



**BSI Standards Publication**

## **Determination of the filtration efficiency of urea filter modules**

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# National foreword

This British Standard is the UK implementation of [ISO 23820:2023](#).

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 committee manager.

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## Determination of the filtration efficiency of urea filter modules

*Détermination de l'efficacité de filtration des modules de filtres à urée*



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## Foreword

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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 document 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](http://www.iso.org/directives)).

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This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

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](http://www.iso.org/members.html).

# Determination of the filtration efficiency of urea filter modules

## 1 Scope

This document specifies requirements relating to the testing method for AUS 32/diesel exhaust fluid (DEF) filters for the removal of suspended matter. This applies to urea filters dedicated to passenger vehicles as well as to commercial vehicles. This method applies to filters with flow rates from 3 l/h to 30 l/h depending on the application (by default 5 l/h for passenger vehicles and 25 l/h for commercial vehicles). This method can be used for other flow rates, provided the validation requirement can be met.

## 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 11218, *Aerospace — Cleanliness classification for hydraulic fluids*

ISO 11923, *Water quality — Determination of suspended solids by filtration through glass-fibre filters*

[ISO 21501-3](#), *Determination of particle size distribution — Single particle light interaction methods — Part 3: Light extinction liquid-borne particle counter*

## 3 Terms and definitions

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

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

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

### 3.1

#### **cumulative overall mean filtration efficiency**

$E_x$

cumulative efficiency calculated from the total number of particles greater than size  $x$  [ $\mu\text{m}$ ] counted upstream and downstream of a filter during the initial 60 min counting period at 5 mg/l

Note 1 to entry: The efficiency is expressed in [%].

### 3.2

#### **differential pressure**

$\Delta P$

pressure difference between the inlet and outlet of the complete filter unit measured under predetermined conditions

Note 1 to entry: The differential pressure generated by the complete filter is equal to the sum of the differential pressures generated by the housing and by the filter element (in case the filter element is removable from the housing).

Note 2 to entry: The differential pressure is expressed in kPa.

### 3.3 ISO MTD ISO medium test dust

siliceous test powder having a particle size distribution by volume in accordance with [ISO 12103-1](#), A3

Note 1 to entry: It may also be referred as [ISO 12103-1](#) A3 dust.

### 3.4 nominal flow rate $Q$

flow rate for the filter specified by the manufacturer

Note 1 to entry: The flow rate is expressed in l/h.

### 3.5 reference filtration rating $S$

dimension of the ISO MTD particles at which the overall mean cumulative filtration efficiency of the integral filter (or the filter element) tested in accordance with the procedure described in this document, is greater than or equal to 99 %

Note 1 to entry: The reference filtration rating is expressed in  $\mu\text{m}$ .

## 4 Symbols

The symbols used in this document are given in [Table 1](#).

**Table 1 — Symbols**

| Symbol                    | Parameter                                                                | Unit          |
|---------------------------|--------------------------------------------------------------------------|---------------|
| $C_e$                     | Test concentration                                                       | mg/l          |
| $C_i$                     | Injection concentration                                                  | mg/l          |
| $C_R$                     | Retention capacity                                                       | g             |
| $C_{NR}$                  | Concentration of the downstream fluid during the clogging period         | mg/l          |
| $C_{ov}$                  | Coefficient of variation                                                 | %             |
| $d$                       | Size of the particle                                                     | $\mu\text{m}$ |
| $\Delta P_0$              | Loss of pressure due to the clean filter alone                           | kPa           |
| $\Delta P_F$              | Loss of pressure at the end of the test                                  | kPa           |
| $E_x$                     | Cumulative efficiency at size greater than $x \mu\text{m}$               | %             |
| $M$                       | Mass of contaminant necessary for the test                               | g             |
| $M_{i1}$                  | Injected mass of contaminant in injection reservoir 1                    | g             |
| $M_{i2}$                  | Injected mass of contaminant in injection reservoir 2                    | g             |
| $N_{iUP} > x \mu\text{m}$ | $i^{\text{th}}$ particle count upstream at size $>x \mu\text{m}$         | -/ml          |
| $N_{iDW} > x \mu\text{m}$ | $i^{\text{th}}$ particle count downstream at size $>x \mu\text{m}$       | -/ml          |
| $Q$                       | Flow rate                                                                | l/h           |
| $Q_r$                     | Recirculation flow rate                                                  | l/h           |
| $Q_{C1}$                  | Injection flow rate circuit 1 (relative to the efficiency concentration) | l/h           |
| $Q_{C2}$                  | Injection flow rate circuit 2 (relative to the capacity concentration)   | l/h           |
| $S_{sc}$                  | Suspended solid concentration                                            | mg/l          |
| $V_{i1}$                  | Injection circuit N°1 fluid volume                                       | l             |

| Symbol          | Parameter                                                                | Unit |
|-----------------|--------------------------------------------------------------------------|------|
| $V_{i2}$        | Injection circuit N°2 fluid volume                                       | l    |
| $V_{iM}$        | Injection circuit maximum fluid volume                                   | l    |
| $V_{CP}$        | Recovered downstream volume during the clogging period                   | l    |
| $V_{CPV}$       | Recovered downstream volume during the validation of the clogging period | l    |
| $\Delta T_{CP}$ | Time duration of the clogging period                                     | h    |

## 5 Test procedures

### 5.1 Principle

The performance of the filter to be tested is determined by measuring its hydraulic and separative properties when subjected to a constant flow rate of water conveying a known quantity of contaminant. The test is performed with the water after passage through clean-up filters to produce a single pass configuration. The test is conducted in two stages.

The first stage determines the initial efficiency of the test filter. It is conducted with a contaminant concentration of 5 mg/l upstream to the test filter for 60 min. The second stage determines the mass of contaminant needed to reach a specified differential pressure. This stage is conducted with an upstream concentration of 800 mg/l, or as specified according to the customer specification. The retention capacity shall be determined from the mass of contaminant required for obtaining a predetermined differential pressure of 10 kPa or other value according to customer's specifications. Several operating parameters are specified as a function of the type of filter under test, e.g. the standard flow rate of 5 l/h is recommended for testing a standard urea filter module for passenger vehicles and 25 l/h for commercial vehicles, unless otherwise specified.