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**Fine bubble technology — Cleaning  
applications —**

**Part 3:  
Test method for cleaning hard flooring  
surfaces**

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

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

A list of all parts in the ISO 21256 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](http://www.iso.org/members.html).

## Introduction

Fine bubble technology has a number of applications across industries such as cleaning, transport, maintenance, agriculture, aquaculture, food and drink, cosmetics as well as biomedical. This list is expected to expand as fine bubble technology matures and becomes even more commonplace.

This document fills a gap in standards development in not only addressing a fine bubble cleaning application but also providing an international hard flooring surfaces cleaning test method standard, which also does not presently exist. Hard flooring surfaces cleaning and its standardization is important to society as there is a public understanding that clean interior spaces, including flooring, also signifies a safer and healthier environment, which provides peace of mind.

This document provides a detailed method, equipment specifics, an applicable soil formulation, analysis of the results, and applicability.

### United Nations Sustainable Development Goals – ISO Standards Contributions, Fine Bubble Technology, Cleaning

Fine bubble technology (FBT) contributes positively toward the United Nations Sustainable Development Goals (SDGs) to achieve a better and more sustainable future for all. Depending on the application, FBT can directly support one or more of the SDGs, including Goal 6: Clean Water and Sanitation, Goal 12: Responsible Production and Consumption, and Goal 13: Climate Action.

FBT solutions can be a substitute for chemical cleaning. The reduction in cleaning chemical use may be directly measured and totalled in support of Goal 6: Clean Water and Sanitation. Eliminating the use of cleaning chemicals reduces waste generation and also provides for the sound management of chemicals and waste during their life cycle, which supports Goal 12: Responsible Consumption and Production. Goal 13: Climate Action is supported through the reduced energy needs of FBT as compared to chemical cleaners. The reduction in carbon dioxide emissions is primarily associated with the elimination of recurring manufacturing and distribution of these chemical cleaners.

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# Fine bubble technology — Cleaning applications —

## Part 3:

## Test method for cleaning hard flooring surfaces

### 1 Scope

This document specifies a test method for the cleaning of hard flooring surfaces. It can be used to demonstrate the comparative cleaning performance of a fine bubble solution to an alternate cleaning solution to remove contaminant from a soiled surface. This alternate cleaning solution can be another fine bubble solution, municipal tap water or a commercially available cleaning solution blended to the manufacturer's specifications.

This method is not suitable for differentiating between cleaning solutions when the contaminant is excessively applied on the surface as the mechanism of cleaning changes.

### 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 21256-3:2021](https://standards.iteh.ai/catalog/standards/sist/d4894ccc-cfe9-42e1-af3c-b607cf8373bc/iso-21256-3-2021)

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### 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 terminological databases for use in standardization at the following addresses:

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

#### 3.1 contaminant

foreign matter, undesired substances of organic and inorganic origin, undesired matter

#### 3.2 test soil

hard flooring *contaminant* (3.1) standardized for testing purposes

#### 3.3 test piece

hard flooring surface standardized for testing purposes

### 4 Principle

The principle is to evaluate the performance of contaminant removal by each cleaning solution by measuring the mass of residual contaminate after exposure to the cleaning solutions.

## 5 Apparatus

### 5.1 Test equipment

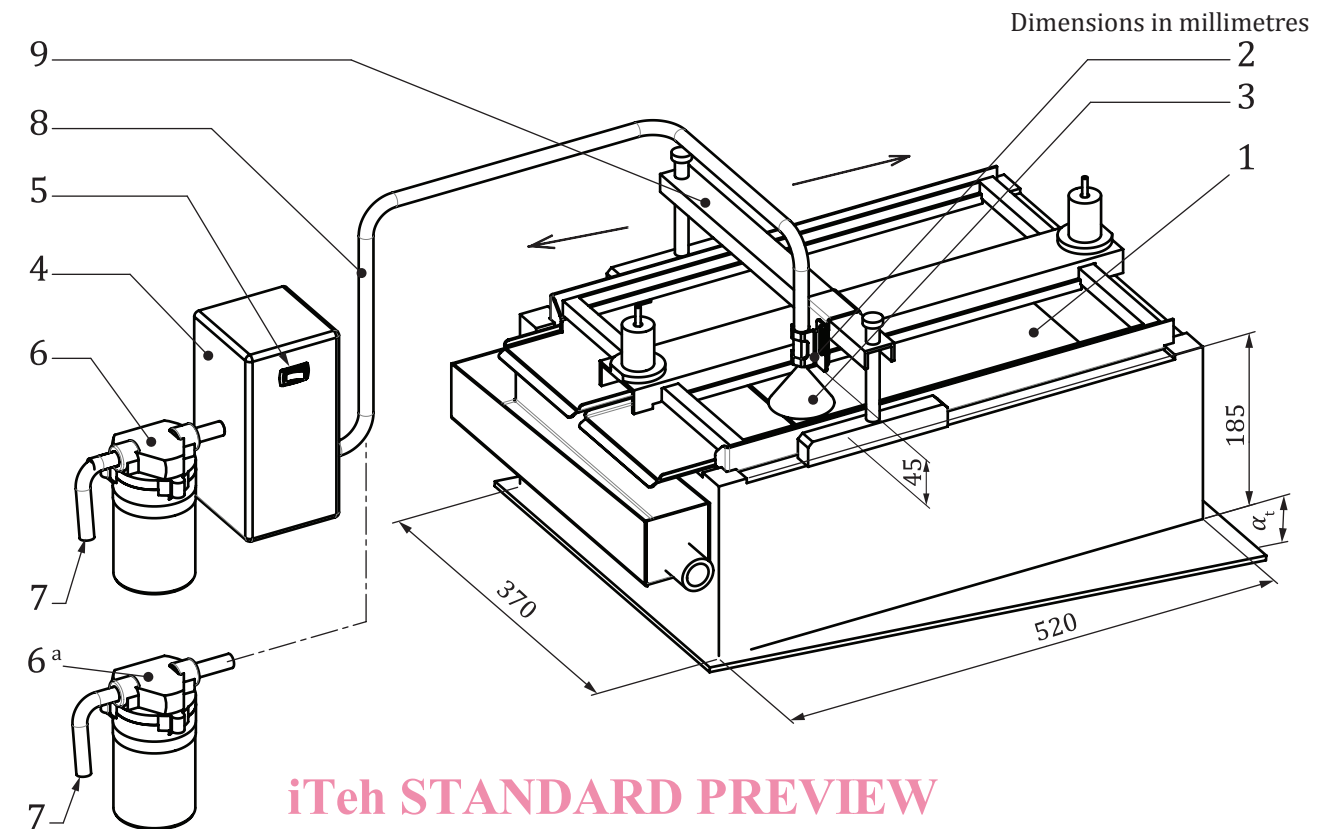
The test equipment shall be as specified below.

Figure 1 shows a typical example of equipment for testing the fine bubble supply system, where the difference in the result under the operation with the fine bubble generator on and off is to be compared.

- a) The test apparatus uses a modified reciprocating scrub testing machine.
  - 1) Replace the brush of the apparatus with a spray nozzle, which provides a light spray of the cleaning solution as the nozzle repeatedly moves back and forth across the soil surface.
  - 2) The nozzle type should be a hydraulic atomizing nozzle providing a hollow cone fine spray with an approximate spray angle of 70° with a nominal diameter orifice of 1 mm.
- b) Municipal tap water should be supplied with a flow rate of  $0,45 \pm 0,05$  l/min.  
NOTE This flow rate is typical for walk-behind hard floor cleaning equipment.
- c) The diameter of the hollow cone spray at the contaminant surface should be 70 mm to 80 mm.
- d) The nozzle tip should be approximately 45 mm above the test piece, creating a spray cone wider than the soil pattern on the substrate.
- e) The centre of the soil pattern of the test piece shall be placed under the path of the nozzle travel.
- f) The fluid nozzle of the cleaning stream shall be normal, perpendicular, to the surface of the test piece.

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#### Key

- 1 test sample
- 2 nozzle
- 3 cleaning fluid spray
- 4 fine bubble generator
- 5 fine bubble generator on/off switch
- 6 pump
- 7 municipal water source
- 8 cleaning solution outlet
- 9 spray bar
- $\alpha_t$  tilt angle of 5°
- <sup>a</sup> Pump only option, for alternative cleaning solution testing.

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**Figure 1 — Test apparatus**

## 5.2 Determination of soil removal

The amount of soil removed from the test surface can be determined by mass loss.

For mass determination, a calibrated weighing instrument with a resolution of 0,01 g or better shall be used.

## 6 Preparation of test pieces

### 6.1 Test pieces

The dimension of the test pieces shall be a length of 300 mm  $\pm$  10 mm and a width of 150 mm  $\pm$  10 mm in consideration of the width of the spray profile and stroke length of the spray bar. Material of the test piece should be uncoated vinyl composite floor tile.

### 6.2 Test soil

The test soil shall be prepared as described in [Annex A](#).

### 6.3 Method of depositing test soil on the test pieces

The test soil should be applied on the test pieces by following the procedure described in [Annex A](#). Twelve (12) test pieces shall be prepared

- a) Ensure that all surfaces of the test pieces are free of cutting debris or other particulate.
- b) Deposit the test soil on the front surface of test piece. The surface density of the test soil should be 8 mg/cm<sup>2</sup>.
- c) The test pieces should be exposed to this cleaning method within 2 h after preparation when using the test soil described in [Annex A](#).
- d) Before testing, determine the surface density of the test soil of each test piece by normalizing the mass of the test soil by its surface area. Distribute them evenly into two sets.

## 7 Procedure

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### 7.1 Condition of the cleaning test

The test pieces shall be cleaned by using the equipment described in [5.1](#), under the following conditions. Additional operational detail of the test apparatus can be found in [Annex B](#).

- a) Water temperature should be 20 °C to 26 °C  $\pm$  1 °C.
- b) The flow rate of cleaning liquid at the outlet shall be 0,23 l/min  $\pm$  0,02 l/min.
- c) The duration of the cleaning operation shall be the number of cycles established in [B.3](#). A cycle shall be the translational motion of back and forth where the end of one cycle is the beginning of the next cycle.
- d) The pressure of the cleaning solution at the spray nozzle should be 200 kPa  $\pm$  10 kPa.
- e) At the time of cleaning, a supply of fine bubble water from the generator shall be continuously provided to the test stand.
- f) Dry the test pieces cleaned above to constant mass or 3 h minimum in an oven at approximately 45 °C.

The temperature shall be chosen so as to not damage the test piece or cause significant mass loss of the residual soil.

- g) Allow the tiles to cool, then record the mass of the cleaned tiles ( $M_c$ ).

## 7.2 Measurement of the test soil on test piece

The measurement of the test soil on the test piece shall be carried out as follows:

- a) measure the initial mass of the test piece before the test soil is applied ( $M_i$ );
- b) measure the mass of the test piece after the test soil has been applied ( $M_s$ ).

## 8 Calculation of the cleaning index of the soil

The cleaning index of the soil stain,  $E$ , shall be calculated for each test piece by [Formula \(1\)](#):

$$E = \frac{M_s - M_c}{M_s - M_i} \quad (1)$$

where

$M_s$  is the mass of the work piece after the soil has been applied, see [7.2, b\)](#);

$M_c$  is the mass of the work piece after the cleaning test, see [7.1, f\)](#);

$M_i$  is the initial mass of the work piece before the soil is applied, see [7.2 a\)](#).

## 9 Test report

The test report shall contain the following information:

- a) the sample;
- b) a reference to this document (including its year of publication), i.e. ISO 21256-3:2021;
- c) the test date;
- d) the ambient temperature and humidity of the test facility;
- e) the test conditions:
  - 1) the flow rate of cleaning liquid;
  - 2) the temperature of the cleaning liquid exiting the nozzle: the beginning and the conclusion of testing;
  - 3) a description of the test piece: material, manufacturer and part number;
  - 4) the operating parameters of the fine bubble generator/description of the cleaning fluid;
  - 5) the name of the test soil;
  - 6) the number of cycles used in the test;
- f) the test result (cleaning index of the test soil), calculated as specified in [Clause 8](#);
- g) any deviations from the procedure;
- h) any unusual features observed.