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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

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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 on 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 22241-1:2006), which has been technically revised. The main changes compared to the previous edition are as follows:

— the test method for measuring urea content by refractive index was revised;

— an alternate test method for measuring trace amounts of phosphorous by ICP-OES was added (a referee method is indicated); and

— the refractive index, nD20, limit values were 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

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 are 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.

The urea solution (AUS 32) as specified in this document is commercially available and may exist under various trade names[1)].

1) Trade names of products AdBlue®, ARLA 32®, DEF, etc. are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the products named.

Diesel engines — NOx reduction agent AUS 32 —

Part 1:
Quality requirements

1 Scope

This document specifies the quality characteristics of the NOx reduction agent AUS 32 (aqueous urea solution) which is needed to operate selective catalytic reduction (SCR) converter systems in motor vehicles with diesel engines. SCR converter systems are particularly suitable for selectively reducing the nitrogen oxide (NOx) emissions of diesel engines.

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 22241-2:2019, *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.

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
AUS 32
aqueous urea solution
DEF
diesel exhaust fluid
solution of *technically pure urea* (3.2) and *pure water* (3.3), having a urea content of 32,5 % (mass fraction), used as a NOx reduction agent in SCR converter systems

Note 1 to entry: The quality characteristics are defined in Clause 5.

3.2
technically pure urea
industrially produced grade of urea (CAS Number 57-13-6) 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 1 to entry: 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 can contain such chemical compounds.

3.3
pure water
water very low in inorganic, organic or colloidal contaminants, produced, for example, by single distillation, by deionization, by ultra-filtration or by reverse osmosis

3.4
manufacturer
AUS 32 (3.1) entity which produces AUS 32 finished product by dilution of virgin urea synthesis, dilution of concentrated urea solutions or dissolution of solid urea

3.5
nD20
refractive index
ratio of the velocity of light of a wavelength equivalent to the sodium D line in a vacuum to its velocity in the medium at 20 °C

3.6
production control plan
documentation of product/process characteristics, process controls, tests and measurement system that occur during serial production

Note 1 to entry: Further information on the content of a production control plan can be found in IATF 16949:2016, Section 8.5.1.1 and Annex A.

3.7
mass fraction
mass of a solute divided by the total mass of solution, expressed as a percent (%)

Note 1 to entry: "mass %" is often used in the AUS 32 community.

4 Designation

AUS 32 meeting the requirements of this document shall be designated in the following order:

a) The term AUS 32 or an alternative term appropriate for the region/locality of use.

b) Reference to this document.

EXAMPLE 1 AUS 32 ISO 22241-1

EXAMPLE 2 DEF ISO 22241-1

5 Requirements and testing

The quality characteristics of AUS 32 are specified in Table 1 and they shall be continuously monitored by the manufacturer following a production control plan.

Conformance with the limits in Table 1 shall be verified by the test methods indicated or other methods specified by a recognized standard. However, in the event of a dispute, the methods specified in Table 1 shall be considered the referee methods.

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

NOTE 2 See Table B.1 in relation to the precision of the test methods.

6 Handling, transportation and storage

In order to maintain the high quality of the product, recommendations for handling, transportation and storage in the logistics chain from the factory to the vehicle are specified in ISO 22241-3.

7 Marking

Retail distribution pumps and containers for the distribution of AUS 32, in conformance with the requirements of this document, shall be marked with the designation as specified in Clause 4.

Table 1 — Quality characteristics

Property	Unit	Limits		Test methods
		min.	max.	
Urea content[a]	% (mass fraction)	31,8	33,2	ISO 22241-2:2019, Annex B[b] ISO 22241-2:2019, Annex C[b]
Refractive index (nD20)	—	1,381 4	1,384 3	ISO 22241-2:2019, Annex C
Alkalinity as NH_3	% (mass fraction)	—	0,2	ISO 22241-2:2019, Annex D
Biuret	% (mass fraction)	—	0,3	ISO 22241-2:2019, Annex E
Aldehydes	mg/kg	—	5	ISO 22241-2:2019, Annex F
Insoluble matter	mg/kg	—	20	ISO 22241-2:2019, Annex G
Phosphate (PO_4)	mg/kg	—	0,5	ISO 22241-2:2019, Annex H ISO 22241-2:2019, Annex I[c]
Aluminium	mg/kg	—	0,5	ISO 22241-2:2019, Annex I
Calcium	mg/kg	—	0,5	
Chromium	mg/kg	—	0,2	
Copper	mg/kg	—	0,2	
Iron	mg/kg	—	0,5	
Potassium	mg/kg	—	0,5	
Magnesium	mg/kg	—	0,5	
Sodium	mg/kg	—	0,5	
Nickel	mg/kg	—	0,2	
Zinc	mg/kg	—	0,2	

If it is necessary to add a tracer to AUS 32, it should 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.

The values quoted for refractive index compensate for maximum allowable biuret content and should not be compared directly to the minimum and maximum values for urea mass fraction (%).

[a] Target value 32,5 % (mass fraction).

[b] Calculated without subtracting nitrogen from ammonia.

[c] Referee test method.

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).
Identity	(see ISO 22241-2:2019, Annex J)

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.
Density (at 20 °C)	between 1 087,0 and 1 093,0 kg/m^3

Annex B
(informative)

Precision of test methods

Values for the precision of the test methods are listed in Table B.1.

Table B.1 — Precision values

Characteristics	Test methods ISO 22241-2	Unit	Repeatability *r*	Reproducibility *R*
Urea content (by total nitrogen)	Annex B	% (mass fraction)	0,466[a]	1,053[a]
Urea content (by refractive index)	Annex C	% (mass fraction)	0,154	0,211
Refractive index nD20		—	0,000 25	0,000 33
Alkalinity as NH_3	Annex D	% (mass fraction)	0,077[a]	0,124[a]
Biuret	Annex E	% (mass fraction)	0,008[a]	0,044[a]
Aldehyde	Annex F	mg/kg	0,109[a]	0,464[a]
Insolubles	Annex G	mg/kg	4,871[a]	8,220[a]
Phosphate (PO_4)	Annex H	mg/kg	0,028[a]	0,075[a]
Phosphate (PO_4) measured as phosphorus	Annex I	mg/kg	0,003 (P) 0,009 (PO_4)	0,012 (P) 0,037 (PO_4)
Aluminium		mg/kg	0,02	0,06
Calcium		mg/kg	0,01	0,04
Chromium		mg/kg	0,01	0,03
Copper		mg/kg	0,01	0,02
Iron		mg/kg	0,02	0,04
Potassium		mg/kg	0,03	0,15
Magnesium		mg/kg	0,01	0,02
Sodium		mg/kg	0,01	0,03
Nickel		mg/kg	0,01	0,04
Zinc		mg/kg	0,01	0,03

[a] Users are warned that these precision estimates are based on inter-laboratory studies that failed to meet the requisite number of samples and degrees of freedom in accordance with ISO 4259 (all parts).