BRITISH STANDARD

BS ISO
22241-1:2006

Diesel engines — NOx reduction agent AUS 32 —

Part 1: Quality requirements

ICS 43.060.40

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of ISO 22241-1:2006. It supersedes DD ISO/PAS 22241-1:2005 which is withdrawn.

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

A list of organizations represented on MCE/22 can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2006

ISBN 0 580 49514 0

Amendments issued since publication

Amd. No.	Date	Comments

INTERNATIONAL STANDARD

ISO 22241-1

First edition
2006-10-15

Diesel engines — NOx reduction agent AUS 32 —

Part 1: Quality requirements

Moteurs diesel — Agent AUS 32 de réduction des NOx —

Partie 1: Exigences de qualité

Reference number
ISO 22241-1:2006(E)

Foreword

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ISO 22241-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 5, *Engine tests*.

This first edition cancels and replaces ISO/PAS 22241-1:2005, which has been technically revised.

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*

The following parts are under preparation:

— *Part 3: Packaging, transportation and storage*

— *Part 4: Refilling interface*

Annexes A, B and C are for information only.

Introduction

In order to protect the environment, keeping the air quality as clean as possible, exhaust emissions regulations around the world have been strengthened considerably. In motor vehicles with diesel engines, particulate matters (PM) and nitrogen oxide (NOx) emissions are the main concern, and efforts have been focused on the development of technology which can reduce them effectively with minimum fuel economy penalty. Selective catalytic reduction (SCR) converters using urea solution as the reduction agent is considered to be a key technology for reducing NOx emissions. The quality of the urea solution used for that technology needs to be specified to ensure reliable and stable operation of the SCR converter systems. The ISO 22241 series provides the specifications for quality characteristics, for handling, transportation and storage and for the refilling interface as well as the test methods, needed by the manufacturers of motor vehicles and their engines, by converter manufacturers, by producers and distributors of the urea solution and by fleet operators.

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Diesel engines — NOx reduction agent AUS 32 —

Part 1:
Quality requirements

1 Scope

This part of ISO 22241 specifies the quality characteristics of the NOx reduction agent AUS 32 (aqueous urea solution) which is needed to operate converters with selective catalytic reduction, so-called SCR (selective catalytic reduction) converters, in motor vehicles with diesel engines. SCR converters are particularly suitable for selectively reducing the nitrogen oxide (NOx) emissions of diesel engines.

In the remaining parts of ISO 22241, the term “NOx reduction agent AUS 32” will be abbreviated to “AUS 32”.

2 Normative references

The following referenced documents are indispensable for the application 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 3675, *Crude petroleum and liquid petroleum products — Laboratory determination of density — Hydrometer method*

ISO 4259, *Petroleum products — Determination and application of precision data in relation to methods of test*

ISO 12185, *Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method*

ISO 22241-2, *Diesel engines — NOx reduction agent AUS 32 — Part 2: Test methods*

3 Terms and definitions

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

3.1
NOx reduction agent AUS 32
aqueous urea solution, manufactured from technically pure urea – with no addition (see NOTE) of any other substances – and pure water, having a urea content of 32,5 % and with the quality characteristics defined in Clause 5

NOTE With the possible exception of a tracer in accordance with the requirement in Table 1.

3.2
technically pure urea
industrially produced grade of urea with traces of biuret, ammonia and water only, free of aldehydes or other substances such as anticaking agent, and free of contaminants such as sulphur and its compounds, chloride, nitrate or other compounds

NOTE For the contaminants mentioned above, which are not a result of the urea production process, limit values and analytical methods are not considered, as this definition excludes urea grades usually used in agriculture, which might contain such chemical compounds.

3.3
pure water
grade of water, produced for example by single distillation, by de-ionization, by ultra-filtration or by reverse osmosis

NOTE This is based on the definition of water grade 3 of ISO 3696.

4 Designation

AUS 32, in compliance with the requirements of this International Standard, shall be designated with the code AUS 32 and the reference number of this series of International Standards:

AUS 32 ISO 22241

5 Requirements and testing

The quality characteristics of the AUS 32 are specified in Table 1. They shall be continuously monitored by the manufacturer following a valid testing plan.

Compliance with the limits specified in Table 1 shall be verified with the test methods indicated.

NOTE 1 See Annex A with respect to the chemical characteristics of urea and the physical properties of AUS 32.

NOTE 2 See Annex B with respect to precision of the test methods.

6 Handling, transportation and storage

Recommendations for the logistics chain from the factory to the vehicle, in order to maintain the high quality of the product, are given in Annex C.

NOTE Requirements and recommendations for handling, transportation and storage will be specified in ISO 22241-3 which, once published, will replace Annex C.

7 Marking

Distribution pumps and containers for the distribution of AUS 32, in compliance with the requirements of this part of ISO 22241, shall be marked with the designation as specified in Clause 4.

Table 1 — Quality characteristics

Characteristics	Unit	Limits		Test methods
		min.	max.	
Urea content [a]	% (*m/m*) [d]	31,8	33,2	ISO 22241-2 Annex B [e] ISO 22241-2 Annex C [e]
Density at 20 °C [b]	kg/m^3	1 087,0	1 093,0	ISO 3675 or ISO 12185
Refractive index at 20 °C [c]	—	1,381 4	1,384 3	ISO 22241–2 Annex C
Alkalinity as NH_3	% (*m/m*) [d]	—	0,2	ISO 22241–2 Annex D
Biuret	% (*m/m*) [d]	—	0,3	ISO 22241–2 Annex E
Aldehydes	mg/kg	—	5	ISO 22241–2 Annex F
Insoluble matter	mg/kg	—	20	ISO 22241–2 Annex G
Phosphate (PO_4)	mg/kg	—	0,5	ISO 22241–2 Annex H
Calcium	mg/kg	—	0,5	ISO 22241–2 Annex I
Iron	mg/kg	—	0,5	
Copper	mg/kg	—	0,2	
Zinc	mg/kg	—	0,2	
Chromium	mg/kg	—	0,2	
Nickel	mg/kg	—	0,2	
Aluminium	mg/kg	—	0,5	
Magnesium	mg/kg	—	0,5	
Sodium	mg/kg	—	0,5	
Potassium	mg/kg	—	0,5	
Identity	—	identical to reference		ISO 22241–2 Annex J

Should it be necessary to add a tracer to AUS 32, it shall be ensured that the quality of AUS 32 specified in this Table is not impaired and that the tracer does not damage the SCR system.

NOTE 1 In establishment of these limit values, the terms of ISO 4259 have been applied in fixing a maximum and minimum value, a minimum difference of $4 \times R$ (R is the Reproducibility of the test method) has been taken into account. However, in case of urea content, the $4 \times R$ rule has not been applied in order to keep the high quality.

NOTE 2 The values quoted regarding urea content, density and refractive index are “true values” (see ISO 4259 for definition of true values).

NOTE 3 The manufacturer of AUS 32 should aim at the target values defined in footnotes a, b and c.

NOTE 4 Should it be necessary to clarify the questions as to whether a given urea solution meets the requirement of the specification, the terms of ISO 4259 should be applied.

[a] Target value 32,5 % (*m/m*).

[b] Target value 1 090,0 kg/m^3.

[c] Target value 1,382 9.

[d] For the purposes of this International Standard, the term “% (*m/m*)” is used to represent the mass fraction of a material.

[e] Calculated without subtracting nitrogen from ammonia.

Annex A
(informative)

Chemical characteristics

A.1 Chemical description of urea

Chemical formula:	$(NH_2)_2CO$;
Molar mass:	60,06 g/mol;
CAS-Nr.:	57-13-6 (CAS : Chemical Abstracts Service).

A.2 Physical properties of AUS 32

Aspect:	colourless clear liquid;
Incipient crystallization:	−11,5 °C;
Viscosity (at 25 °C):	approx. 1,4 mPa·s;
Thermal conductivity (at 25 °C):	approx. 0,570 W/m·K;
Specific heat (at 25 °C):	approx. 3,40 kJ/kg·K;
Surface tension (at 20 °C):	min. 65 mN/m.

Annex B
(informative)

Precision of test methods

Characteristics	Unit	Repeatability r	Reproducibility R
Urea content (total nitrogen)	% (m/m)	0,4	1,0
Urea content (refractive index)	% (m/m)	0,1	1,0
Refractive index	—	0,000 1	0,001
Density according to ISO 3675	kg/m^3	0,5	1,2
Density according to ISO 12185	kg/m^3	0,2	0,5
Alkalinity as NH_3	% (m/m)	0,01	$0,2 \times x$
Biuret	% (m/m)	0,01	0,04
Aldehydes	mg/kg	0,14	$0,5 \times x$
Insoluble matter	mg/kg	$0,23 \times x$	$0,38 \times x$
Phosphate (PO_4)	mg/kg	0,02	0,03
Calcium	mg/kg	0,02	$0,1 \times x$
Iron	mg/kg	0,01	$0,3 \times x$
Copper	mg/kg	0,01	$0,2 \times x$
Zinc	mg/kg	0,01	$0,3 \times x$
Chromium	mg/kg	0,01	$0,3 \times x$
Nickel	mg/kg	0,01	$0,3 \times x$
Aluminium	mg/kg	0,02	$0,3 \times x$
Magnesium	mg/kg	0,02	$0,3 \times x$
Sodium	mg/kg	0,03	$0,5 \times x$
Potassium	mg/kg	0,03	$0,5 \times x$

x is mean value.

NOTE 1 The precision of the test methods for determination of the density was taken from the existing ISO 3675 and ISO 12185.

NOTE 2 The precision of all other test methods referenced in this part of ISO 22241 was obtained in an interlaboratory test programme conducted in the year 2004 with 18 laboratories in Austria, Germany and the Netherlands participating. The data obtained were evaluated according to ISO 4259.

Annex C
(informative)

Handling, transportation and storage

Transportation of the AUS 32 should be in insulated tanks or in plastic containers.

Alloyed steels, various plastic materials and plastic-coated metal containers are suitable container materials. Non-alloyed steels, copper, copper-containing alloys and zinc-coated steels should not be used. Any other material not cited above should be tested regarding corrosion resistance and possible influences on the product specification.

The AUS 32 should leave the manufacturer for shipping at a temperature of 30 °C maximum.

To avoid crystal precipitation or hydrolysis of the AUS 32, storage at normal conditions (optimum up to 25 °C) is recommended.

Information on further properties of AUS 32 is given in the material safety data sheet, which contains indications on the hazard ranking and regulations to be respected as well as measures required to be taken for the protection of persons and of the environment when handling the product.

Bibliography

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

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