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International Standard

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Fine bubble technology — Domestic applications —

Part 1:

Assessment of showerhead devices by evaluating size and concentration indices of generated fine bubbles

ISO/TC 281

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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Requirements	2
4.1 Sample.....	2
4.2 Measuring instruments.....	2
5 Environment	2
6 Evaluation	2
6.1 General.....	2
6.2 Setting of fine bubble showerhead device to retention container.....	3
6.3 One-way flow.....	4
6.3.1 General.....	4
6.3.2 System configuration.....	4
6.3.3 Evaluation procedure for the one-way flow.....	5
6.4 Circulation flow.....	6
6.4.1 General.....	6
6.4.2 System configuration.....	6
6.4.3 Evaluation procedure for the circulation flow.....	7
7 Test report	7
Annex A (informative) Example of results for microbubbles using the one-way flow	9
Annex B (informative) Example of results for ultrafine bubbles using the circulation flow	10
Annex C (informative) Water service standards for water pressure in different countries	11
Annex D (informative) Example of test systems to evaluate the shower head device	12
Annex E (normative) Test report requirements for conformity assessment application	14
Bibliography	15

Foreword

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This document was prepared by Technical Committee ISO/TC 281, *Fine bubble technology*.

A list of all parts in the ISO 7428 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.

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Introduction

Fine bubble technology has recently seen growth in its application to markets such as cleaning, water treatment, agriculture and aquaculture and biomedical fields. To clarify the efficacy and the efficiency of fine bubbles, the characteristics of fine bubbles should be evaluated accurately. The most important characteristics of fine bubbles are the number or volume concentration and size indices of the fine bubbles produced by the fine bubble generating systems.

Above all, fine bubble showerhead devices have been extensively used as most popular fine bubble generating devices at home. Therefore, standardization of evaluation for fine bubble showerhead device should be accelerated to maintain the reputation of fine bubble technology as an advanced technology used for consumer products all over the world.

The evaluation method for size and concentration indices of fine bubbles is the basis for fair and appropriate business of fine bubble showerhead devices, which can introduce the dissemination of fine bubble products.

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Fine bubble technology — Domestic applications —

Part 1:

Assessment of showerhead devices by evaluating size and concentration indices of generated fine bubbles

1 Scope

This document specifies the evaluation method for size and concentration indices of fine bubbles generated from the fine bubble showerhead device. It is only applicable to fine bubble dispersion in water generated from fine bubble showerhead devices using air. It describes the sampling method for fine bubble dispersion in water from the fine bubble showerhead devices into the retention container and the measurement procedure of size and concentration indices.

NOTE The discharging drive force for fine bubble showerhead devices is applied using a pump or water pressure. Therefore, the test of the subject device is performed under environmental conditions including such a practical environment.

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 20480-1, *Fine bubble technology — General principles for usage and measurement of fine bubbles — Part 1: Terminology*

ISO 20298-1, *Fine bubble technology — Sampling and sample preparation for measurement — Part 1: Ultrafine bubble dispersion in water*

ISO 21910-1, *Fine bubble technology — Characterization of microbubbles — Part 1: Off-line evaluation of size index*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20480-1 and the following 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

fine bubble showerhead device

device driven by the outer water pressure and applied to discharge fine bubble dispersion in water into the air or water in the form of a spray or shower of water droplets

4 Requirements

4.1 Sample

To reduce the influence of particulate contaminants and to keep the accuracy of measurement, the fine bubble dispersions in water used to test fine bubble showerhead devices shall be generated using cleaned test systems with clean water and clean air.

The purity level of water and air depends on the purpose of the test.

The fine bubble dispersion shall not contain stabilizing agents such as surfactants.

If the measurement accuracy of size and concentration indices is very important (for example, in the case of application to the accreditation of fine bubble business), the water purity level of ISO Grade 1 (see ISO 3696) and the air cleanliness of ISO Class 5 (see ISO 14644-1) are recommended for the water and the air used for generating the fine bubble dispersion (FBD).

4.2 Measuring instruments

When the measuring instruments are selected for evaluating the size and concentration indices of fine bubbles generated from showerhead device, the following requirements for the concentration and the size range shall be considered. These requirements depend on the characteristics of the sample to be evaluated.

- a) The total number concentration and total volume concentration of the entire sample generated from the fine bubble showerhead devices including fine bubbles and contaminants (solid and liquid particles) shall be measured. Raw water can be used for diluting the FBD when the concentration is too high for the measurement technique in question.
- b) The size range of the entire sample including fine bubbles, contaminants and aggregates of contaminants shall be measured. Different measuring instruments can be used to confirm the larger aggregates.

NOTE The particle tracking analysis method can be used for evaluation of number concentration, and the laser diffraction method can be used for the evaluation of volume concentration. ISO/TR 23015 can be referred to for details of measurement techniques, which can be used for FBD in water.

[ISO/FDIS 7428-1](https://www.iso.org/standard/7428-1)

5 Environment

The air cleanliness should be considered for the measurement to prevent the introduction of impurities. Ambient temperature and atmospheric pressure should be stable to maintain the stability of the size and concentration of fine bubbles.

Air cleanliness, ambient temperature and atmospheric pressure depend on the local environment and can vary. However, as they are important settings and can influence the evaluation process, they should be recorded prior to any evaluation occurring.

If the measurement accuracy of size and concentration indices is very important, (for example, in the case of application to the accreditation of fine bubble business), the air cleanliness of ISO Class 7 (see ISO 14644-1) is recommended as the environment for generation and measurement of a FBD in water.

6 Evaluation

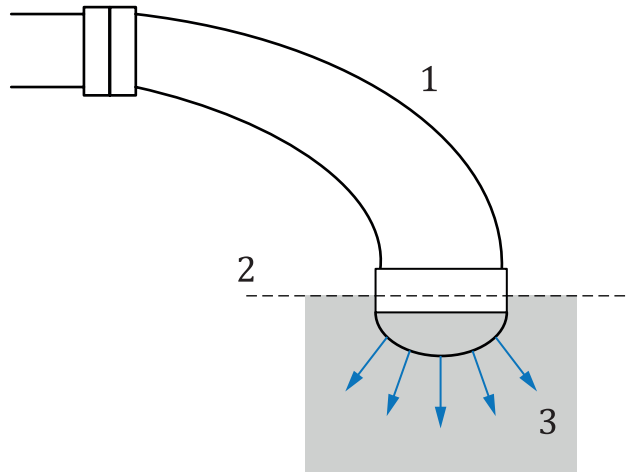
6.1 General

When evaluating the size and concentration indices of fine bubbles generated from the fine bubble showerhead device, the one-way flow configuration shall be used. However, the circulation flow configuration shall be used in the case that signal from UFB is too low to measure because of the low concentration of UFB.

6.2 Setting of fine bubble showerhead device to retention container

As shown in [Figure 1](#), the fine bubble showerhead device shall be set to fix all the discharge holes of the fitted showerhead device so that they are submerged below the water surface. The water surface level can be maintained by overflow from retention container.

To prevent the destruction of fine bubbles by collision, sufficient distance is necessary between the discharge holes and the wall or bottom of retention container.

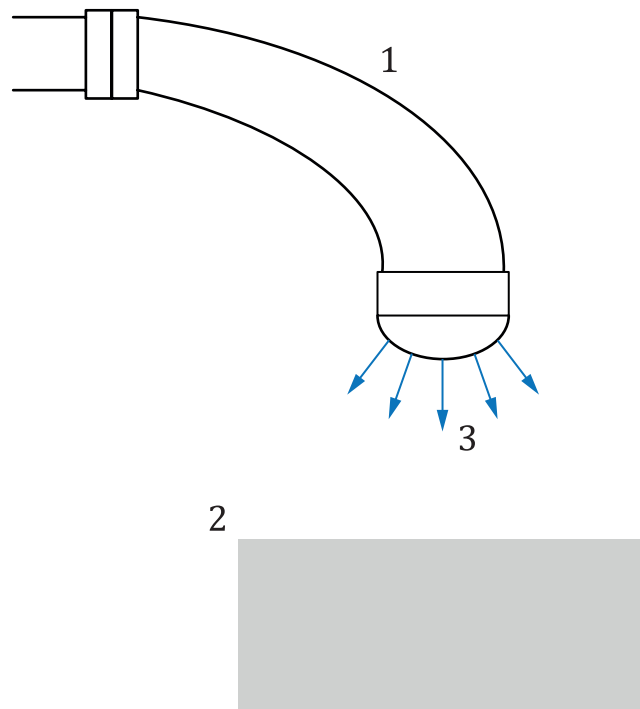


Key

- 1 fine bubble showerhead device
- 2 water surface
- 3 fine bubble dispersion in water

Figure 1 — Correct setting

In the case of incorrect setting of the fine bubble showerhead device as shown in [Figure 2](#), measurement results are unstable because contaminants in the air are mixed, and turbulent bubbles are generated by collision with the water surface, other than fine bubbles generated from the showerhead device.



Key

- 1 fine bubble showerhead device
- 2 water surface
- 3 fine bubble dispersion in water

Figure 2 — Incorrect setting

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6.3 One-way flow

6.3.1 General

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When evaluating the size and concentration indices of microbubbles, the one-way flow configuration shall be used. When the signal from ultrafine bubble (UFB) is sufficient for measurement, the one-way flow configuration shall also be used for UFB.

6.3.2 System configuration

The system configuration of one-way flow is shown in [Figure 3](#):