INTERNATIONAL STANDARD

ISO 12103-1

Second edition
2016-03-01

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

Reference number
ISO 12103-1:2016(E)

© ISO 2016

COPYRIGHT PROTECTED DOCUMENT

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

© ISO 2016 – All rights reserved

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 meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This second edition cancels and replaces the first edition (ISO 12103-1:1997), which has been technically revised.

ISO 12103 consists of the following parts, under the general title *Road vehicles — Test contaminants for filter evaluation*:

— *Part 1: Arizona test dust*

— *Part 2: Aluminium oxide test dust*

The following parts are under preparation:

— *Part 3: Soot aerosol*

© ISO 2016 – All rights reserved

Introduction

This part of 12103 specifies four 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 part of ISO 12103 specifies particle size distribution of four grades of test dust by volume percent as opposed to number characterization.

Dusts complying with volume distribution specified in this part of ISO 12103 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 part of ISO 12103 defines particle size distribution and chemical content limits involving four grades of test dust made from Arizona desert sand.

2 Test dust description

ISO test dusts according to this part of ISO 12103 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.

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 ultrafine	500
ISO fine	900
ISO medium	1 025
ISO coarse	1 200

3 Test dust designation

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

- ISO 12103-1, A.1 ultrafine test dust;
- ISO 12103-1, A.2 fine test dust;
- ISO 12103-1, A.3 medium test dust;
- ISO 12103-1, A.4 coarse test dust.

4 Particle size distribution

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

© ISO 2016 – All rights reserved

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

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, µm	**A1 ultrafine**	**A2 fine**	**A3 medium**	**A4 coarse**
352,00	—	—	—	100,0
248,90	—	—	100,0	99,0 – 100,0
176,00	—	100,0	99,0 – 100,0	97,2 – 98,2
124,50	—	99,0 – 100,0	97,2 – 98,6	93,0 – 94,0
88,00	—	97,9 – 98,9	94,7 – 96,0	85,0 – 86,5
44,00	—	89,5 – 91,5	82,0 – 83,5	58,0 – 60,0
22,00	100,0	73,5 – 76,0	62,5 – 64,5	36,0 – 38,5
11,00	95,5 – 97,5	57,0 – 59,5	42,3 – 43,6	21,0 – 23,0
5,50	65,0 – 69,0	39,5 – 42,5	22,1 – 23,2	11,5 – 12,5
2,75	23,0 – 27,0	21,3 – 23,3	10,3 – 11,1	5,5 – 6,3
1,38	7,0 – 10,0	8,0 – 9,5	3,8 – 4,4	1,8 – 2,1
0,97	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 normative Annex A. Use of any other particle size analysis equipment will obtain different results.

5 Chemical composition

5.1 Typical chemical content of ISO specified Arizona test dusts

See Table 3.

Table 3 — Chemical content

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

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

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

---

1) Microtrac and Microtrac 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.

© ISO 2016 – All rights reserved

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 ISO 12103-1, if suitability and correlation is determined between the Microtrac S3500™ and the other analyser. Use of particle size analysis instruments other than the Microtrac 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 microns to 2 800 microns (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 micron to 2 800 micron
Basic range	Wet 0,7 micron to 1 000 micron
High range	Wet 2,75 micron to 2 800 micron
Standard range	Wet 0,24 micron to 1 400 micron
Special range	Wet 0,086 micron to 1 400 micron
Extended range	Wet 0,021 micron to 2 000 micron
Enhanced range	Wet 0,021 micron to 2 800 micron
Precision	Spherical Glass Beads D50 = 642 micron, Precision as CV = 0,7 % Spherical Glass Beads D50 = 56 micron, Precision as CV = 1,0 % Spherical Latex Beads D50 = 0,4 micron, Precision as CV = 0,6 %
Lasers	Wavelength 780 nm

Table A.1 *(continued)*

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.
Data handling	Volume, Number and Area distributions as well as percentile and other summary data. Data are stored in ODBC format in encrypted Microsoft Access Databases to ensure compatibility with external statistical software applications. Data integrity may be ensured using FDA 21 CFR Part 11 compliant security features including password protection, electronic signatures and assignable permissions.

A.1.2 Microtrac S3500™ particle size analysis procedure

A.1.2.1 Sample preparation

Typical sample preparation is as follows.

a) It is important to ensure the sample taken is representative of the lot of test dust to be tested and mixed well before placing into a clean 20 ml to 50 ml sample vial.

b) Obtain a clean vial and add the required representative sample quantity based on Table A.2.

Table A.2 — Microtrac S3500™ Sample Weights

ISO grade	Sample amount in mg
ISO ultrafine	14-16
ISO fine	29-31
ISO medium	39-41
ISO coarse	54-56

c) Add one drop of dispersant to the vial. It is very important that dispersant used does not create bubbles.

d) Add approximately 10 ml distilled water to the vial and mix by gently moving the vial in a circular motion. Avoid creating bubbles.

e) Place sample vial and contents in an external low power ultrasonic bath, having a water depth of 2 cm, for 30 s. The ultrasonic bath should be in the range of 50 W to 100 W, 50 kHz to 80 kHz. Do not use the Microtrac internal ultrasonic as it may cause bubbles.

A.1.2.2 Analyser software sample set-up

Analyser software sample set-up is done as follows.

a) Open the Microtrac FLEX software program.

b) Click “Measure” on the main program window and select S3500/S3000.

c) Click “File” and select “Open Measurement Database”, select appropriate database for the material being analysed.

d) Click “SOP” (Standard Operating Procedure) icon on the measure toolbar. Click Options button to setup appropriate measurement setup parameters. Set measurement parameters per the followings:

   1) Timing tab is set as follows:

      — Set Zero time = 30 s;

- Run time = 30 s;
- Number of runs = 3.

2) Identifier tab is used to enter general information if desired.

3) Analysis tab is set using the following tabs:

   i) Particle information tab:

      I) Select Refractive Index of 1,51 and save with the appropriate particle name.

      II) Particle characteristics box:

      - Set transparency; Transparent;
      - Set Shape; Irregular.

   ii) Fluid information tab:

      - Select fluid; water;
      - Select refractive index; 1,333.

   iii) Analysis options tab:

      - Select S3000 from Analysis Mode drop down list;
      - Select Enabled Standard from Filter drop down list.

   iv) Sample loading tab is used to enter user defined loading index limits for each grade per Table A.2.

Table A.3 — Microtrac S3500^{TM} loading index limits

ISO grade	Loading index limits
ISO ultrafine	0,89 – 0,90
ISO fine	0,86 – 0,87
ISO medium	0,86 – 0,87
ISO coarse	0,87 – 0,88

   v) Perspective tab is set as follows:

      - Select Geom 4 Root from Progression drop down list;
      - Select Volume from the Distribution drop down list.

   vi) SDC tab is set as follows:

      I) SDC options; Set the following parameters:

      - Number of Rinses = 3;
      - Number of Deaerate Cycles = 3;
      - Flow = 55.

      II) Click OK button when all parameters have been entered.

        III) Enter appropriate name in the SOP Name to Save or Delete box on the Measurement SOP dialogue box and then click the save button.

e) Open the identifiers (ID) tab. Set the identifiers per the following:

    1) Enter material description in the title section, i.e. ISO 12103-1, A.2 fine test dust.

    2) Enter ID in first line of Sample ID section.

f) Click “Flow” icon on SDC/ASVR toolbar on the right side of the measurement window to start the recirculator.

g) Click “S/Z” (set zero) icon on the measure toolbar. After the set zero is successfully completed, the time will appear on the upper left portion of the screen highlighted in green.

h) Click the “Load Sample” (LD) icon on the measure toolbar.

A.1.2.3 Sample loading and analysis

Obtain a clean pipette and load prepared sample into recirculator making sure the entire sample is loaded without creating bubbles. The indicator bar shall be within the transmission range (green zone) when the entire sample has been loaded. If excess sample has been loaded abort the procedure, rinse recirculator and start over.

Operate icons per the following.

- Click “Run” icon on the measurement bar.
- Click the print icon when sample run is completed.

A.2 Instrument calibration

The Microtrac S3500™ analyser cannot be calibrated by the user, but National Institute of Standards and Technology traceable glass powder sold by the manufacturer can be used to verify the analyser is working correctly. Analysis of NIST traceable glass beads should be performed at least every six months.

A secondary calibration material shall be used to verify the analyser is operating correctly. Analysis of the secondary calibration material shall immediately follow analysis of the batch of test dust analysed. Secondary calibration material used shall be from a prior batch of the same grade of test dust being analysed.

© ISO 2016 – All rights reserved

Annex B
(informative)

History of Arizona test dust

During the 1930s, air intake cleaning devices became widely used by engine manufacturers for use in reducing particulates ingested by internal combustion engines. By 1940, the SAE Journal indicated a need for a standardized test contaminant to evaluate performance of air cleaner systems. The 1943 edition of the SAE Handbook recommends collecting test dust by placing canvas cloth on the ground behind tractors or implements in the Salt River Valley, Arizona, USA.

During following years, a more controlled method of producing large volumes of test dust was required. As a result, the AC Spark Plug Company, division of General Motors Corporation, devised a method of manufacturing test dust by ball milling Arizona desert sand. Two grades of test dust were produced to the following particle size specification given in Table B.1, as published in former SAE J726 Air Cleaner Test Standard, and analysed for particle size using a Roller™[2] analyser.

Table B.1 — Particle size distribution by mass %

Size, µm	**Fine grade**	**Coarse grade**
0 – 5	39 ± 2	12 ± 2
5 – 10	18 ± 3	12 ± 3
10 – 20	16 ± 3	14 ± 3
20 – 40	18 ± 3	23 ± 3
40 – 80	9 ± 3	30 ± 3
80 – 200	—	9 ± 3

In 1979, AC Spark Plug began using a Leeds and Northrup Microtrac™ laser diffraction particle size analyser, in place of the Roller™ analyser, to determine particle size distributions of AC Fine and Coarse Test Dusts. AC indicated that considerable correlation testing between the L and N Microtrac™ and Roller™ analysers was performed and in 1982 requested that SAE subcommittees revise fine and coarse test dust particle size specifications per Table B.2.

Table B.2 — Particle size distribution by volume % (as measured with an L and N Microtrac™ analyser)

Size, µm	**Fine grade**	**Coarse grade**
5,5	38 ± 3	13 ± 3
11	54 ± 3	24 ± 3
22	71 ± 3	37 ± 3
44	89 ± 3	56 ± 3
88	97 ± 3	84 ± 3
176	100	100

---

2) Roller is a trademark. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

AC Rochester (formerly AC Spark Plug Company) ceased production of AC fine and coarse test dusts in August 1992. AC™ fine[3] and AC™ coarse[4] were also referred to as air cleaner fine (ACFTD) and air cleaner coarse (ACCTD). These dusts were ball mill processed and are no longer available.

During 1981, Powder Technology, Inc. (PTI) began formulating test contaminants for the filtration and aerospace industries. PTI used a Coulter Counter TAII™ [5]analyser to determine particle size of test dusts. The published specification during 1982 for standardized fine and coarse Arizona test dusts was the Roller™ table shown previously as Table B.1.

PTI originally produced SAE fine and coarse test dusts according to the distributions listed per Table B.1 using the Coulter Counter TAII™ analyser as a means of size measurement.

The Coulter Counter TAII™ instrument originally used by Powder Technology, Inc. became obsolete and was replaced with a Coulter Multisizer IIe™ [6]analyser May 1994. Particle size designation of ISO test dusts described in ISO 12103-1:1997 reflect Coulter Multisizer IIe™ correlation data derived from analysis of samples of PTI manufactured test dusts produced prior to May 1994. ISO 12103-1:1997 provided cumulative volume particle size limits in Table B.3.

Table B.3 — Particle size distribution as measured by Coulter Multisizer IIe™

Size, µm	ISO 12103-1:2016, A.1 ultrafine (% less than)	ISO 12103-1:2016, A.2 fine (% less than)	ISO 12103-1:2016, A.3 medium (% less than)	ISO 12103-1:2016, A.4 coarse (% less than)
1	1,0 – 3,0	2,5 – 3,5	1,0 – 3,0	0,6 – 1,0
2	9,0 – 13,0	10,5 – 12,5	4,0 – 5,5	2,2 – 3,7
3	21,0 – 27,0	18,5 – 22,0	7,5 – 9,5	4,2 – 6,0
4	36,0 – 44,0	25,5 – 29,5	10,5 – 13,0	6,2 – 8,2
5	56,0 – 64,0	31,0 – 36,0	15,0 – 19,0	8,0 – 10,5
7	83,0 – 88,0	41,0 – 46,0	28,0 – 33,0	12,0 – 14,5
10	97,0 – 100	50,0 – 54,0	40,0 – 45,0	17,0 – 22,0
20	100	70,0 – 74,0	65,0 – 69,0	32,0 – 36,0
40	—	88,0 – 91,0	84,0 – 88,0	57,0 – 61,0
80	—	99,5 – 100	99,0 – 100	87,5 – 89,5
120	—	100	100	97,0 – 98,0
180	—	—	—	99,5 – 100
200	—	—	—	100

ISO test dusts according to this part of ISO 12103 are produced by a dry jet milling process. Particle size distributions are not identical to former dusts produced by AC Rochester Corporation, a division of GM. Therefore, efficiency and dust capacity of filters tested with this part of ISO 12103 test dusts may deviate from results obtained with former dusts.

Revision of the first edition of this part of ISO 12103 proposed by PTI in 2010 was approved by ISO committee members because the Coulter Multisizer IIe™ became obsolete and its replacement with a Microtrac S3500™ was judged to be rational. The proposed particle size limits in Table 2 were determined by multiple analyses of historical samples used to determine the particle size limits specified in ISO 12103-1:1997.

---

3) AC fine is a trademark. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

4) AC coarse is a trademark. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

5) Coulter Counter TAII is a trademark. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

6) Coulter Multisizer IIe is a trademark. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of the product named.

© ISO 2016 – All rights reserved

Annex C
(informative)

Handling and preparation

C.1 Preparation prior to use

Care should be taken in preparation of test dusts because stratification or agglomeration of particles may occur during shipping and handling. Stratification of particles involves formation of layers of particles of differing sizes within a vessel containing test dust. Stratification is caused by natural migration of particles propelled by vibration during handling or storage. Although no documented scientific studies have been conducted relative to stratification of Arizona test dust particles, it is possible that coarse particles migrate to the top and fine particles concentrate near the bottom of storage containers. Therefore, it is recommended that test dusts be mixed or reblended immediately preceding use.

Test dusts may retain or absorb moisture during the manufacturing process or in storage. Moisture content of test dusts is not considered significant relative to many types of testing involving these materials. However, sensitive or closely controlled test programs may require that test dust be dried in an oven prior to use.

C.2 Health hazards in handling test dusts

Health hazards are identified by the following causes and effects:

a) **Eye contact**. (Acute/chronic) exposure to airborne dust may cause immediate or delayed irritation or inflammation of the cornea.

b) **Inhalation**. (Chronic) Inhalation exposure to free silica may cause delayed lung injury, including silicosis, a disabling and potentially fatal lung disease, and/or cause or aggravate other lung diseases or conditions.

c) **Skin contact**. This material contains sodium oxide and calcium oxide, which may be harmful or irritating to skin.

d) **Ingestion**. No adverse effects.

e) **Carcinogenic potential**. This material contains respirable crystalline silica (quartz). Crystalline silica (quartz) inhaled from occupational sources is classified as carcinogenic to humans.

NOTE Potential health effects might vary depending upon the duration and degree of exposure.

C.3 First aid measures

First aid measures should be taken per the following:

a) **Eyes**. Immediately flush eye thoroughly with water. Get medical attention if irritation persists.

b) **Skin**. Wash with soap and water. Seek medical attention if irritation persists.

c) **Inhalation**. Remove person to fresh air. If breathing is difficult, administer oxygen. If not breathing, give artificial respiration. Seek medical help if coughing and other symptoms do not subside.

d) **Ingestion**. Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician if discomfort is experienced.

C.4 Fire fighting measures

Fire fighting measures are not necessary because of the following descriptions:

a) **Flash point**. N/A.

b) **Auto ignition temperature**. Not combustible.

c) **Flammable limits**. N/A.

d) **Lower explosive limit**. None.

e) **Upper explosive limit**. None.

f) **Special fire fighting procedures**. None.

g) **Extinguishing media**. Not combustible.

h) **Unusual fire and explosion hazards**. None.

i) **Hazardous combustion products**. None.

C.5 Accidental release measures

Accidental release measures should be taken per the following:

a) **Respiratory protection**. Use local exhaust or general dilution ventilation to control dust levels below applicable exposure limits. Minimize dispersal of dust into the air. Use appropriate approved respiratory protection for respirable crystalline silica.

b) **Eye protection**. Wear safety glasses with side shields or goggles to avoid contact with the eyes. In extremely dusty environments and unpredictable environments, wear tight-fitting unvented or indirectly vented goggles to avoid eye irritation or injury.

c) **Methods for cleanup**. Use a vacuum or other appropriate cleaning device that does not generate airborne dust.

C.6 Handling and storage

Handling and storage should be done per the following:

a) **Handling**. Use adequate ventilation and dust collection.

b) **Storage**. Store in a manner so that airborne dust does not exceed applicable exposure limits. Store material in a closed container.

C.7 Exposure controls/personal protection

Exposure controls and personal protection should be done per the following:

a) **Local exhaust ventilation**. Use sufficient local exhaust ventilation to reduce the level of airborne respirable crystalline silica.

b) **Respiratory protection**. Use appropriate, approved respiratory protection for respirable crystalline silica.

c) **Hand protection**. Hand protection is not needed, as the material does not pose a health risk to skin.

d) **Eye protection**. Wear safety glasses with side shields or goggles to avoid contact with the eyes. In extremely dusty environments and unpredictable environments, wear tight-fitting unvented or indirectly vented goggles to avoid eye irritation or injury.

© ISO 2016 – All rights reserved

e) **Skin protection**. Skin protection is not needed, as the material does not pose a health risk to skin.

C.8 Physical and chemical properties

Physical and chemical properties are as follows:

a) **Appearance**. Tan, brown, light brown, reddish brown.

b) **Odor**. No odor**.**

c) **Physical state**. Solid.

d) **Boiling point**. 2 212 °C.

e) **Flash point**. Non-flammable.

f) **Flammability**. Non-flammable.

g) **Explosive properties**. Not explosive.

h) **Oxidizing properties**. N/A.

i) **Vapor pressure**. N/A.

j) **Specific gravity (H_20 = 1,0)**. 2,65.

k) **Solubility in water**. Insoluble**.**

l) **Vapor density**. Not applicable.

m) **Fat solubility**. Insoluble**.**

n) **Melting point**. 1 615 (±75) °C.

C.9 Stability and reactivity

Stability and reactivity are characterized as follows:

a) **Stability**. Product is stable.

b) **Incompatibility** (materials to avoid). Strong acids.

c) **Hazardous decomposition**. Will not occur.

d) **Hazardous polymerization**. Will not occur.

e) **Conditions to avoid**. None.

C.10 Toxicology information

C.10.1 Potential health effects

Potential health effects may vary depending upon the duration and degree of exposure. To reduce or eliminate health hazards associated with this product, use exposure controls or personal protection methods as described in C.7.

C.10.2 Eye contact

(Acute/chronic) Exposure to airborne dust may cause immediate or delayed irritation or inflammation of the cornea.

© ISO 2016 – All rights reserved

C.10.3 Inhalation

The following are concerns regarding inhalation.

a) The major concern is silicosis, caused by the inhalation and retention of respirable crystalline silica dust. Silicosis can exist in several forms, chronic (or ordinary), accelerated, or acute. Chronic or ordinary silicosis (often referred to as simple silicosis) is the most common form of silicosis, and can occur after many years of exposure to relatively low levels of airborne respirable crystalline silica dust. It is further defined as either simple or complicated silicosis. Simple silicosis is characterized by lung lesions (shown as radiographic opacities) less than 1 cm in diameter, primarily in the upper lung zones. Often, simple silicosis is not associated with symptoms, detectable changes in lung function or disability.

b) Simple silicosis may be progressive and may develop into complicated silicosis or progressive massive fibrosis (PMF). Complicated silicosis or PMF is characterized by lung lesions (shown as radiographic opacities) greater than 1 cm in diameter. Although there may be no symptoms associated with complicated silicosis or PMF, the symptoms, if present, are shortness of breath, wheezing, cough and sputum production. Complicated silicosis or PMF may be associated with decreased lung function and may be disabling.

c) Advanced complicated silicosis or PMF may lead to death. Advanced complicated silicosis or PMF can result in heart disease secondary to the lung disease (corpumonale). Accelerated Silicosis can occur with exposure to high concentrations of respirable crystalline silica over a relatively short period; the lung lesions can appear within five (5) years of initial exposure. Progression can be rapid. Accelerated silicosis is similar to chronic or ordinary silicosis, except that lung lesions appear earlier and progression is more rapid.

d) Acute silicosis can occur with exposures to very high concentrations of respirable crystalline silica over a very short time period, sometimes as short as a few months. The symptoms of acute silicosis include progressive shortness of breath, fever, cough and weight loss. Acute silicosis is fatal.

C.10.4 Carcinogenic potential

The International Agency for Research on Cancer ("IARC") concluded that there was "*sufficient evidence* in humans for the carcinogenicity of crystalline silica in the forms of quartz or cristobalite from occupational sources", and that there is "*sufficient evidence* in experimental animals for the carcinogenicity of quartz and cristobalite."

NOTE 1 The overall IARC evaluation was that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is *carcinogenic to humans* (*Group 1*)."

NOTE 2 The IARC evaluation noted, "Carcinogenicity was not detected in all industrial circumstances studies. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." For further information on the IARC evaluation, see IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 68, and "Silica, Some Silicates..." (1997).

C.11 Ecological information

No ecological concerns have been identified.

C.12 Disposal considerations

All disposal methods shall be in accordance with all local laws and regulations. Regulations may vary in different locations. Waste characterization and compliance with applicable laws are the responsibility solely of the waste generator.

The packaging and material may be land filled; however, material should be covered to minimize generation of airborne dust.

© ISO 2016 – All rights reserved

C.13 Transportation information

Arizona test dusts are treated in transportation as follows:

- UN number not assigned;
- Not classified as dangerous goods under ADR (road), RID (train) or IMDG (ship).

© ISO 2016 – All rights reserved

Bibliography

[1] ISO 11171, *Hydraulic fluid power — Calibration of automatic particle counters for liquids*

[2] ISO 13319, *Determination of particle size distributions — Electrical sensing zone method*

[3] ISO 13320, *Particle size analysis — Laser diffraction methods*

[4] SAE J726, *Specification — Air Cleaner Test Code (June 1993 Revision)*

[5] BS 3406-51983, *Determination of particle size of powders*

[6] ASTM C114-15,7) *Standard Test Methods for Chemical Analysis of Hydraulic Cement*

[7] AIR CLEANER TEST CODE SAE 1943 Edition

[8] SAE Air Cleaner Test Code Subcommittee Minutes 24 February 1992

[9] Microtrac S3500TM operation manual

---

7) Replaced ASTM C114-13.

© ISO 2016 – All rights reserved

ICS 43.060.40; 43.060.20
Price based on 14 pages

© ISO 2016 – All rights reserved