INTERNATIONAL STANDARD

ISO 12103-1

Third edition

Road vehicles — Test contaminants for filter evaluation —

Part 1: Arizona test dust

Véhicules routiers — Poussière pour l'essai des filtres —

Partie 1: Poussière d'essai d'Arizona

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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 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).

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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 third edition cancels and replaces the second edition (ISO 12103-1:2016), which has been technically revised.

The main changes are as follows:

— A0 (0 to 5) µm test dust was added.

A list of all parts in the ISO 12103 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

This document specifies five grades of test dusts made from Arizona desert sand composed of naturally occurring compounds which motor vehicles are commonly subjected to. These test dusts are used to determine performance of filtration systems. Due to the abrasive characteristics of these materials, they have also been used in wear studies involving bearings, internal combustion engines and fuel injection systems, seals, fan blades, windshield wipers, etc.

This document specifies particle size distribution of five grades of test dust by volume percent as opposed to number characterization.

Dusts complying with volume distribution specified in this document are not appropriate for calibration of particle counters. For this purpose, refer to ISO 11171.

This is an Arizona test dust standard, not other region document. Other dusts and documents can be brought forward to the committee to be developed into a standard.

Road vehicles — Test contaminants for filter evaluation —

Part 1: Arizona test dust

1 Scope

This document defines particle size distribution and chemical content limits involving five grades of test dust made from Arizona desert sand.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

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/

4 Test dust description

ISO test dusts according to this document are manufactured from Arizona desert sand. Arizona desert sand is a naturally occurring contaminant consisting primarily of silicon dioxide with smaller amounts of other compounds. It is collected from the Salt River area of Arizona desert and sized to specific particle size. Refer to Annex B for the history of Arizona test dust and to Annex C for the proper handling of the material.

Arizona desert sand has also been referred to as Arizona road dust, Arizona test dust, Arizona silica, AC fine or coarse test dust, and SAE fine or coarse test dust.

Bulk density of ISO test dusts made from Arizona sand varies with particle size (see Table 1).

Table 1 — Bulk density

Category	Approximate bulk density, kg/m^3
ISO (0 to 5) µm	500
ISO ultrafine	500
ISO fine	900
ISO medium	1 025
ISO coarse	1 200

5 Test dust designation

Arizona test dusts are available in five standard grades designated as follows:

— ISO 12103-1, A0 (0 to 5) µm test dust;

— ISO 12103-1, A1 ultrafine test dust;

— ISO 12103-1, A2 fine test dust;

— ISO 12103-1, A3 medium test dust;

— ISO 12103-1, A4 coarse test dust.

6 Particle size distribution

Particle size distribution is determined using a light scattering particle size analyser, as referenced in ISO 13320.

Table 2 specifies cumulative volume particle size limits for ISO test dusts made from Arizona desert sand, when determined using a Microtrac Model S3500™[1)] particle size analyser per Annex A.

When the different type analyser is employed by a test laboratory, the laboratory should generate suitable correlation data between the analyser by which these powders are supplied to conform [Microtrac[1] analyser] and by the analyser adopted by the test laboratory.

Table 2 — Particle size distributions (volume % less than)

Size, micrometre	**A0 (0 to 5) µm**	**A1 ultrafine**	**A2 fine**	**A3 medium**	**A4 coarse**
352,00	—	—	—	—	100,0
248,90	—	—	—	100,0	99,0 to 100,0
176,00	—	—	100,0	99,0 to 100,0	97,2 to 98,2
124,50	—	—	99,0 to 100,0	97,2 to 98,6	93,0 to 94,0
88,00	—	—	97,9 to 98,9	94,7 to 96,0	85,0 to 86,5
44,00	—	—	89,5 to 91,5	82,0 to 83,5	58,0 to 60,0
22,00	100,0	100,0	73,5 to76,0	62,5 to 64,5	36,0 to 38,5
11,00	98,9 to 99,3	95,5 to 97,5	57,0 to 59,5	42,3 to 43,6	21,0 to 23,0
5,50	90,3 – 92,7	65,0 – 69,0	39,5 – 42,5	22,1 – 23,2	11,5 – 12,5
2,75	57,9 – 61,8	23,0 – 27,0	21,3 – 23,3	10,3 – 11,1	5,5 – 6,3
1,38	20,5 – 23,0	7,0 – 10,0	8,0 – 9,5	3,8 – 4,4	1,8 – 2,1
0,97	11,0 – 12,6	3,0 – 5,0	4,5 – 5,5	2,0 – 2,4	0,74 – 0,83

NOTE Data shown per Table 2 was determined using the particle size analysis instrument indicated in Annex A. Use of any other particle size analysis equipment will obtain different results.

7 Chemical composition

7.1 Typical chemical content of ISO specified Arizona test dusts

See Table 3.

1) Microtrac and Microtrac Model S3500 are trademarks. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

Table 3 — Chemical content

Element	Percentage of mass
Silicon	69,0 to 77,0
Aluminium	8,0 to 14,0
Iron	4,0 to 7,0
Potassium	2,0 to 5,0
Calcium	2,5 to 5,5
Sodium	1,0 to 4,0
Magnesium	1,0 to 2,0
Titanium	0,0 to 1,0

7.2 Chemical analysis methodology — X-ray fluorescence analysis (XRF)

Chemical analysis is performed using an X-ray fluorescence analyser per ASTM C114-15.

Annex A
(normative)

Analysis equipment and operating procedure

A.1 Particle size analyser

A.1.1 General

Particle size data of ISO specified Arizona test dusts as shown in Table 2, were determined using a Microtrac Model S3500™ light scattering type analyser. Use of any other particle size analysis equipment will obtain different results. Other particle size analysis instruments may be acceptable for analysis of test dust products specified in this document, if suitability and correlation is determined between the Microtrac Model S3500™ and the other analyser. Use of particle size analysis instruments other than the Microtrac Model S3500™ will require a modified particle size analysis procedure.

The Microtrac Model S3500™ employs use of three light scattering lasers that are combined to produce the resulting particle size distribution data. A tri-laser system uses precise angular measurement of scattered light through a full 180° angular range with three lasers and two detector arrays. Analysis of scattered light to determine particle size employs a Mie based unified angular scattering theory with a dynamic range of 0,02 µm to 2 800 µm (see Table A.1).

Normally, it is not acceptable to publish a manufacturer's name or equipment identification. However, due to the close tolerance of the specified particle size limits and variation between instruments by multiple manufacturers, one particle size analysis instrument was defined for this specification.

Particle size distribution specified limits shown in Table 2 were derived from sample analysis of PTI manufactured test dust produced prior to May 1994 using three separate Microtrac Model S3500™ light scattering analysers.

Table A.1 — Microtrac Model S3500™ specifications

Item	Specification
Measuring range	0,02 µm to 2 800 µm
Basic range	Wet 0,7 µm to 1 000 µm
High range	Wet 2,75 µm to 2 800 µm
Standard range	Wet 0,24 µm to 1 400 µm
Special range	Wet 0,086 µm to 1 400 µm
Extended range	Wet 0,021 µm to 2 000 µm
Enhanced range	Wet 0,021 µm to 2 800 µm
Precision	Spherical glass beads D50 = 642 µm, Precision as CV = 0,7 Spherical glass beads D50 = 56 µm, Precision as CV = 1,0 % Spherical latex beads D50 = 0,4 µm, Precision as CV = 0,6 %
Lasers	Wavelength 780 nm
Power	3 mW nominal
Detection system	Two fixed photo-electric detectors with logarithmically spaced segments placed at correct angles for optimal scattered light detection. 0,02° to 163° using 151 detector segments.

