



SLOVENSKI STANDARD

SIST ISO 13317-1:2002

01-junij-2002

8 c`c Yj Ub`Y[fUbi `UM`Y`n`a YrcXUa][fUj]HUM`g_Y`gYX]a YbHUM`Y`j `HY_c]b]!`%`XY.
Gd`c`ybU`bU YU]b`ga Yfb]W

Determination of particle size distribution by gravitational liquid sedimentation methods --
Part 1: General principles and guidelines

iTeh STANDARD PREVIEW

Détermination de la distribution granulométrique par les méthodes de sédimentation par
gravité dans un liquide -- Partie 1: Principes généraux et lignes directrices

[SIST ISO 13317-1:2002](https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9540ca46ab6/sist-iso-13317-1-2002)

Ta slovenski standard je istoveten z:

ISO 13317-1:2001

ICS:

19.120

Analiza velikosti delcev.
Sejanje

Particle size analysis. Sieving

SIST ISO 13317-1:2002

en

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST ISO 13317-1:2002

<https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ea46ab6/sist-iso-13317-1-2002>

INTERNATIONAL STANDARD

ISO
13317-1

First edition
2001-05-01

Determination of particle size distribution by gravitational liquid sedimentation methods —

Part 1: General principles and guidelines

STANDARD PREVIEW
*Détermination de la distribution granulométrique par les méthodes de
sédimentation par gravité dans un liquide —*

Partie 1: Principes généraux et lignes directrices

[SIST ISO 13317-1:2002](https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ea46ab6/sist-iso-13317-1-2002)

<https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ea46ab6/sist-iso-13317-1-2002>



Reference number
ISO 13317-1:2001(E)

© ISO 2001

ISO 13317-1:2001(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST ISO 13317-1:2002

<https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ea46ab6/sist-iso-13317-1-2002>

© ISO 2001

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Page

Foreword.....	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms, definitions and symbols.....	2
4 Principles.....	4
5 Particle size, shape and porosity limitations.....	5
6 Test conditions	7
7 Sampling.....	8
8 Preparation for a sedimentation analysis	8
9 Tests in duplicate and validation	9
10 Reporting of results.....	10
Annex A (informative) The effect of measurement zone height	11
Annex B (informative) Accuracy of Stokes law as a function of Reynolds number	13
Annex C (informative) Particle displacement due to Brownian motion.....	14
Annex D (informative) Effect of open pores on the terminal velocity of spherical particles.....	15
Bibliography	17

ISO 13317-1:2001(E)

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 13317 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13317-1 was prepared by Technical Committee ISO/TC 24, *Sieves, sieving and other sizing methods*, Subcommittee SC 4, *Sizing by methods other than sieving*.

ISO 13317 consists of the following parts, under the general title *Determination of particle size distribution by gravitational liquid sedimentation methods*:

- *Part 1: General principles and guidelines*
- *Part 2: Fixed pipette method*
- *Part 3: X-ray gravitational technique*

Annexes A to D of this part of ISO 13317 are for information only.

Introduction

Gravitational sedimentation particle size analysis methods are among those in current use for determining size distribution of many powders. Typically, the gravitational methods apply to samples in the 0,5 μm to 100 μm size range and where the sedimentation condition for a Reynolds number $< 0,25$ is satisfied.

No single method of size analysis can be specified to cover the many different types of material encountered, but it is possible to recommend procedures that may be applied in the majority of cases. The purpose of this part of ISO 13317 is to obtain uniformity in procedure for any gravitational method selected to facilitate comparisons of size analysis made in different laboratories.

Gravitational sedimentation methods may be undertaken:

- as part of a research project involving an investigation of the particle size distribution of a material;
- as part of a control procedure for the production of a material where the particle size distribution is important;
- as the basis of a contract for the supply of material specified to be within stated specification limits.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST ISO 13317-1:2002

<https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ea46ab6/sist-iso-13317-1-2002>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST ISO 13317-1:2002

<https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ea46ab6/sist-iso-13317-1-2002>

Determination of particle size distribution by gravitational liquid sedimentation methods —

Part 1: General principles and guidelines

1 Scope

This part of ISO 13317 covers methods for determining the particle size distributions of particulate materials, typically in the size range 0,5 µm to 100 µm, by gravitational sedimentation in a liquid.

NOTE This part of ISO 13317 may involve hazardous materials, operations and equipment. This part of ISO 13317 does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this part of ISO 13317 to establish appropriate safety and health practices and to determine the applicability of the regulatory limitations prior to its use.

The methods of determining the particle size distribution described in this part of ISO 13317 are applicable to slurries or to particulate materials which can be dispersed in liquids. A positive density difference between the discrete and continuous phases is necessary, although gravitational photosedimentation can be used for emulsions where the droplets are less dense than the liquid in which they are dispersed. Particles should not undergo any physical or chemical change in the suspending liquid. The usual precautions need to be taken with hazardous material, and explosion proof analysers are required when examining volatile liquids with a low flash point.

[SIST ISO 13317-1:2002](https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ca46ab6/sist-iso-13317-1-2002)

<https://standards.iteh.ai/catalog/standards/sist/347b9a58-69a7-4530-80e1-a9340ca46ab6/sist-iso-13317-1-2002>

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13317. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13317 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 758, *Liquid chemical products for industrial use — Determination of density at 20 °C.*

ISO 787-10, *General methods of test for pigments and extenders — Part 10: Determination of density — Pyknometer method.*

ISO 2591-1, *Test sieving — Part 1: Methods using test sieves of woven wire cloth and perforated metal plate.*

ISO 8213, *Chemical products for industrial use — Sampling techniques — Solid chemical products in the form of particles varying from powders to coarse lumps.*

ISO 9276-1, *Representation of results of particle size analysis — Part 1: Graphical representation.*

ISO 13317-2, *Determination of particle size distribution by gravitational liquid sedimentation methods — Part 2: Fixed pipette method.*

ISO 13317-3, *Determination of particle size distribution by gravitational liquid sedimentation methods — Part 3: X-ray gravitational technique.*

ISO 14887, *Sample preparation — Dispersing procedures for powders in liquids.*

ISO 13317-1:2001(E)

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this part of ISO 13317, the following terms and definitions apply.

3.1.1

terminal settling velocity

velocity of a particle through a still liquid at which the force due to gravity on the particle is balanced by the drag exerted by the liquid

3.1.2

Stokes diameter

equivalent spherical diameter of the particle that has the same density and terminal settling velocity as the real particle in the same liquid under creeping flow conditions

3.1.3

open pores

cavities that are connected to the external surface of the particle either directly or via one another

3.1.4

closed pores

cavities that are closed off by surrounding solid and are inaccessible to the external surface

3.1.5

oversize

portion of the charge which has not passed through the apertures of a stated sieve

3.1.6

undersize

portion of the charge which has passed through the apertures of a stated sieve

3.1.7

effective particle density

particle mass divided by the volume of liquid it displaces

3.1.8

true particle density

particle mass divided by the volume it would occupy excluding all pores, closed or open, and surface fissures

NOTE True particle density is sometimes referred to as the absolute particle density.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST ISO 13317-1:2002

<https://standards.iteh.ai/en/standards/SIST-ISO-13317-1-2002-4530-80e1-a9340ca46ab6/sist-iso-13317-1-2002>

3.2 Symbols

For the purposes of this part of ISO 13317, the following symbols apply.

Quantity	Symbol	Unit	Derivative unit
Effective particle density	ρ_s	$\text{kg}\cdot\text{m}^{-3}$	$\text{g}\cdot\text{cm}^{-3}$
Liquid density	ρ_l	$\text{kg}\cdot\text{m}^{-3}$	$\text{g}\cdot\text{cm}^{-3}$
True particle density (no porosity)	ρ_p	$\text{kg}\cdot\text{m}^{-3}$	$\text{g}\cdot\text{cm}^{-3}$
Liquid viscosity	η	$\text{Pa}\cdot\text{s}$	$\text{mPa}\cdot\text{s}$
Acceleration due to gravity	g	$\text{m}\cdot\text{s}^{-2}$	—
Sedimentation distance	h	m	mm
Sedimentation time	t	s	—
Stokes diameter	x_{St}	m	μm
Upper Stokes diameter	$x_{\text{St,U}}$	m	μm
Lower Stokes diameter	$x_{\text{St,L}}$	m	μm
Particle diameter exiting measurement zone	$x_{\text{St},h}$	m	μm
Particle diameter entering measurement zone	$x_{\text{St},h\Delta h}$	m	μm
Terminal settling velocity	v_t	$\text{m}\cdot\text{s}^{-1}$	$\mu\text{m}\cdot\text{s}^{-1}$
Reynolds number	Re	dimensionless	—
Grouped parameter	K_1	$\text{m}\cdot\text{s}^{-1}$	—
Grouped parameter	K_2	$\text{m}^3\cdot\text{s}^{-1}$	—
Hyperbolic scan constant	K_{scan}	$\text{m}\cdot\text{s}$	—
Boltzmann constant	k	$\text{J}\cdot\text{K}^{-1}$	—
Absolute temperature (Kelvin)	T	K	—
Particle porosity	ε	dimensionless	—
Fraction of open particle porosity filled with sedimentation liquid	f	dimensionless	—
Fractional uncertainty of particle position due to thermal diffusion	f_{diff}	dimensionless	—
Statistical average positional change in one direction for large number of particles due to thermal diffusion	Δh_{diff}	m	μm
Thickness of measurement zone	Δh_{zone}	m	μm
Resolution ratio	P	dimensionless	—
Minimum acceptable resolution	P_{min}	dimensionless	—
Zone-height-limited resolution	P_{zone}	dimensionless	—
Minimum settling distance for acceptable resolution, P_{min}	$h_{\text{zone},P_{\text{min}}}$	m	μm