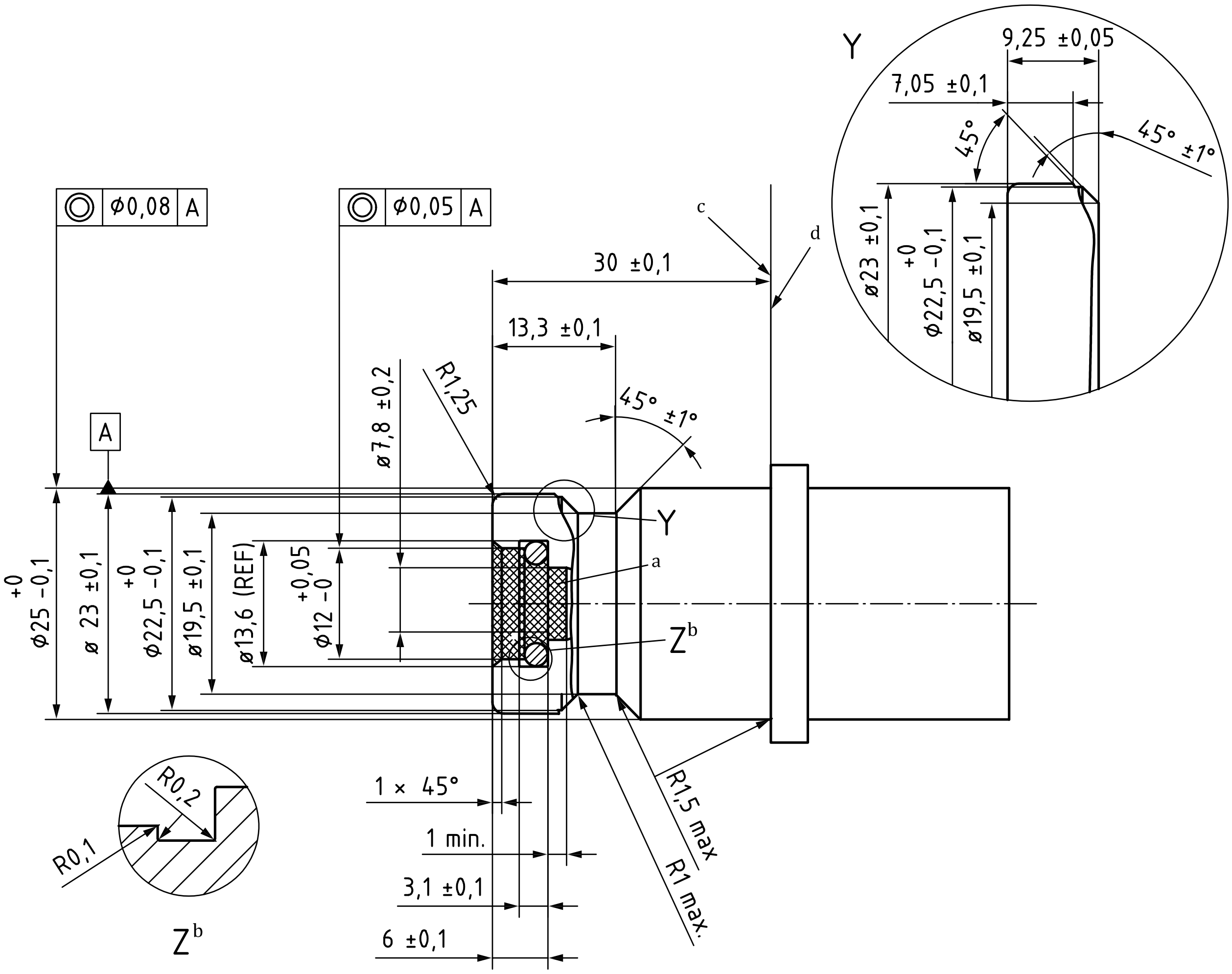
[b] Reference sealing material surface to a no. 110 O-ring with the following dimensions: internal diameter: 9,19 mm ± 0,13 mm; width: 2,62 mm ± 0,08 mm.

[c] Nozzle side: No part of the nozzle assembly shall extend beyond the receptacle stop ring.

[d] Vehicle side: The stop ring shall have a continuous shape that has an effective diameter of 30 mm or more and a thickness greater than 5 mm.

Figure B.2 — H25 hydrogen receptacle

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Unless otherwise specified, surface finish Ra shall be 0,4 µm to 3,2 µm.

a Shaded area represents an area, which shall be kept free of all components except for the seal. Surface finish Ra shall be 0,8 µm ± 0,05 µm.

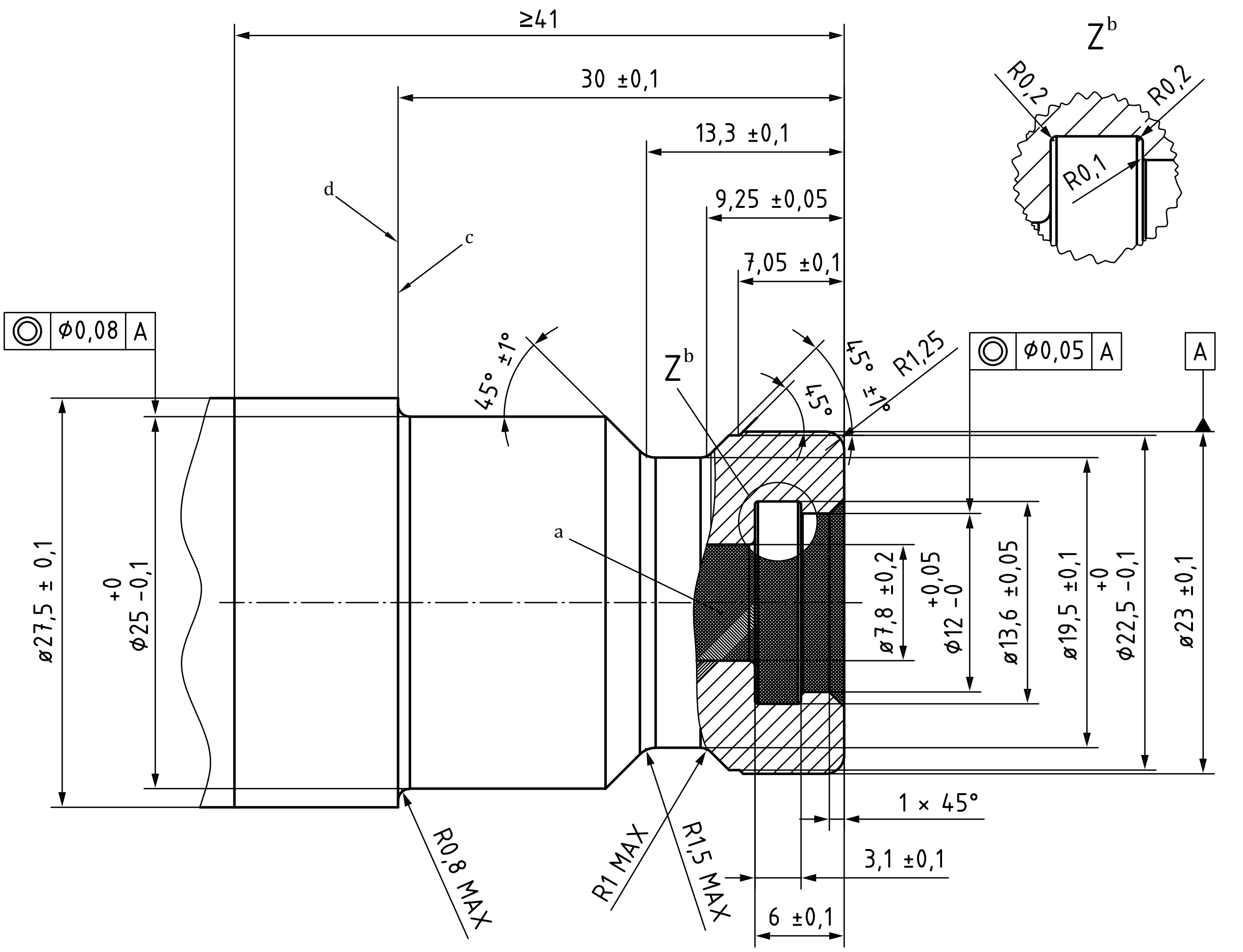
b Reference sealing material surface to a no. 110 O-ring with the following dimensions: internal diameter: 9,19 mm ± 0,13 mm; width: 2,62 mm ± 0,08 mm.

c Nozzle side: No part of the nozzle assembly shall extend beyond the receptacle stop ring.

d Vehicle side: The stop ring shall have a continuous shape that has an effective diameter of 30 mm or more and a thickness greater than 5 mm.

Figure B.3 — H35 hydrogen receptacle

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Unless otherwise specified, surface finish Ra shall be 0,4 µm to 3,2 µm.

a Shaded area represents an area, which shall be kept free of all components except for the seal. Surface finish Ra shall be 0,8 µm ± 0,05 µm.

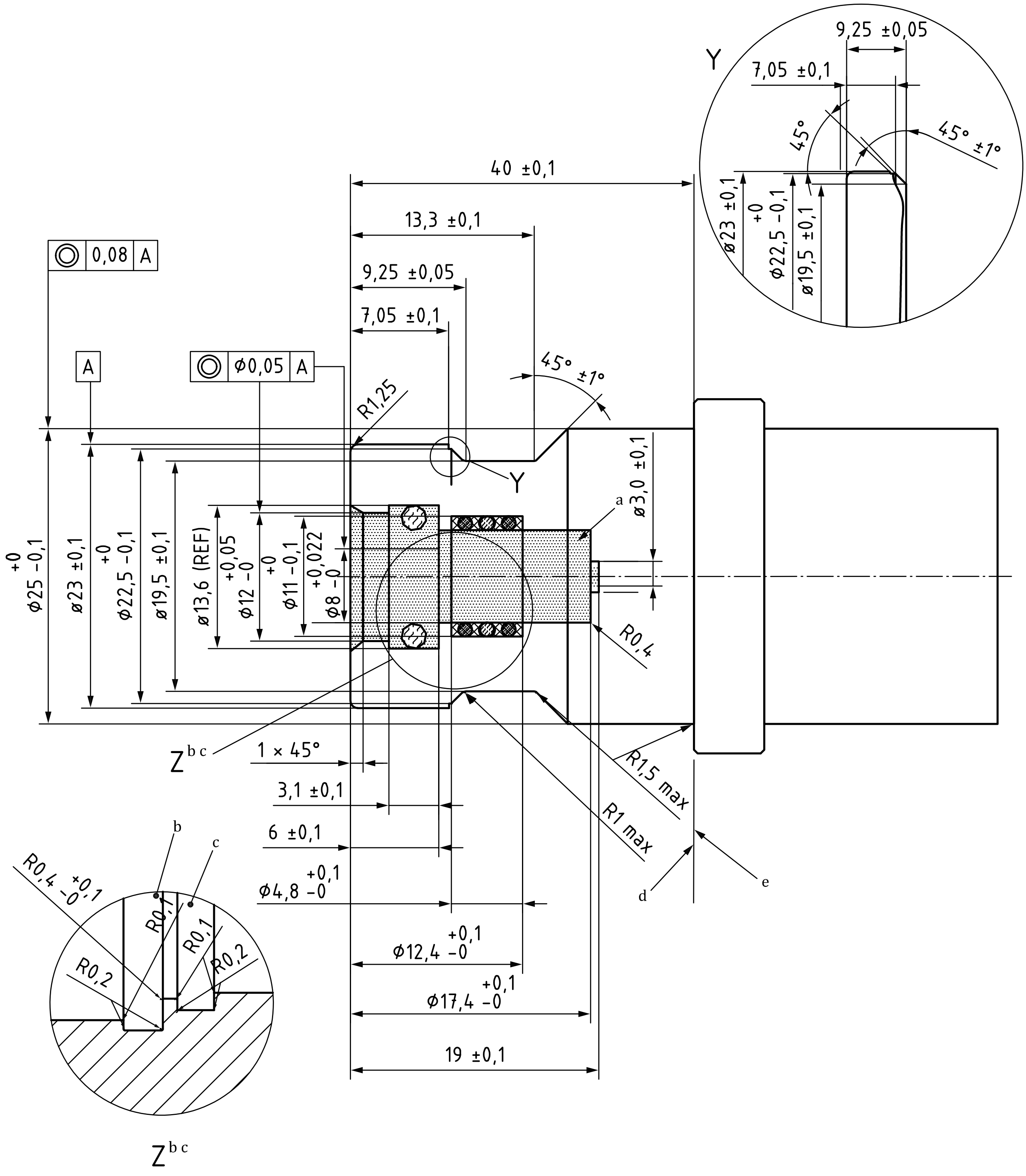
b Reference sealing material surface to a no. 110 O-Ring with the following dimensions: internal diameter: 9,19 mm ± 0,13 mm; width: 2,62 mm ± 0,08 mm.

c Nozzle side: No part of the nozzle assembly shall extend beyond the receptacle stop ring.

d Vehicle side: The stop ring shall have a continuous shape that has an effective diameter of 30 mm or more and a thickness greater than 5 mm.

Figure B.4 — H35HF hydrogen receptacle (high flow for commercial vehicle applications)

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB).

The seal part on the nozzle side shall meet the requirements of Figure B.6.

a Shaded area represents an area, which shall be kept free of all components except for the seals and anti-extrusion rings. Surface finish Ra shall be 0,8 µm ± 0,05 µm.

b Reference sealing material surface to a no. 110 O-Ring with the following dimensions: internal diameter: 9,19 mm ± 0,13 mm; width: 2,62 mm ± 0,08 mm.

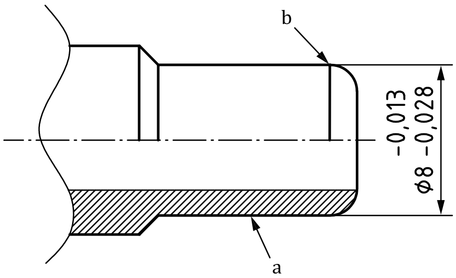
[c] Reference sealing material surface to a no. 011 O-Ring with the following dimensions: internal diameter: 7,65 mm ± 0,13 mm; width: 1,78 mm ± 0,08 mm, mounted with two suitable anti extrusion rings. Unless otherwise specified, surface finish Ra shall be 0,4 µm to 3,2 µm.

[d] Nozzle side: No part of the nozzle assembly shall extend beyond the receptacle stop ring.

[e] Vehicle side: The stop ring shall have a continuous shape that has an effective diameter of 30 mm or more and a thickness greater than 5 mm.

Figure B.5 — H70 hydrogen receptacle

Dimensions in millimetres



[a] Surface finish Ra shall be 0,8 µm ± 0,05 µm.

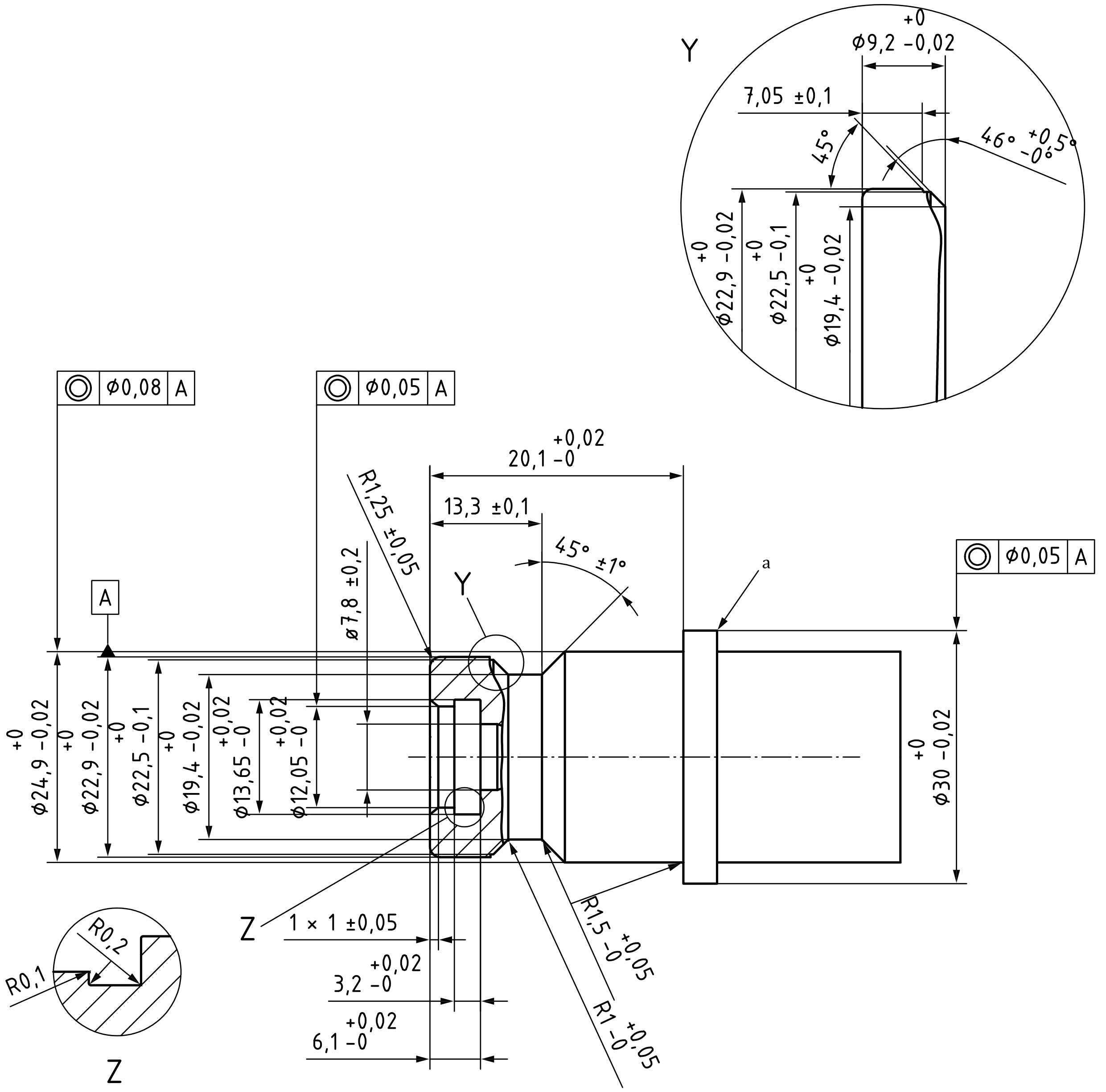
[b] The leading chamfer of nozzle pin shall extend part rear anti-extrusion ring of the receptacle.

Figure B.6 — Seal part on the 70 MPa nozzle side

Annex C
(normative)

Loose fit test fixtures

Dimensions in millimetres

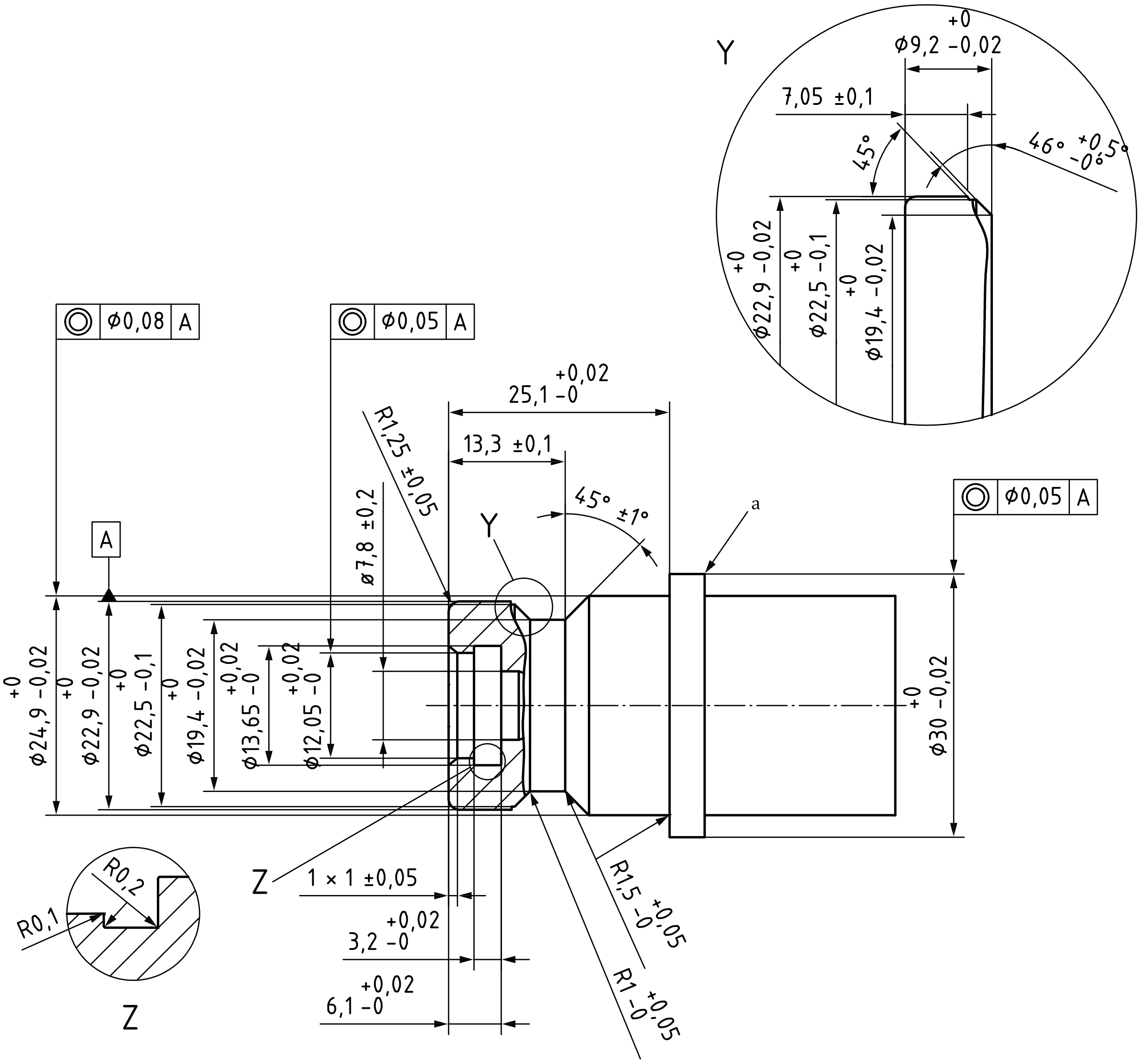


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure C.1 — H11 loose fit test fixture

Dimensions in millimetres

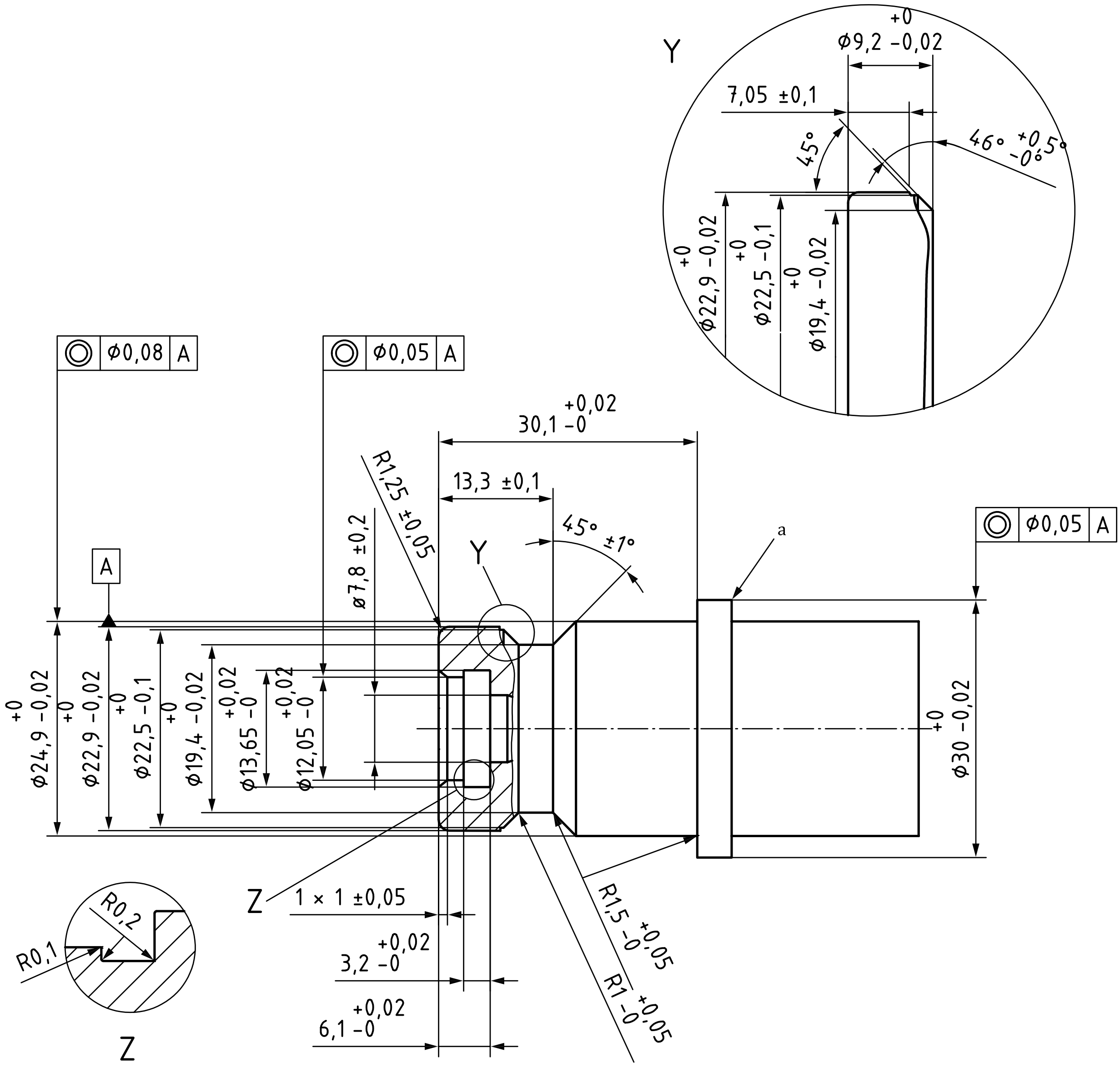


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure C.2 — H25 loose fit test fixture

Dimensions in millimetres

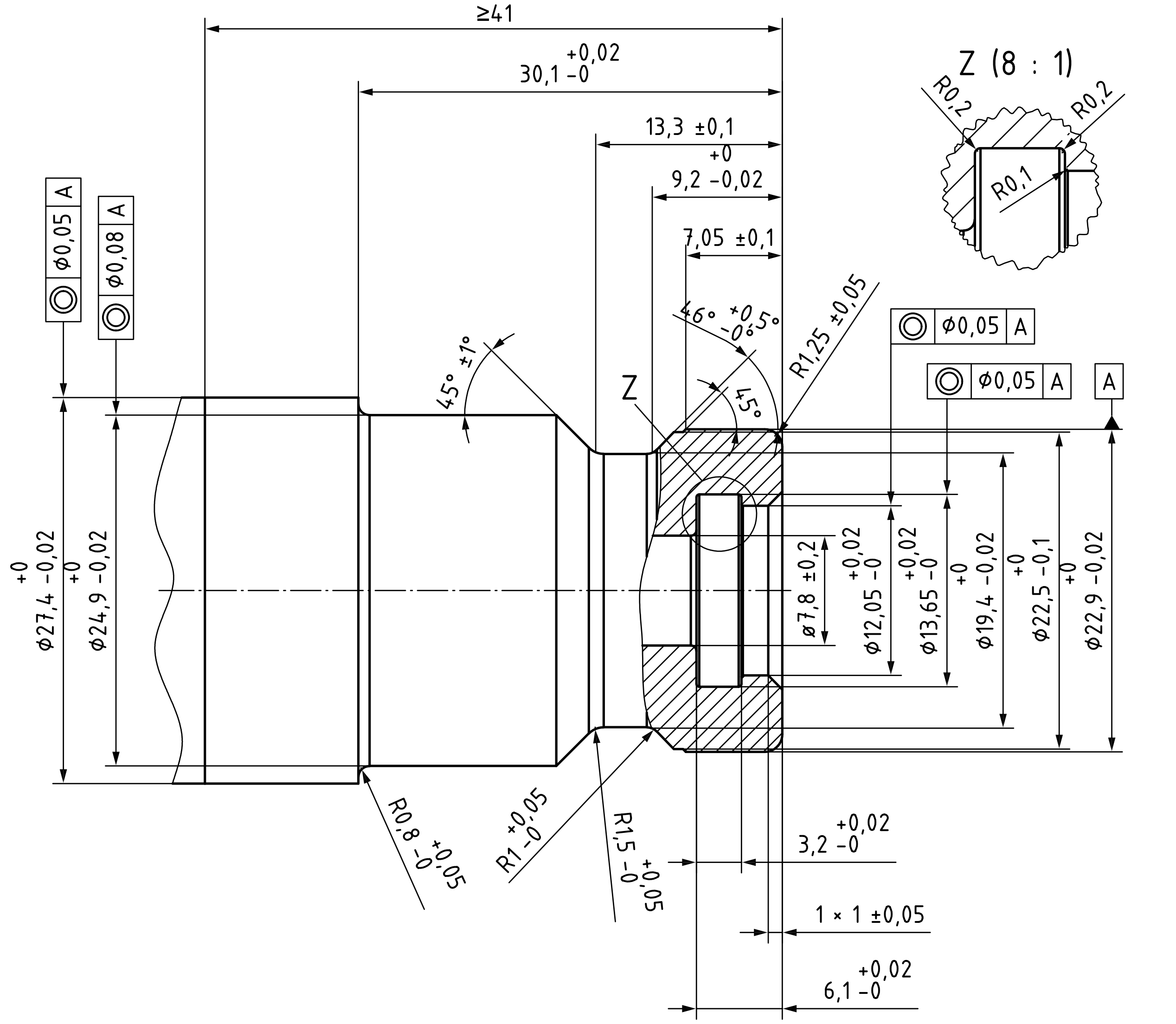


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

a The stop ring shall have a thickness greater than 5 mm.

Figure C.3 — H35 loose fit test fixture

Dimensions in millimetres

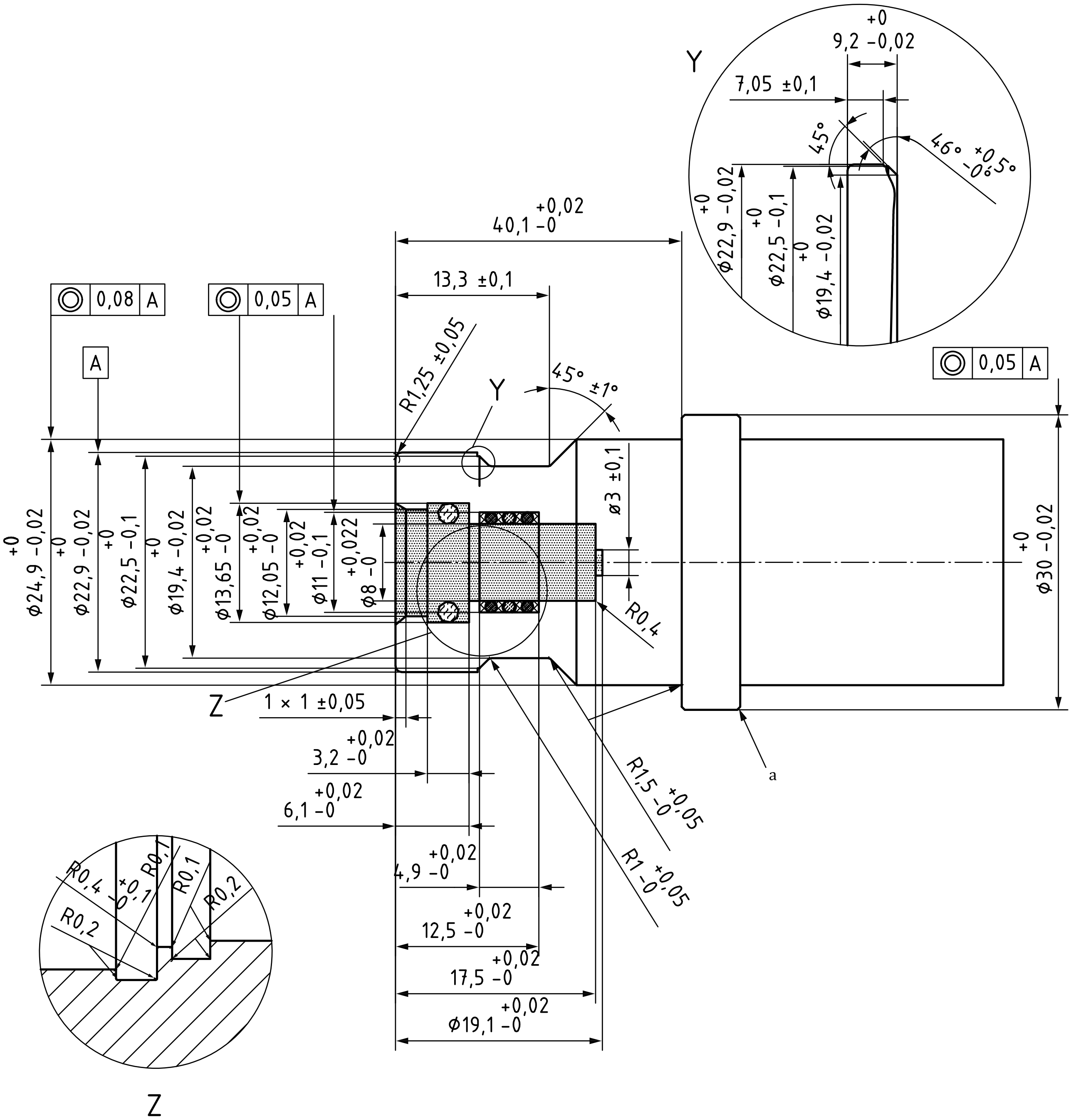


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

a The stop ring shall have a thickness greater than 5 mm.

Figure C.4 — H35HF loose fit test fixture

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

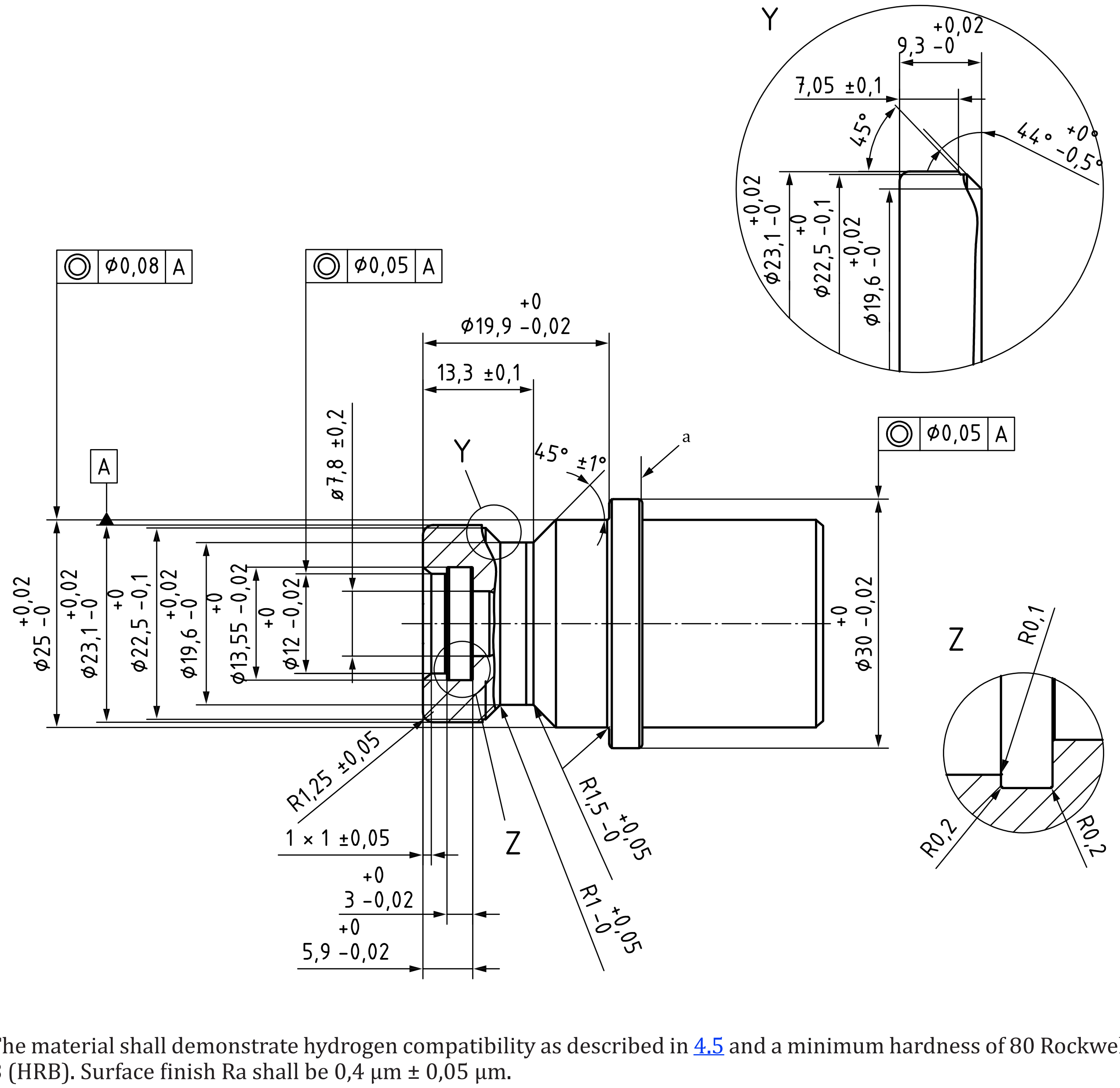
a The stop ring shall have a thickness greater than 5 mm.

Figure C.5 — H70 loose fit test fixture

Annex D
(normative)

Tight fit test fixtures

Dimensions in millimetres

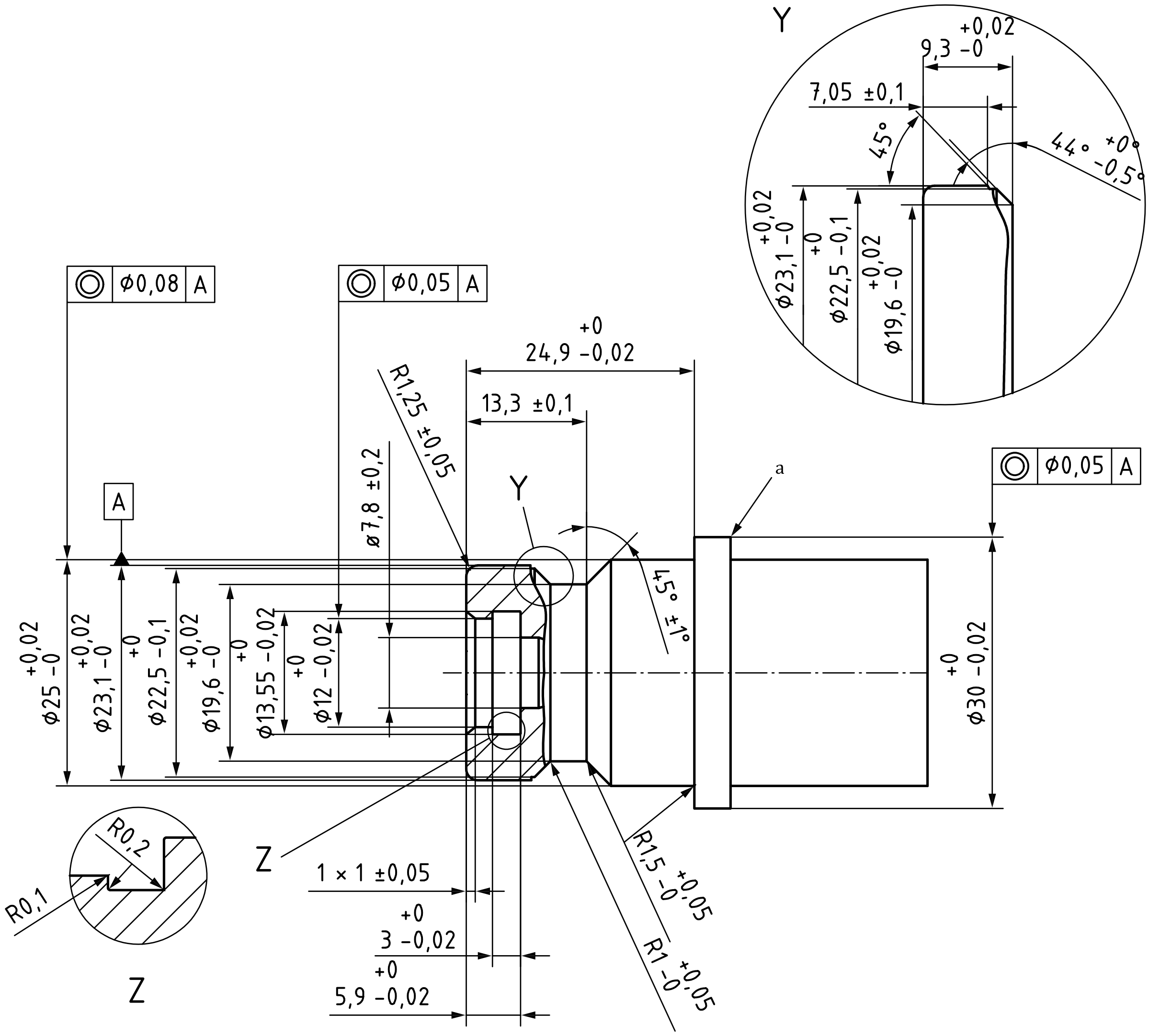


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 μm ± 0,05 μm.

a The stop ring shall have a thickness greater than 5 mm.

Figure D.1 — H11 tight fit test fixture

Dimensions in millimetres

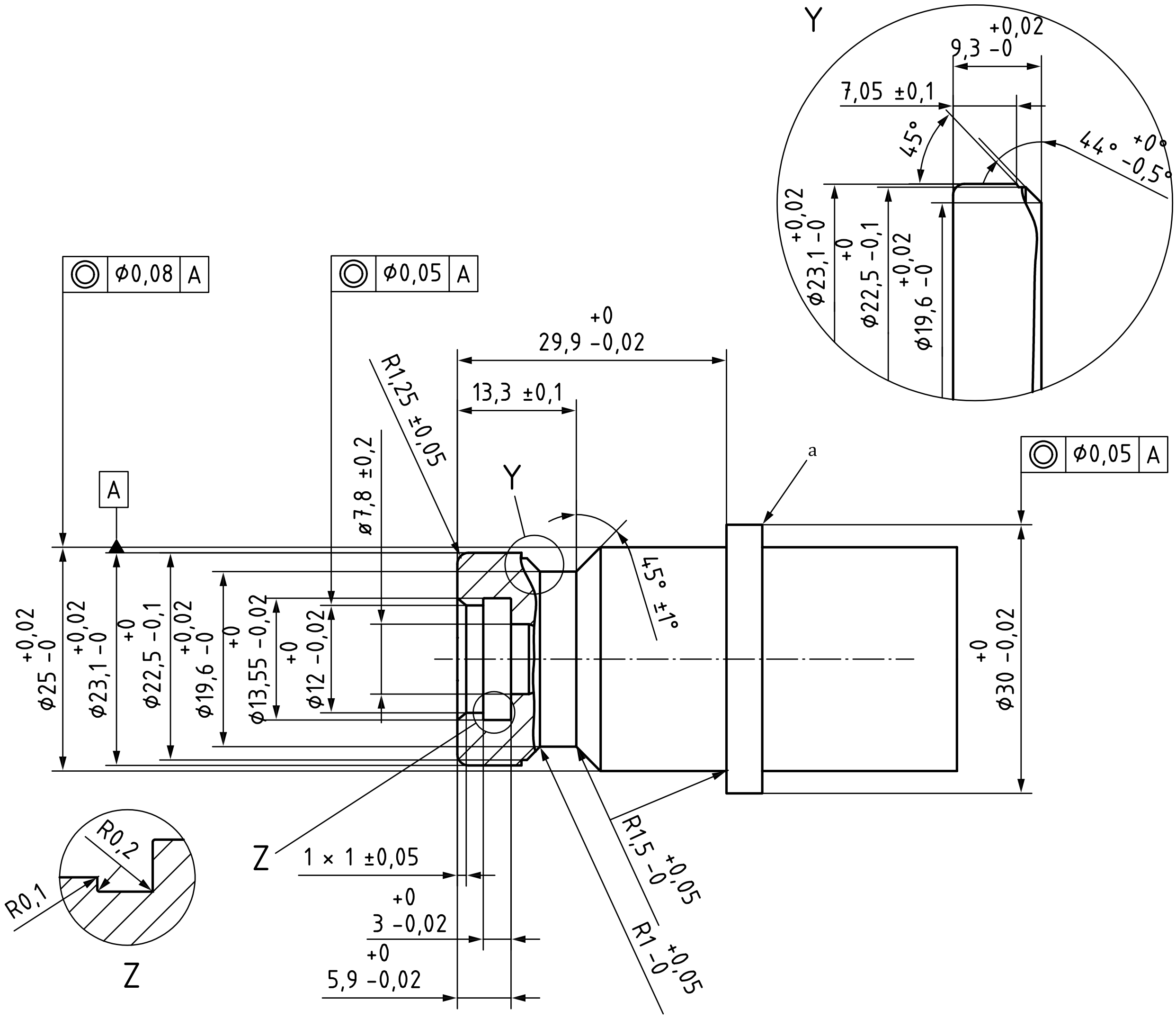


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure D.2 — H25 tight fit test fixture

Dimensions in millimetres

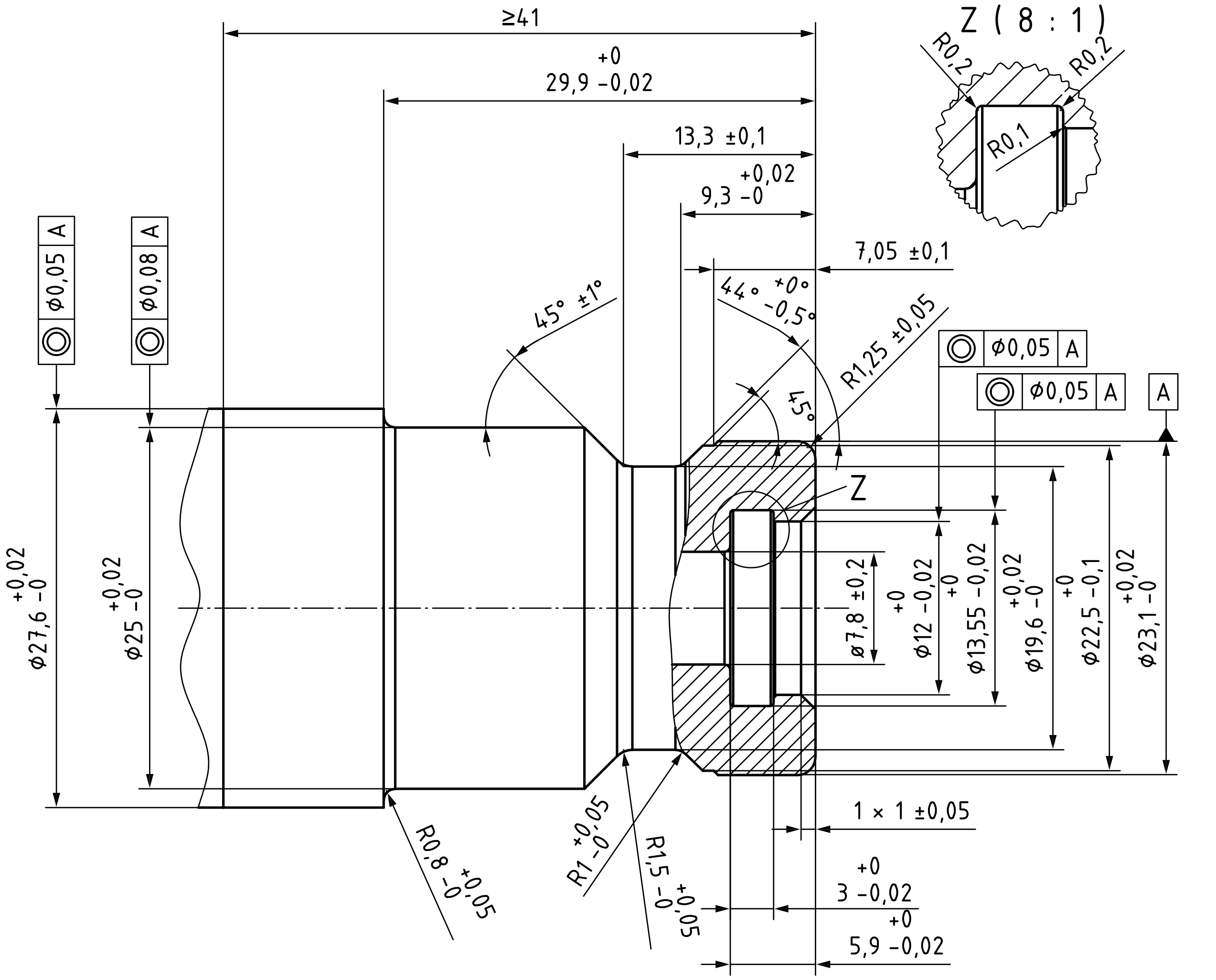


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure D.3 — H35 tight fit test fixture

Dimensions in millimetres

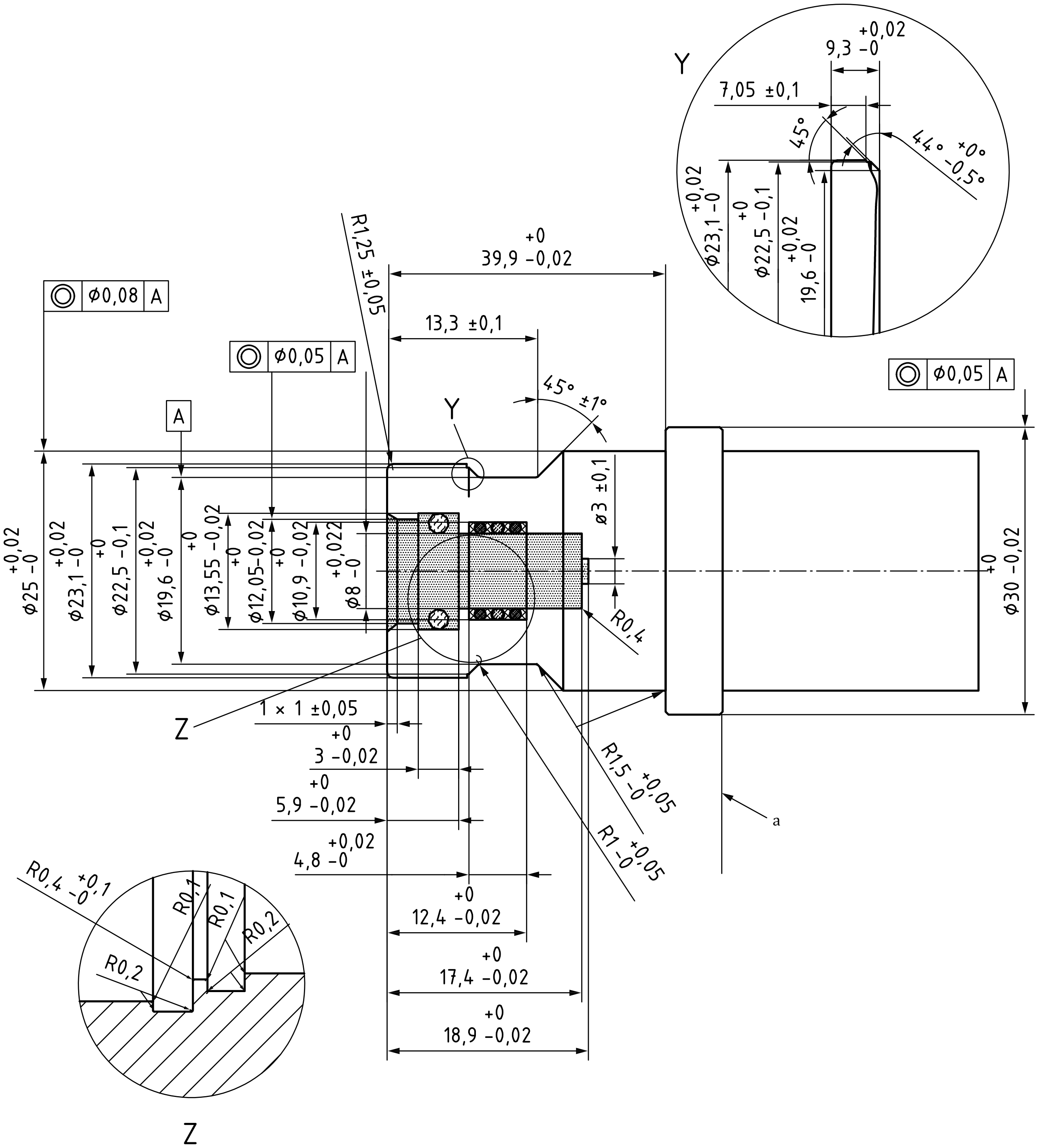


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

a The stop ring shall have a thickness greater than 5 mm.

Figure D.4 — H35HF tight fit test fixture

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

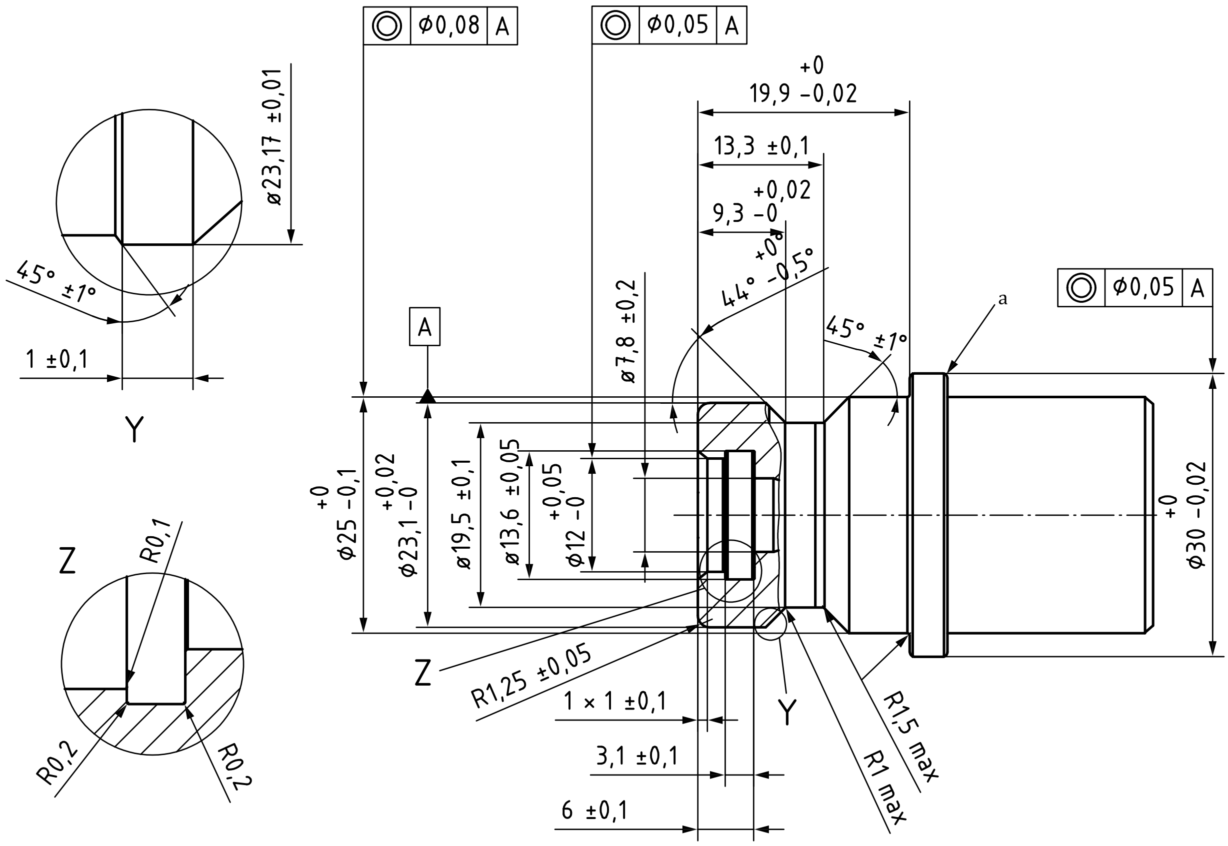
a The stop ring shall have a thickness greater than 5 mm.

Figure D.5 — H70 tight fit test fixture

Annex E
(normative)

Wear pattern test fixtures

Dimensions in millimetres

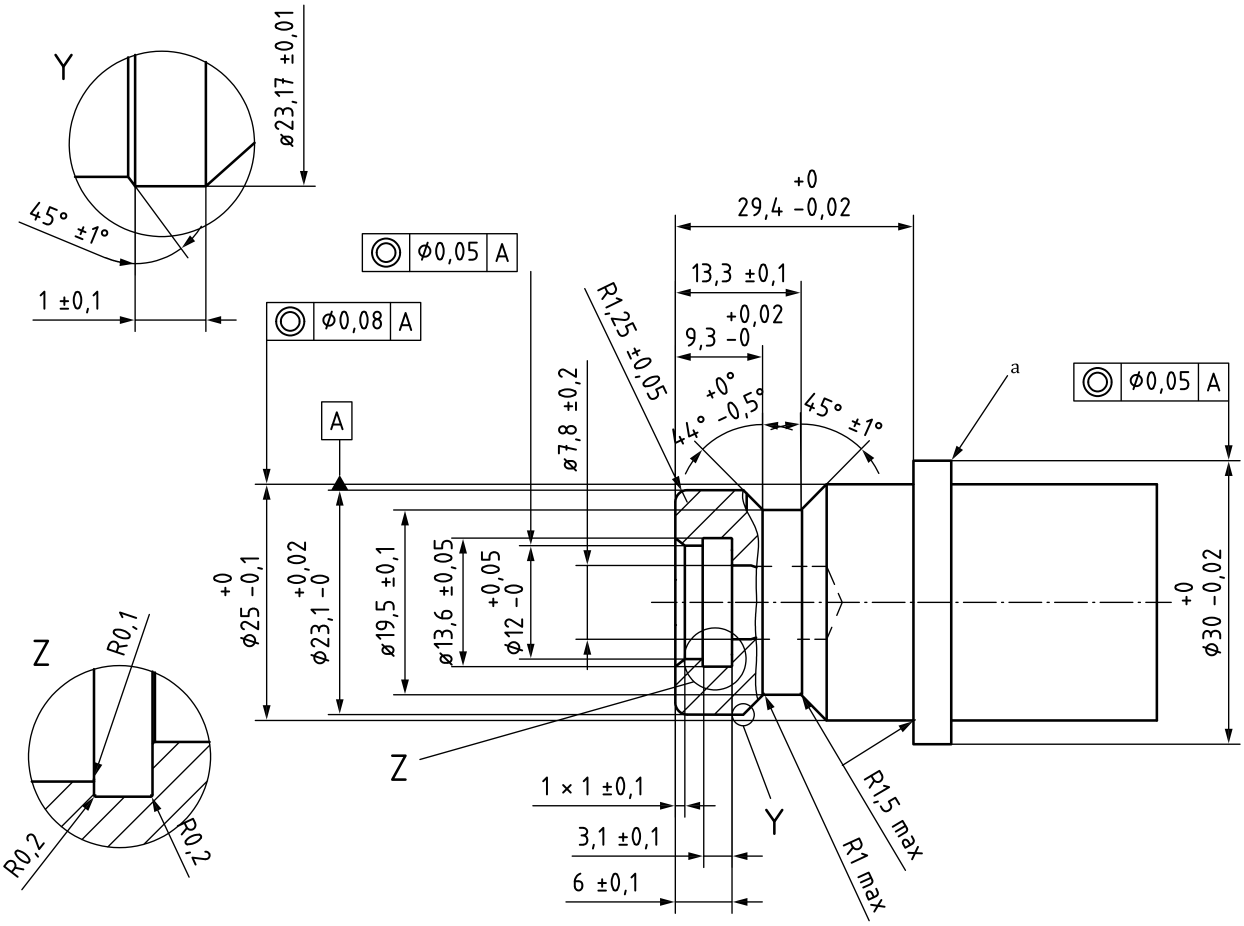


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

a The stop ring shall have a thickness greater than 5 mm.

Figure E.1 — H11 wear pattern test fixture

Dimensions in millimetres

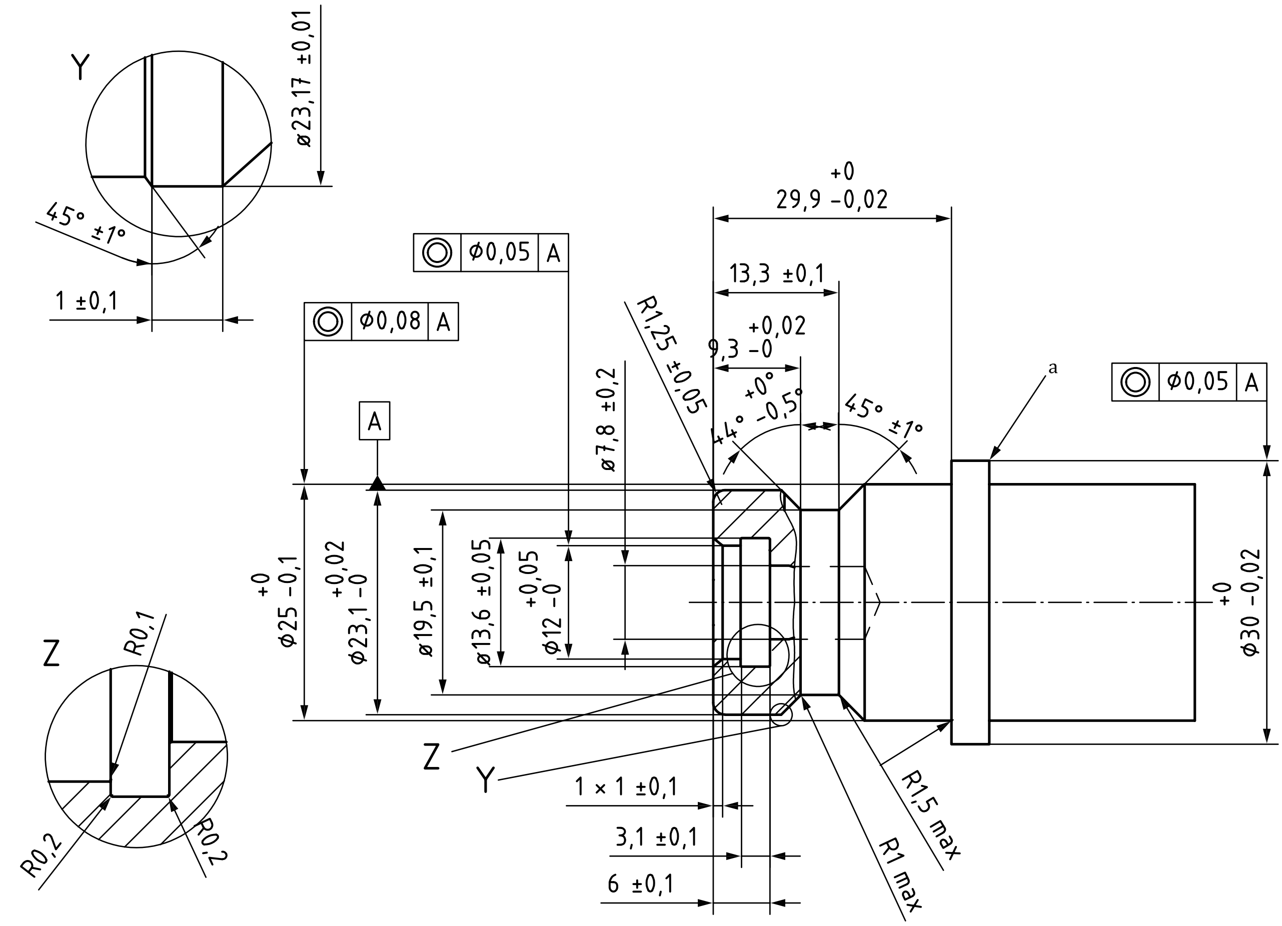


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure E.2 — H25 wear pattern test fixture

Dimensions in millimetres

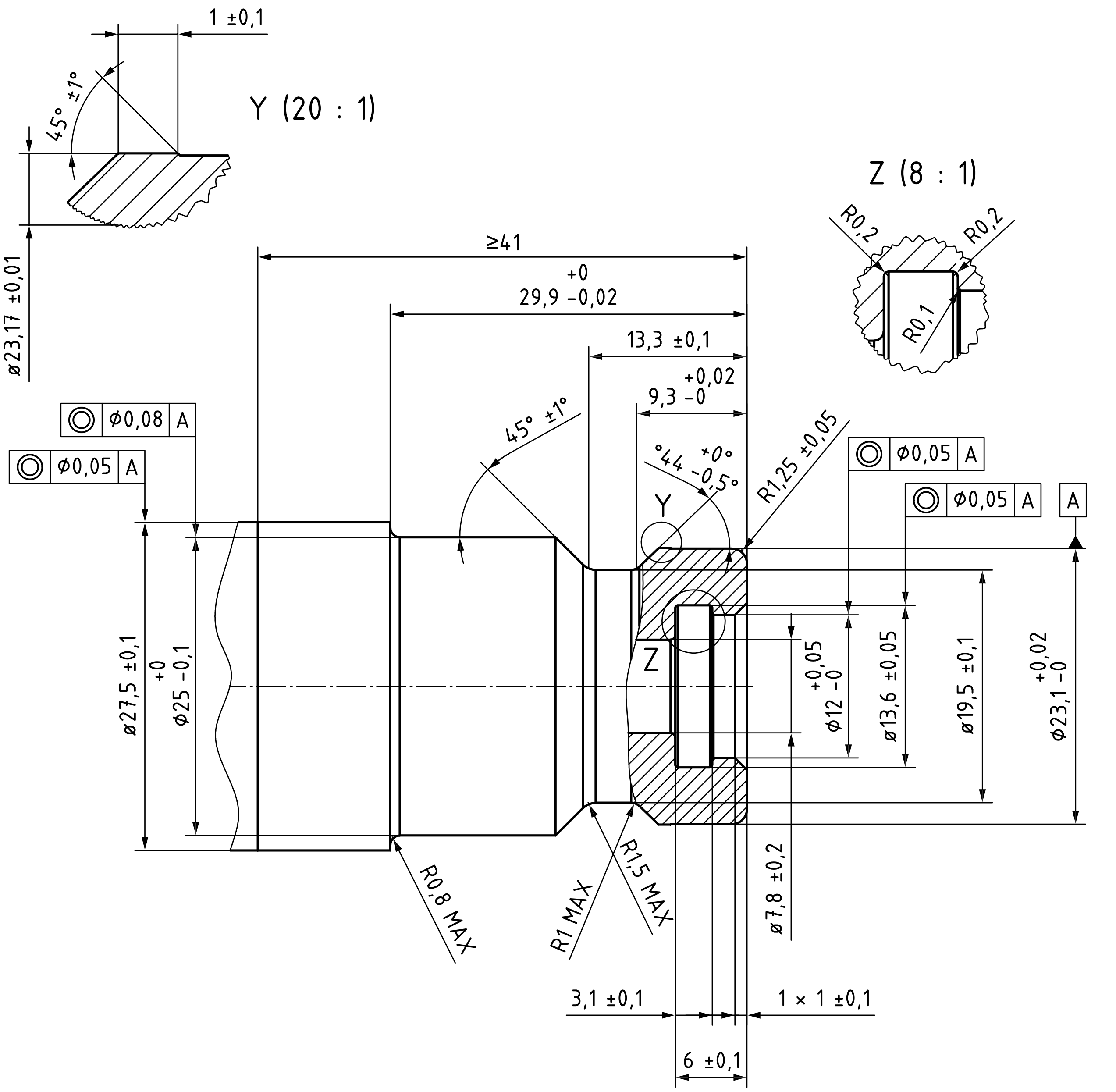


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure E.3 — H35 wear pattern test fixture

Dimensions in millimetres

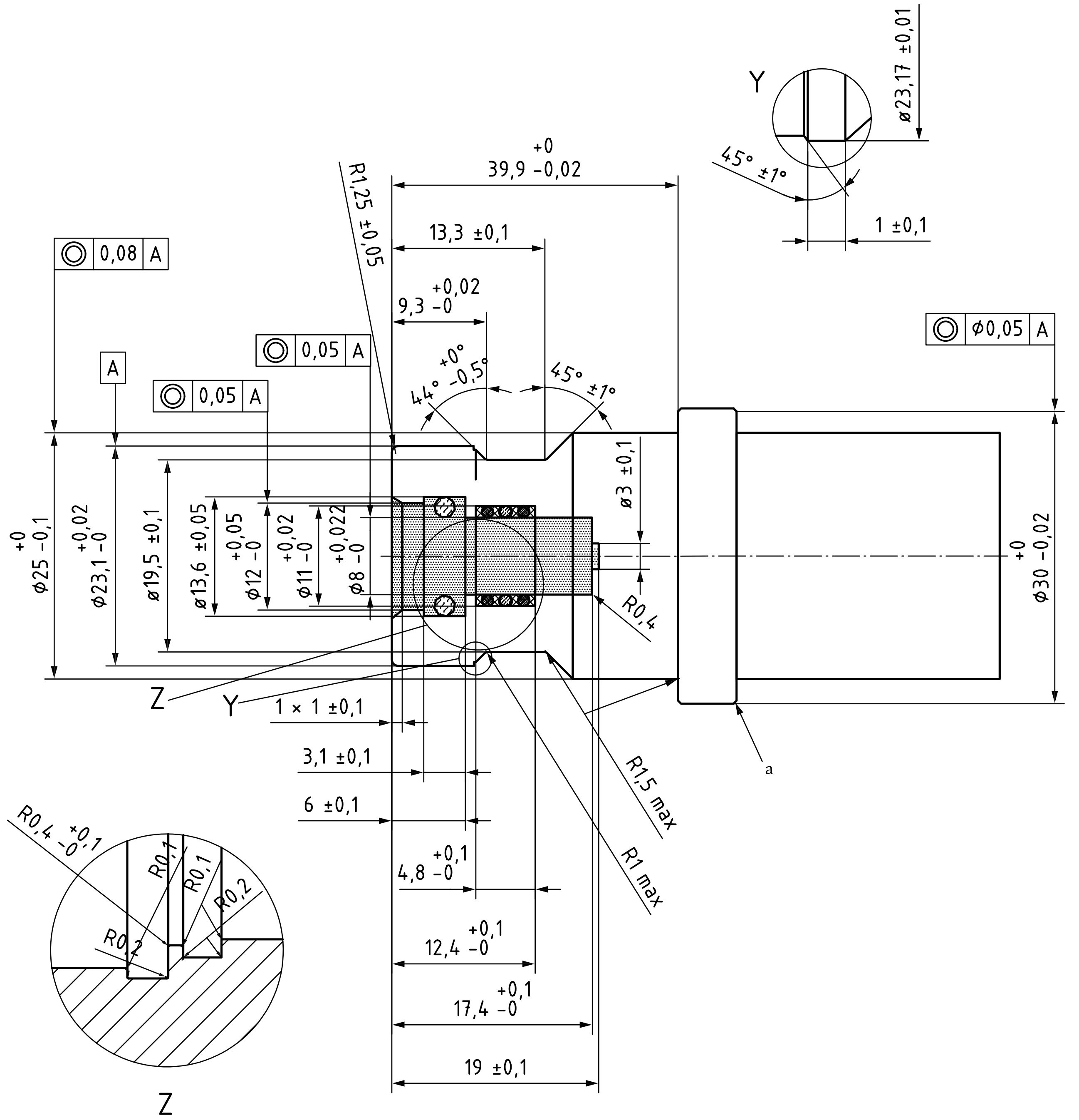


The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

[a] The stop ring shall have a thickness greater than 5 mm.

Figure E.4 — H35HF wear pattern test fixture

Dimensions in millimetres



The material shall demonstrate hydrogen compatibility as described in 4.5 and a minimum hardness of 80 Rockwell B (HRB). Surface finish Ra shall be 0,4 µm ± 0,05 µm.

a The stop ring shall have a thickness greater than 5 mm.

Figure E.5 — H70 wear pattern test fixture

Annex F
(informative)

Example hex design

Dimensions in millimetres

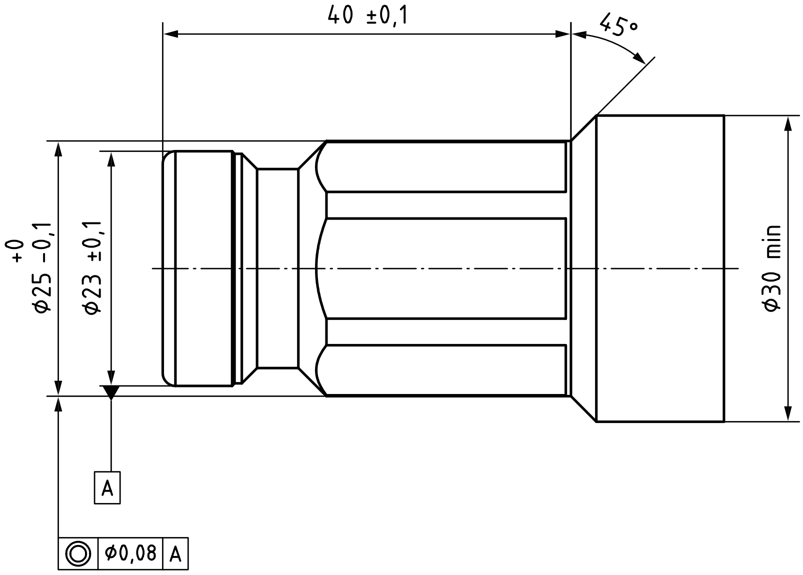


Figure F.1 — Example hex design

NOTE This design is an example countermeasure against freezing issues. It is not to be utilized in the misconnected nozzle test specified in 7.22.

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[6] Pressure Equipment Directive (PED) 2014/68/EU, DIRECTIVE 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 May 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment

1) Under preparation. Stage at the time of publication: ISO/FDIS 19880-1:2019.

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