
**Diesel engines — NO_x reduction agent
AUS 32 —**

**Part 5:
Refilling interface for passenger cars**

Moteurs diesel — Agent AUS 32 de réduction des NO_x —

Partie 5: Interface de remplissage pour voitures particulières

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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 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This second edition cancels and replaces the first edition (ISO 22241-5:2012) which has been technically revised.

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

- the definition of AUS 32 has been deleted as it is included in ISO 22241-1 and the document is cited normatively;
- new definitions have been added;
- new normative references have been added;
- [Table 1](#) has been editorially and technically revised.

A list of all parts in the ISO 22241 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The refilling system specified in this document has been developed in accordance with passenger vehicle manufacturer's specifications. The functional requirements include a filling system that has minimal obtrusive odours, has minimal spill risk, limits pressure build-up and includes mismatch prevention. The system should be designed to prevent the deleterious effects of AUS 32, including, but not limited to, uncontrolled flow into gaps in body work with the potential to cause corrosion, smell nuisance and crystal formation.

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Diesel engines — NO_x reduction agent AUS 32 —

Part 5: Refilling interface for passenger cars

1 Scope

This document applies to diesel engine powered road vehicles using selective catalytic reduction (SCR) technology. It is primarily intended for use by passenger cars and light commercial vehicles including buses with a gross vehicle mass of not more than 3,5 t, but can also be used by vehicles with a gross vehicle mass of over 3,5 t.

This document specifies the refilling interface for the NO_x reduction agent AUS 32 in conformance with ISO 22241-1, which is needed to operate converters with selective catalytic reduction (SCR) exhaust treatment system. This document specifies the essential functional and geometric requirements of the refilling system in order to ensure compatibility between the on-board refilling system and the off-board refilling system.

For light commercial vehicles and buses having a gross vehicle mass of not more than 3,5 t, the open refilling system specified in ISO 22241-4 can be used.

NOTE Throughout this document, the term “NO_x reduction agent AUS 32” is abbreviated to “AUS 32”.

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 2575, *Road vehicles — Symbols for controls, indicators and tell-tales*

ISO 22241-1, *Diesel engines — NO_x reduction agent AUS 32 — Part 1: Quality requirements*

ISO 22241-3, *Diesel engines — NO_x reduction agent AUS 32 — Part 3: Handling, transportation, and storage*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22241-1 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

refilling system

off-board system and on-board system including their refilling interface for dispensing AUS 32 into the on-board tank of the vehicles

3.2

canister bottle

container of size one to ten litres capacity, with spout, used to refill the on-board tank of the vehicle

3.3

off-board refilling system

stationary equipment for dispensing AUS 32 into the on-board tank of the vehicles, consisting typically of storage tank, pump, hose and *filler nozzle* (3.5)

3.4

on-board refilling system

equipment of the vehicles necessary for refilling AUS 32 and consisting typically of *filler neck* (3.6), *filler cap* (3.7) and on-board tank

3.5

filler nozzle

interfacing part of an *off-board refilling system* (3.3) which allows the operator to control the flow of AUS 32 during the filling, consisting of a nozzle spout with a defined interface geometry and an automatic shut-off system

3.6

filler neck

interfacing part of the *on-board refilling system* (3.4)

3.7

filler cap

part fitted to the *filler neck* (3.6) to prevent spillage as well as to minimize contamination of AUS 32 and which is temporarily opened or removed for refilling

3.8

spillage

quantity of fluid that escapes from the *filler nozzle* (3.5) to the atmosphere after the nozzle has shut off

4 Requirements

4.1 Functional requirements

The on-board refilling system and the off-board refilling system shall comply with the following basic functional requirements:

- minimal spillage;
- minimal smell nuisance;
- minimal pressure; and
- mismatching prevention.

The detailed requirements specified in [Table 1](#) apply.

Details not specified are left to the manufacturer's choice.

Table 1 — Basic functional requirements

No.	Characteristic	Requirement	Remark
1	Maximum flow rate range	$5 \text{ l/min} \leq x \leq 10 \text{ l/min}$.	Flow rates do not apply to: — canister filling; — production line filling.

Table 1 (continued)

No.	Characteristic	Requirement	Remark
2	Automatic shut-off of filler nozzle	Automatic shut-off feature required. The maximum amount of flow after automatic stop shall be not more than 50 ml.	For example, a nozzle in conformance with EN 13012.
3	Maximum filling level in AUS 32 on-board tank	The automatic shut-off system of the nozzle shall be used to protect against filling above maximum level.	High volume expansion of AUS 32 during freezing (approx. 7 %).
4	Spillage	Less than 0,4 ml per refilling with filler neck angle from the horizontal $\geq 30^\circ$.	For test procedure see 5.2
5	Pressure in the filler neck	At five seconds after starting the refilling process, the pressure in the filler neck shall be not more than ± 3 mbar. At the end of refilling process, there shall be ambient pressure in the filler neck.	—
6	Ventilation during refilling	The filler neck shall be used for ventilation of the AUS 32 on-board tank. During refilling, no more than 15 mg/l ammonia concentration should be measured.	For test procedure see 5.3
7	Operational temperature range	-30°C to $+80^\circ\text{C}$ for on-board components -20°C to $+40^\circ\text{C}$ for off-board components	For specific regions, the temperature range specified may not be sufficient or excessive. In such cases, a wider or more narrow temperature range, representative of that specific region, may be considered.
8	Freezing of AUS 32	Provide protection at the service station in accordance with operational temperature range. Vehicle parts shall be designed to cope with freezing and thawing in accordance with operational temperature range.	AUS 32 freezes at $-11,5^\circ\text{C}$ and has a volume increase of approximately 7 %.
9	Misfilling of fuel into the AUS 32 on-board tank	Feature required to prevent dispensing of fuel into the AUS 32 on-board tank.	The geometry of the filler neck specified in Figure 1 is significantly smaller than the filler nozzles for fuel in service; thus misuse is precluded.
10	Misfilling of AUS 32 into the diesel fuel tank	Feature required to prevent dispensing of AUS 32 in the fuel on-board tank. The design and geometry of the filler nozzle shall be such that the insertion of this device in the filler neck of on-board fuel tank is not feasible; thus misuse is precluded. For canister filling such design and geometry is recommended.	—
11	Materials	Materials in contact with AUS 32 shall be compatible with AUS 32 to avoid contamination of AUS 32 as well as corrosion of the devices used.	Suitable materials in accordance with ISO 22241-3 should be selected.

Table 1 (continued)

No.	Characteristic	Requirement	Remark
12	Cleanliness	A high level of cleanliness of all components of the on-board and off-board refilling systems shall be secured during the manufacturing, assembly and installation processes in order to minimize contamination of AUS 32. Regarding cleanliness level for the components of the off-board refilling system, see ISO 22241-3. Cleanliness level for the components of the on-board refilling system shall be agreed between vehicle and component manufacturers, in conformance with state of the art.	—
13	Reliability	The filler neck and the filler cap shall be designed and manufactured to be fully functional for the life of the vehicle as defined by vehicle manufacturers.	—
14	Crystallization ^a	Protection recommended	Contact with air should be minimized.
15	Marking ^a	Symbol as specified in ISO 2575 or equivalent national standard.	Blue is the recommended colour for filler caps.
^a Recommendations only.			

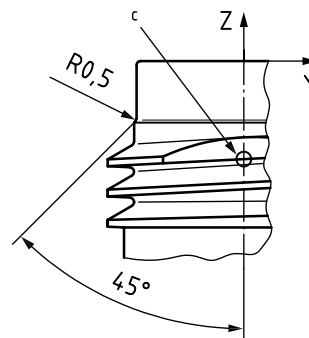
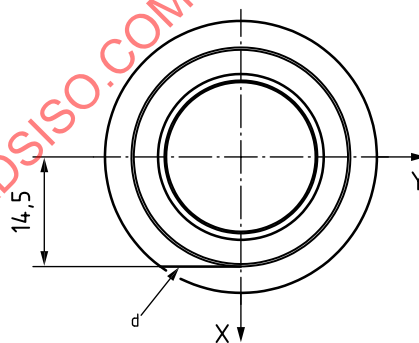
4.2 Filler neck

The dimensional characteristics of the filler neck on the vehicle shall be in accordance with the specifications of [Figure 1](#). The interface of the filler neck shall be furnished with a buttress thread S 36 × 4 as specified in [Figure 1](#), [Figure 2](#) and [Table 2](#). The front face of the filler neck shall be designed as sealing surface having a surface finish as specified in [Figure 1](#).

The thread on the filler neck shall withstand a torque of at least 5 Nm.

The filler neck designer should be aware of the potential for insufficient venting with nozzle filling. One possibility for a design with improved venting capability is a filler neck with ribs as shown in [Annex A](#).

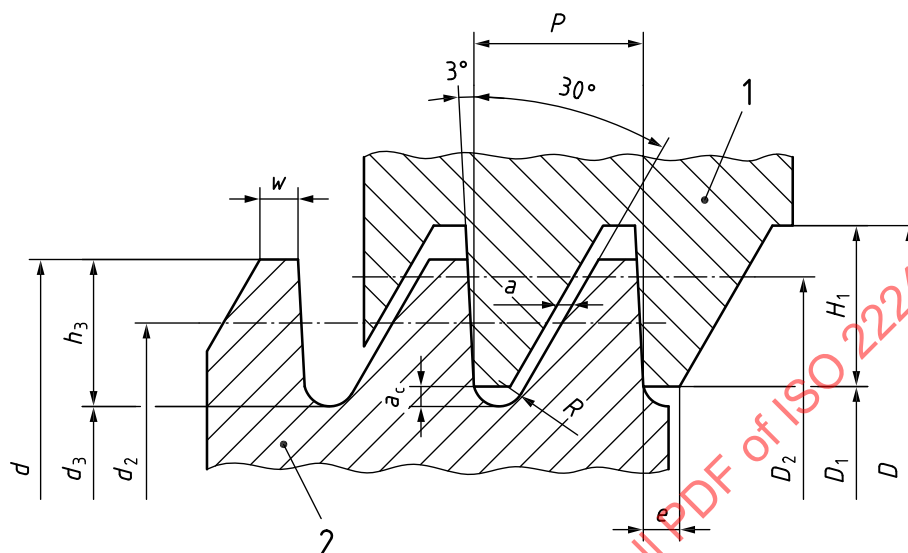
NOTE Buttress thread: a thread with an asymmetrical ridge that has one straight and one angled flank.



^e Venting of internal vapour through the filler neck.

- f Area for venting pipe.
- g Horizontal line.
- h Minimum straight portion of filler neck.

Figure 1 — Filler neck



Key

- 1 nut
- 2 screw

Figure 2 — Buttress thread

4.3 Filler nozzle

If the filler nozzle is of screw-coupling design, the dimensional characteristics shall be as specified in [Figure 2](#) and [Table 2](#). The screw-on filler nozzle shall be furnished with a gasket. The gasket shall be made of suitable material and the shape of the gasket shall be such that the leakage of ammonia meets [5.2](#) and [5.3](#).

For screw-coupling designs, the filler nozzle shall be designed to limit the maximum screwing torque to 5 Nm in order to protect the filler neck thread.

A screw-coupled nozzle shall include internal vapour recovery to avoid pressurizing the tank system during refill. The back pressure in the filler neck generated by the vapour recovery during the refilling process shall be not more than ± 3 mbar five seconds after starting the refilling process. There shall be ambient pressure in the filler neck at the end of the filling process.

[Table 2](#) is a calculation and is based on DIN 513 (see Bibliography). Tolerances are recommended to calculate in accordance to the material, etc.

Table 2 — Buttruss thread

Dimensions in millimetres

Symbol	Screw thread S36x4	Nut thread S37,6x4
D, d	36	37,6
P	4	
d_3	29,058	
D_1		30
d_2	33	
D_2		35,235
a	0,2	
h_3	3,471	
H_1		3,8
R	0,496	
w	1,056	
a_c	0,472	
e		0,856

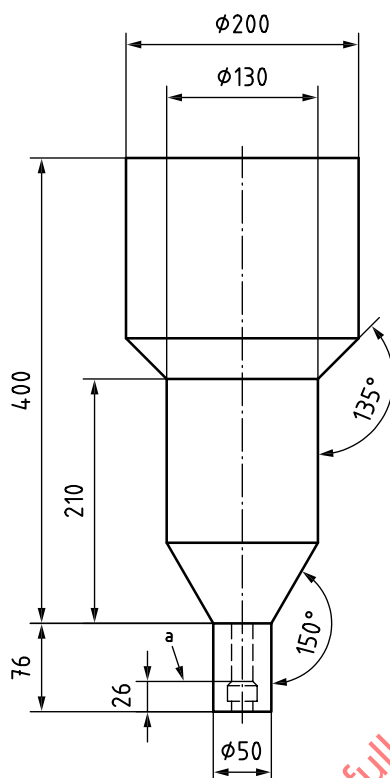
4.4 Clearance space

4.4.1 General

The vehicle manufacturer shall inform his customer, which kind of filling process the customer must use and choose the freespace accordingly. The following three options are possible. The Class A-freespace (see 4.4.2), which is primarily for canister filling, the Class B-freespace (see 4.4.3), which is primarily for nozzle filling, or a combination of both freespaces.

4.4.2 Minimum clearance "Class A"

Capability of refilling only by use of canisters is required. Therefore, vehicle manufacturers shall ensure that the minimum space defined in Figure 3 is available and is not obstructed by any components in order to permit unrestricted access to the filler neck for insertion of the nozzle spout of appropriate canisters.

**Key**

- ^a Top surface of filler neck (see [Figure 1](#)).

Figure 3 — Required free space "Class A"

4.4.3 Minimum clearance "Class B"

The vehicle manufacturer shall ensure that the clearance dimensions in accordance with [Figure 4](#) are provided to ensure safe handling when coupling and uncoupling a filler nozzle.

5 Testing

5.1 General test requirements

The filler neck shall be able to withstand loads induced by the filler nozzle during and after life cycle testing.

Testing of filler necks shall be conducted with new samples and with samples aged in AUS 32 at 60 °C for 168 hours. Testing shall be conducted at the following temperatures unless other temperatures are specified:

- -30 °C;
- room temperature (21 °C ± 5 °C);
- +45 °C.

5.2 Determination of spillage from nozzle

Five nozzles, each tested five times, shall be used for the following test. Conformance with the specified spillage limit shall be determined by the following test procedure:

- 1) Pre-conditioning of nozzle samples and equipment at room temperature (21 °C ± 5 °C), tank empty.
- 2) Filler neck to be positioned at 30° + 10°/ -0° from horizontal.
- 3) Unscrew filler cap.
- 4) Couple/ insert the filler nozzle at six o'clock position.
- 5) Fill with flow rate as specified in [Table 1](#) until automatic shut-off.
- 6) Wait 6 seconds.
- 7) Remove nozzle from filler neck and, after removal, collect any existing droplets.
- 8) Turn the nozzle upwards into vertical position, then 180° backwards to collect the droplets in a measuring device for 60 seconds.

Determine and record spillage. The average test result of 25 measurements (5 nozzles, 5 measurements each) shall be in conformance with the specified spillage limit in [Table 1](#). It is acceptable to weigh the spillage amount.

5.3 Determination of smell

5.3.1 General

For the purpose of this test the on-board tank shall be replaced by a container having a volume of 25 l.

A filler neck according to this document is fixed on the container by means of a 200 mm long filling pipe (internal diameter = 18 mm) and a ventilation pipe (internal diameter = 8 mm) as shown in [Figure 5](#). The ventilation pipe and the filling pipe are connected to each other by the filler neck as specified.

Dimensions in millimetres

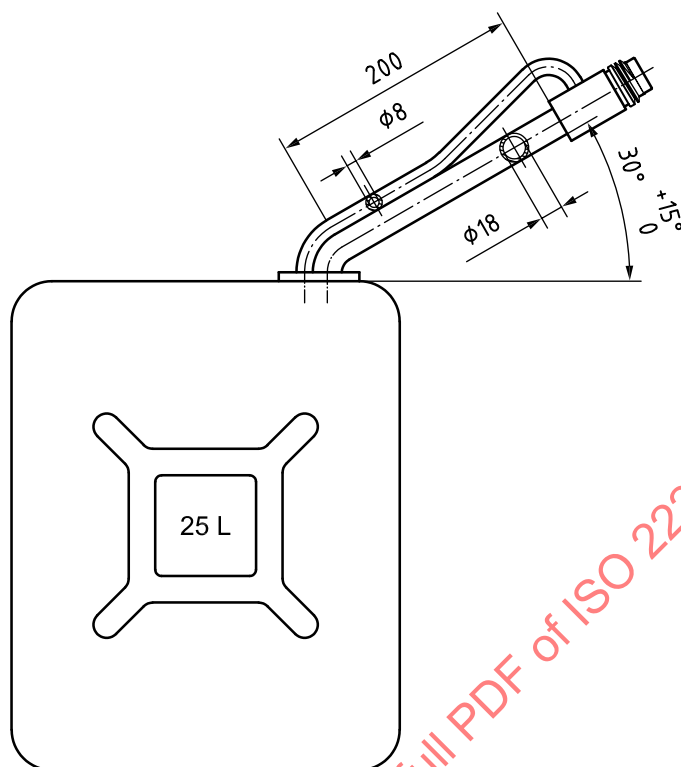


Figure 5 — Equipment for determination of smell

5.3.2 Preconditioning the system to establish constant test conditions

The container is filled with $5\text{ l} \pm 1\text{ l}$ of unused (new) AUS 32. The container is closed, stored in a heating cabinet at $60\text{ }^{\circ}\text{C}$ for 96 hours. Then the container should be cooled down to room temperature ($21\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$). One hour after reaching room temperature the test procedure should start.

5.3.3 Test procedure

The equipment for measuring the ammonia concentration shall be installed at a distance of $65\text{ cm} \pm 5\text{ cm}$ from the top of the filler neck in line with the axis of the filler neck.

After removing the filler cap the nozzle shall then be inserted into the filler neck. The refilling shall be started immediately and $16\text{ l} \pm 1\text{ l}$ of unused (new) AUS 32 at room temperature ($21\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$) shall be filled into the container while measuring the ammonia concentration.

Test chamber shall be a closed room having a size of not more than 54 m^3 and having no mechanical air ventilation.

The measuring of the ammonia concentration should start from $30\text{ s} \pm 2\text{ s}$ after the start of the refilling procedure. The measuring time shall be at least 1 minute. The average value shall be determined and noted. The use of detector tubes is acceptable.

The test shall be performed in two positions of the nozzle on the filler neck (normal six o'clock position and a position shifted 45° with respect to the normal position) and at a flow rate of 10 l/min .

Every measurement shall be started with a preconditioned system according to 5.3.2 in an ammonia free environment and shall be carried out at least three times.

The average ammonia concentration during one series of measurements shall not exceed 15 mg/l .

5.4 Minimum strength of filler neck

5.4.1 General

The filler neck shall be tested in vehicle representative implementation. The tests specified in this sub clause shall be carried out to prove the ability of the refilling system to disconnect, in the case of the driver failing to uncouple the filler nozzle correctly. Upon completion of the tests, the on-board refilling system shall show no deformation which will render it unsuitable for use, and it shall be evident that the filler nozzle of the off-board refilling system is the weak part of the coupling.

Drive-off nozzle disconnection incidents (also known as breakaway) shall follow national standards.

The following test in 5.4.2 and 5.4.3 shall be conducted separately.

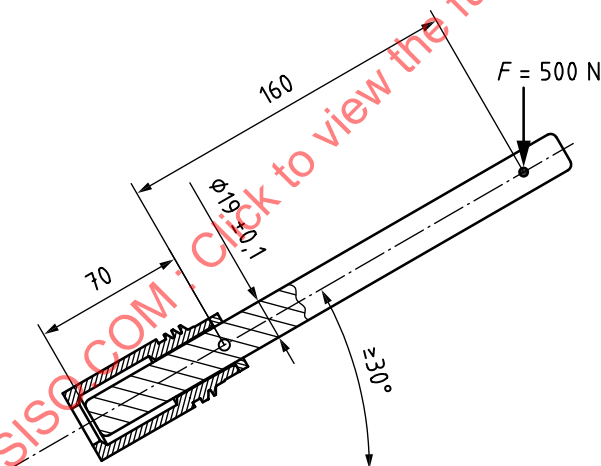
5.4.2 Testing simulating misuse

Testing shall be conducted with two dummy nozzles specified in Figure 6 and Figure 7. A force of 500 N shall be applied with each dummy nozzle.

The force F of 500 N shall be applied as shown in Figures 6 and 7. The test force shall be applied within 30 s after coupling dummy nozzle and shall be maintained for at least 30 s.

The test is considered passed if there is no damage on the filler neck in terms of functional characteristics of Table 1.

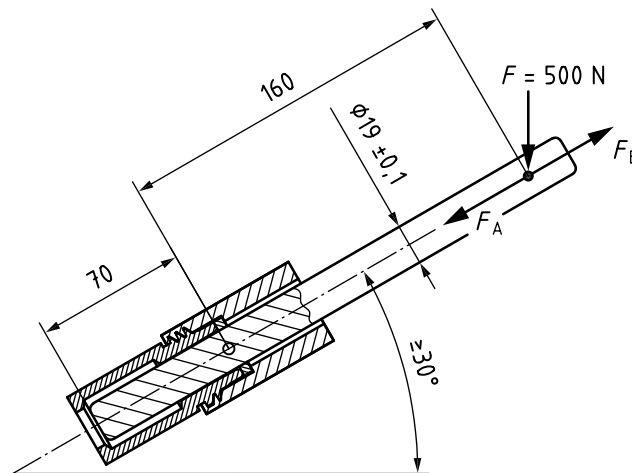
Dimensions in millimetres



NOTE The filler neck angle used in the test is depended on angles in the vehicle.

Figure 6 — Plug in dummy

Dimensions in millimetres



NOTE The filler neck angle used in the test is depended on angles in the vehicle.

Figure 7 — Screw-on dummy

5.4.3 Testing in axial direction

a) Static load

An axial force F_A of 500 N shall be applied using a screw-on dummy nozzle (see [Figure 7](#)). The screw-on dummy nozzle shall provide a rigid connection to a filler neck. The test force shall be applied within 30 s after coupling dummy nozzle and shall be maintained for at least 30 s.

b) Dynamic (impact test)

A test body as shown in [Figure 8](#) having the following characteristics shall be applied: A cylinder (tube) made of steel or aluminium, having:

- an outer diameter of 70 mm;
- a length of 100 mm;
- a mass of 1 kg; and
- corners of front face radiused 5 mm.

The test body shall impact the filler neck in the area of the sealing face. Loading of the filler neck shall be 3 J.