BS ISO 22241-5:2012

BSI Standards Publication

Diesel engines — NOx reduction agent AUS 32

Part 5: Refilling interface for passenger cars

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National foreword

This British Standard is the UK implementation of ISO 22241-5:2012.

The UK participation in its preparation was entrusted to Technical Committee MCE/22, Engines for road vehicles.

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

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First edition
2012-12-01

Diesel engines — NOx reduction agent AUS 32 —

Part 5: Refilling interface for passenger cars

Moteurs diesel — Agent AUS 32 de réduction des NOx —

Partie 5: Interface de remplissage pour voitures particulières

Reference number
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Foreword

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ISO 22241-5 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 5, *Engine tests*.

ISO 22241 consists of the following parts, under the general title *Diesel engines — NOx reduction agent AUS 32*:

— *Part 1: Quality requirements*

— *Part 2: Test methods*

— *Part 3: Handling, transportation and storing*

— *Part 4: Refilling interface*

— *Part 5: Refilling interface for passenger cars*

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Introduction

The refilling system specified in this part of ISO 22241 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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INTERNATIONAL STANDARD **ISO 22241-5:2012(E)**

Diesel engines — NOx reduction agent AUS 32 —

Part 5:
Refilling interface for passenger cars

1 Scope

This part of ISO 22241 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 may also be used by vehicles with a gross vehicle mass of over 3,5 t.

This part of ISO 22241 specifies the refilling interface for the NOx reduction agent AUS 32 in compliance with ISO 22241-1, which is needed to operate converters with selective catalytic reduction (SCR) exhaust treatment system. This part of ISO 22241 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 part of ISO 22241, the term “NOx reduction agent AUS 32” is abbreviated to “AUS 32”.

2 Normative references

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

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

3 Terms and definitions

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

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
container of size 1 to 10 litres capacity, with spout used to refill the vehicle on-board tank

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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 which is 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

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;

— mismatching prevention.

The detailed requirements specified in Table 1 apply.

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

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Table 1 — Basic functional requirements

No.	Characteristic	Requirements	Remark
1	Flow rate	Not less than 5 Litres per minute Not more than 10 Litres per minute	Flow rates do not apply to — canister filling; — production line filling.
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.	Feature required in compliance with EN 13012 or equivalent standards
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.	
4	Spillage	Less than 0,4 ml per refilling with filler neck angle from the horizontal ≥ 30°.	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, not more than 15 ppm ammonia concentration may be measured.	For test procedure see 5.3
7	Operational temperature range	– 30 °C to + 80 °C for components installed on the vehicle	
		– 20 °C to + 40 °C for components at the service station	
		For specific regions, the temperature range specified may not be sufficient. In such a case, a wider temperature range, representative of that specific region, shall be considered. For specific regions, the temperature range specified may be excessive. In such a case, a narrower temperature range, representative of that specific region, may be considered.	
8	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.

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Table 1 (*continued*)

No.	Characteristic	Requirements	Remark
9	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.	
10	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 shall be selected.	
11	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 compliance with state of the art.	
12	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 national regulations or vehicle manufacturers.	
13	Crystallization [REC]	Protection recommended	Contact with air should be minimized.
14	Marking [REC]	See symbol specified in ISO 2575 and see marking specified in ISO 22241-1. Or use equivalent standards.	Blue is the recommended colour for filler caps.
NOTE Characteristics marked [REC] are 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 x 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.

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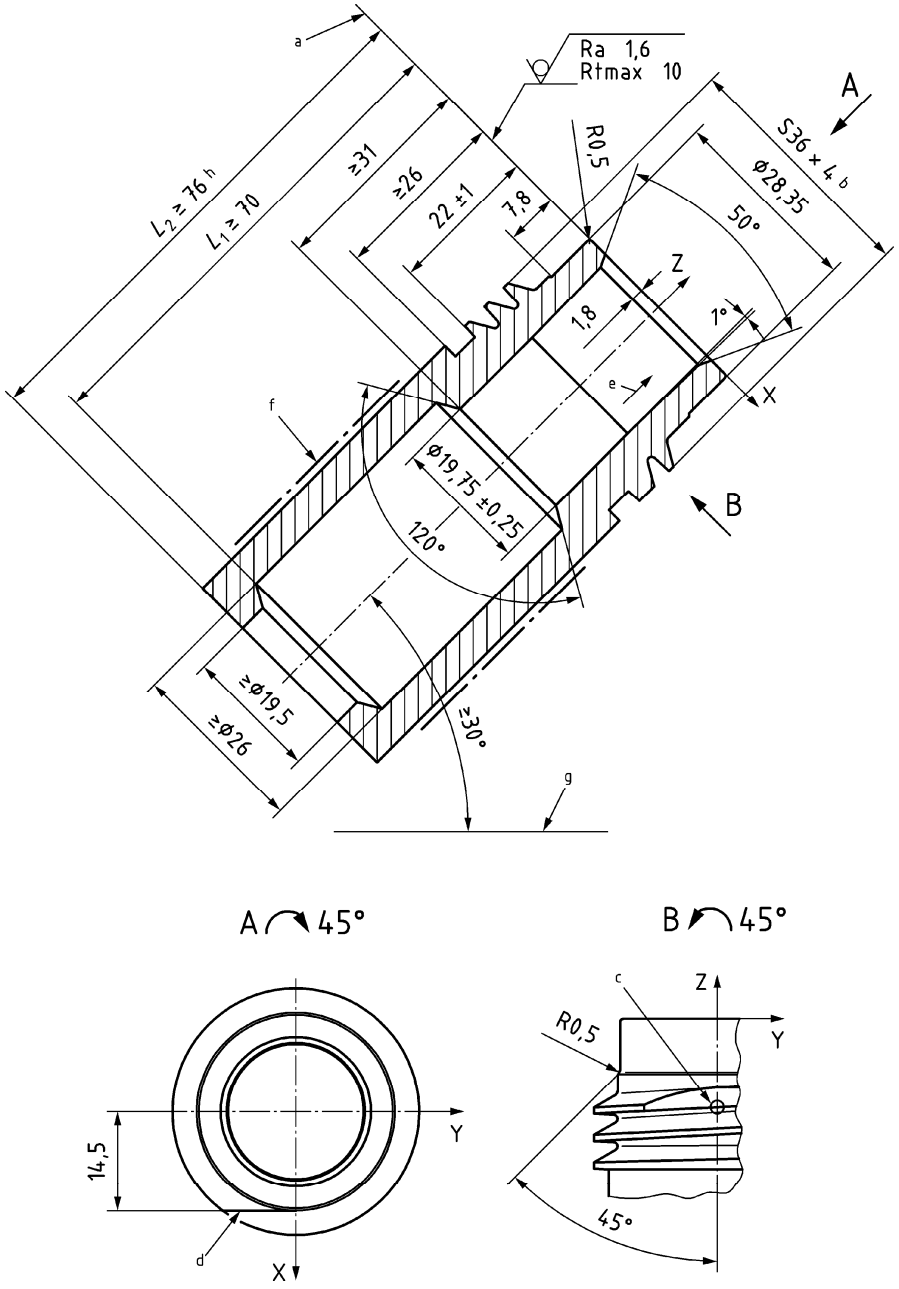
The vehicle manufacturer should be aware of the potential for insufficient venting with nozzle filling. One possibility for a design with improved venting capability is a filler neck with ribs as shown in Annex A.

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

Dimensions in millimetres



Key

a top surface of filler neck
b nominal dimension for thread details see Figure 2 and Table 2
c thread reference point at Y-Axis 0,0mm at Ø29,0 mm for measuring point for start of thread on Z-Axis
d position of surface thread start surface to adjust at six o'clock position
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

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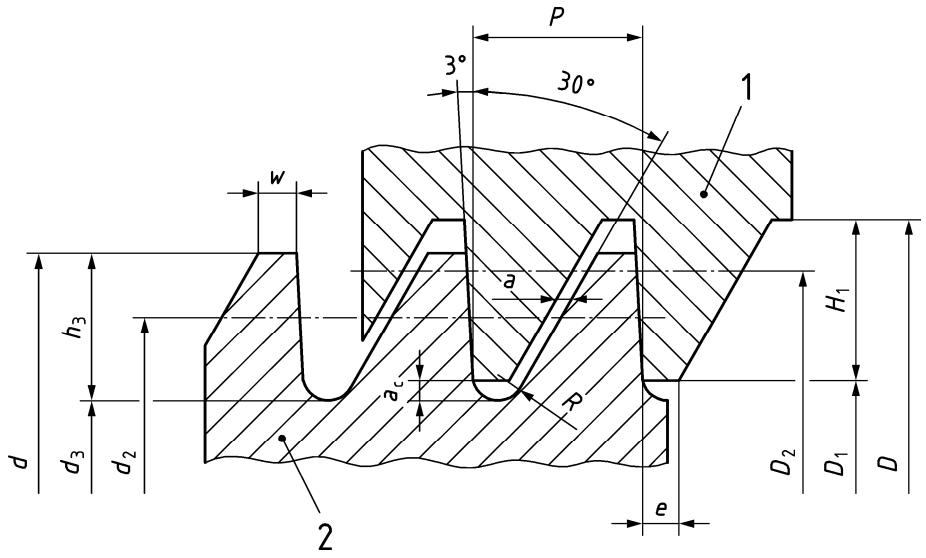

Key

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 shall be lower than +/- 3mbar five seconds after starting the refilling process. There shall be ambient pressure in the filler neck at the end of the filling process.

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Table 2 — Buttress 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

NOTE This table sheet is a calculation and is based on DIN 513 (see Bibliography). Tolerances are recommended to calculate in accordance to the material, etc.

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.

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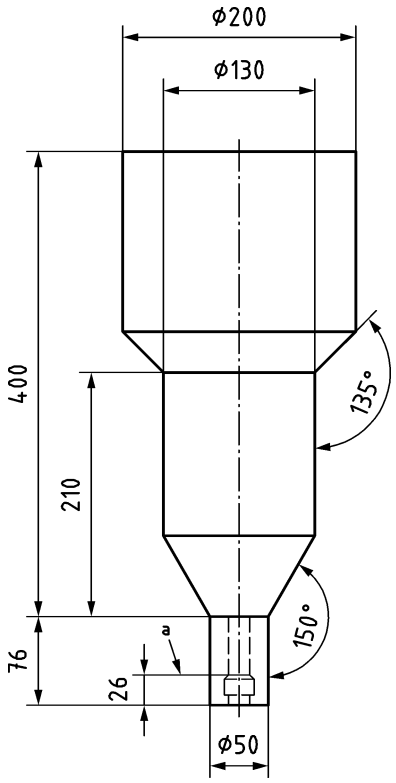
4.4.2 Minimum clearance "Class A"

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.

Dimensions in millimetres



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.

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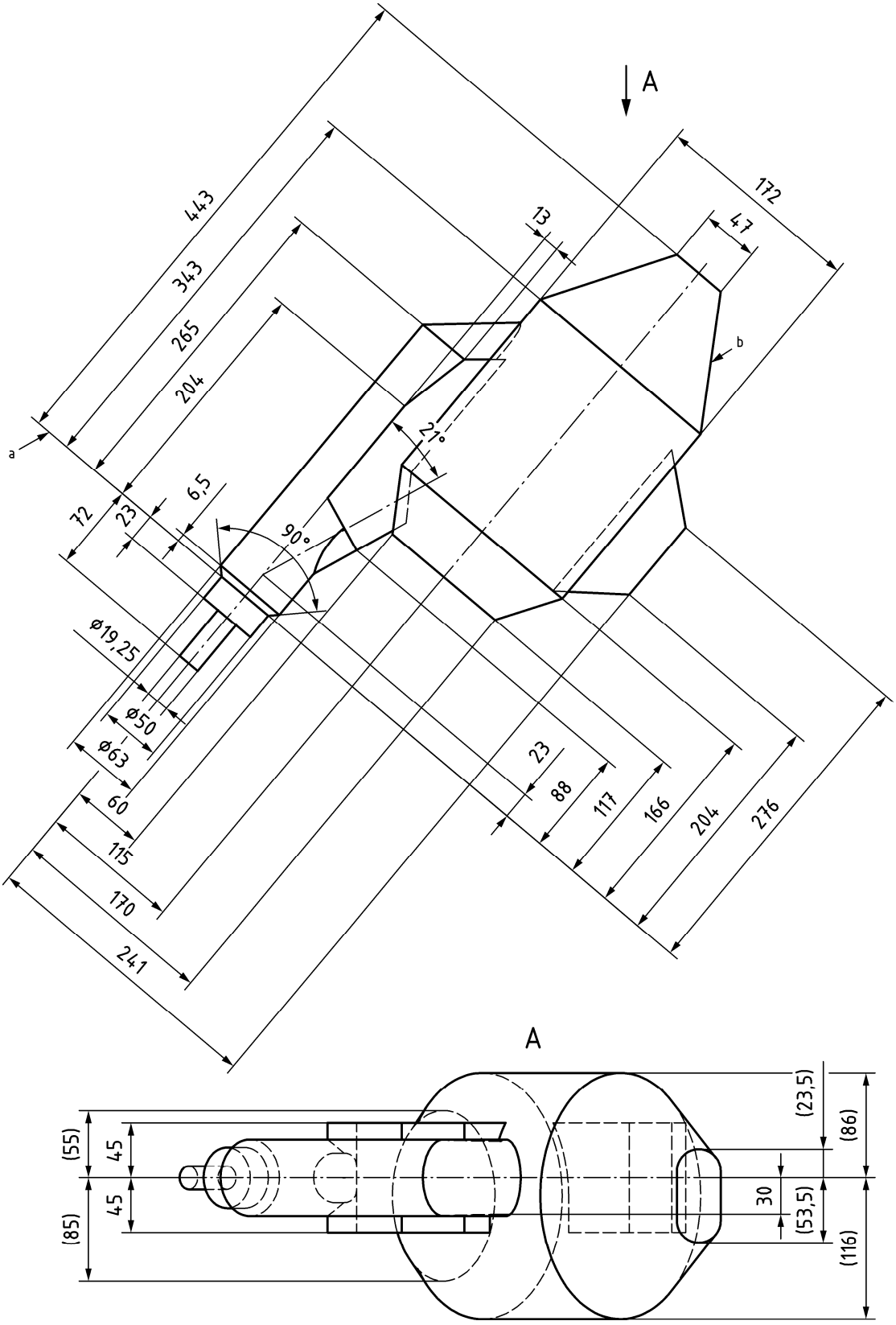
Dimensions in millimetres



Key

a top surface of filler neck (see Figure 1)

b free space for operator's hand

Figure 4 — Required free space "Class B"

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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. Compliance 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 compliance 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 standard 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.

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Dimensions in millimetres

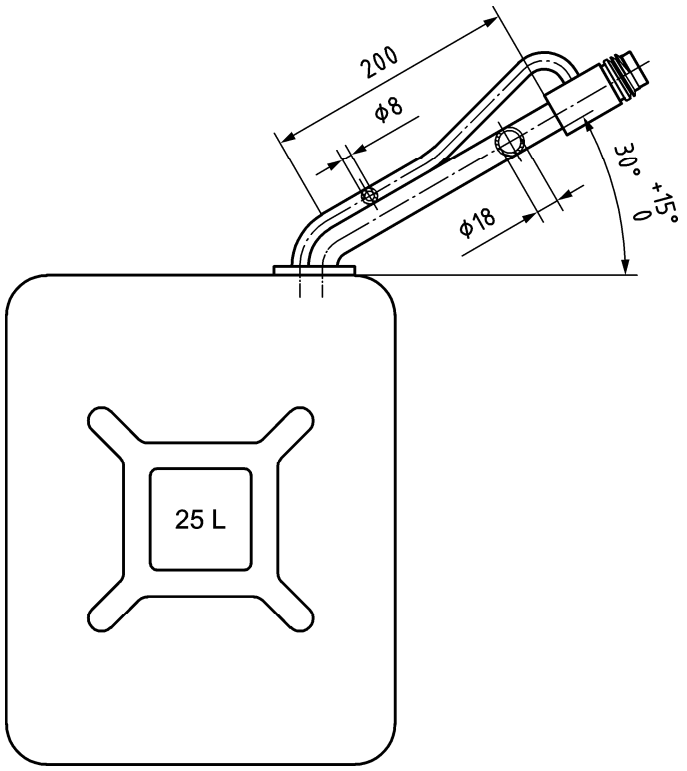

Figure 5 — Equipment for determination of smell

5.3.2 Preconditioning the system to establish constant test conditions

The container is filled with 5 l ±1 l of unused (new) AUS 32. The container is closed, stored in a heating cabinet at 60 °C for 96 hours. Then the container should be cooled down to room temperature (21 °C ± 5 °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 cm ± 5 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 l ±1 l of unused (new) AUS 32 at room temperature (21 °C ± 5 °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 m³ and having no mechanical air ventilation.

The measuring of the ammonia concentration should start from 30 s +/- 2 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 ppm.

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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 subclause 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 or laws.

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

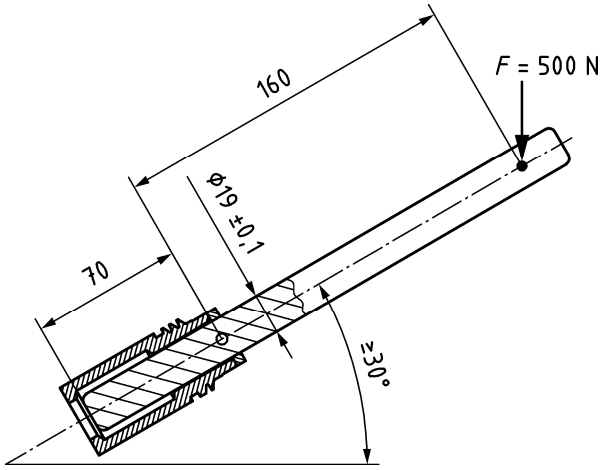
5.4.2 Testing simulating misuse

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

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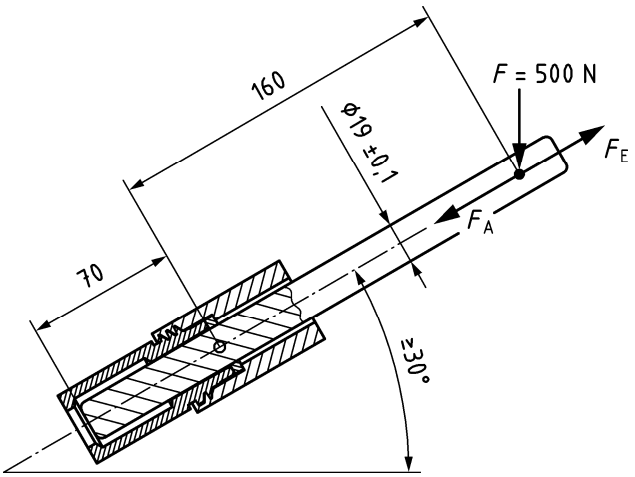
Dimensions in millimetres



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;
- 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.

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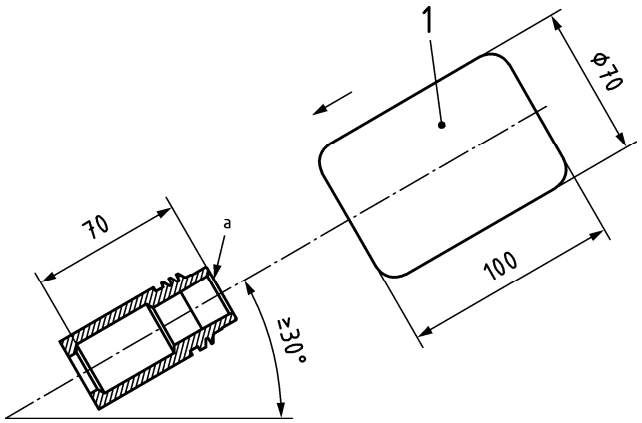
Dimensions in millimetres



Key

1 test body (m = 1 kg)

[a] apply impact on this face (3J)

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

Figure 8 — Dynamic impact test

c) Extraction force

A force F_E of 500 N as shown in Figure 7 shall be applied using a screw-on dummy nozzle. 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.

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

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Annex A
(informative)

Filler neck with ribs

The vehicle manufacturer 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 Figure A.1.

Dimensions in millimetres

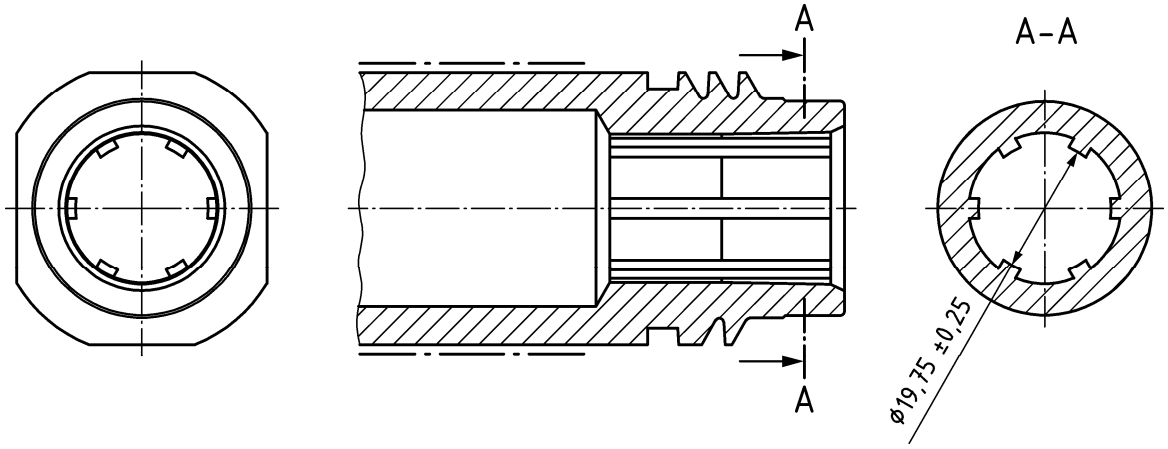

Figure A.1 — Filler neck with ribs

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