PD ISO/TS 4240-1:2023



BSI Standards Publication

Fine bubble technology — Environmental applications

Part 1: Inspection method using online particle counter in dissolved air flotation (DAF) plant

bsi.

National foreword

This Published Document is the UK implementation of ISO/TS 4240-1:2023.

The UK participation in its preparation was entrusted to Technical Committee LBI/50, Fine Bubble Technology (FBT).

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2023
Published by BSI Standards Limited 2023

ISBN 978 0 539 16594 4

ICS 07.030

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 April 2023.

Amendments/corrigenda issued since publication

Date	Text affected

PD ISO/TS 4240-1:2023

TECHNICAL SPECIFICATION

ISO/TS 4240-1

First edition
2023-03-31

Fine bubble technology — Environmental applications —

Part 1: Inspection method using online particle counter in dissolved air flotation (DAF) plant

Reference number
ISO/TS 4240-1:2023(E)

© ISO 2023



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023, 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

© ISO 2023 – All rights reserved

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Principle ... **2**
5 BVC measurement technique ... **2**
5.1 Test equipment ... 2
5.2 Procedure ... 3
6 Bubble bed depth measurement technique ... **4**
6.1 Test equipment ... 4
6.2 Procedure ... 5
7 Advantages and limitations ... **6**
7.1 Advantages ... 6
7.2 Limitations ... 7
Annex A (informative) **Measurement of bubble size and size distribution by PCM** ... **8**
Annex B (informative) **Height from the water surface to the bubble bed depth** ... **9**
Annex C (informative) **Comparison of the results of bubble bed depth obtained by using the naked eye and by using a particle counting method** ... **10**
Annex D (informative) **Measuring bubble bed depth of DAF process in full scale** ... **12**
Annex E (informative) **Change of bubble bed depth at different operating conditions** ... **14**
Annex F (informative) **Contribution of particles and bubbles in particle count measurements** ... **15**
Annex G (informative) **Effect of sampling tube length** ... **17**
Bibliography ... **18**

© ISO 2023 – 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 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 281, *Fine bubble technology*.

A list of all parts in the ISO 4240 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.

© ISO 2023 – All rights reserved

Introduction

The dissolved air flotation process is widely used for water treatment plant. This process used micro bubbles to remove particles by floating them on the surface. There are various factors to check the operation of the DAF plant. Many of these factors can be measured in field scale DAF plant. However, some factors are very difficult to measure in the field.

One of these factors is bubble volume concentration (BVC). BVC is usually used as index of the number of bubbles. Generally, BVC is evaluated by the water displacement method. This method measures the volume of bubbles as the volume of water displaced. The water displacement method is a direct way to give accurate BVC of bubble water. However, this method needs large equipment depending on the capacity of the bubble generator. So, it is almost impossible to measure BVC directly from the DAF plant. Lab and pilot test with the same nozzle of DAF plant and predictions based on the test results are most widely used.

Bubble bed depth is also difficult to measure in DAF plant. It is easy to observe the creation of a bubble bed interface in the middle part of the reactor by the naked eye in a lab and pilot scale DAF reactor manufactured with a transparent wall. Although it is not possible to present the interface by a single straight line, a bubble interface zone exists in which above the interface there are clouds of bubbles and below the interface almost no bubbles are observed. The centre of the bubble interface zone is defined as the bubble bed interface. Bubble bed depth is defined by the height from the water surface to the bubble bed interface as presented in Figure A.1. However, in a full-scale DAF plant, it is not easy to locate the bubble bed interface. The difficulty is that observation by the naked eye is not possible due to structural constraints.

Therefore, this document specifies indirect measurement methods of BVC and bubble bed depth. This approach can be useful for on-site inspection of DAF plant.

© ISO 2023 – All rights reserved

Fine bubble technology — Environmental applications —

Part 1: Inspection method using online particle counter in dissolved air flotation (DAF) plant

1 Scope

This document specifies the bubble volume concentration and bubble bed depth measurement methods by online particle counter for checking DAF process performance in plant.

The test method of bubble volume concentration is made by measuring bubble size distribution in contact zone of DAF tank and calculating using formula. And bubble bed depth is evaluated by measuring the number of bubbles and particles according to the depth at five points in separation zone of DAF tank.

This document provides the advantages and limitations of using online particle counter in plant.

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 20480-4, *Fine bubble technology — General principles for usage and measurement of fine bubbles — Part 4: Terminology related to microbubble beds*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20480-4 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
bubble volume concentration
BVC
index of the volume of bubbles contained in the unit volume of water

Note 1 to entry: It is calculated by the ratio of the total bubble volume to the volume of generated bubble water during any given time, expressed in %.

[SOURCE: ISO 20480-4:2021, 3.16, modified — "index" has been removed from the term.]

3.2
particle counting method
indirect method to count the number of bubbles and its size distribution in a measurement

Note 1 to entry: Particle counting method (PCM) can trace the variation tendency of the BVC index.

© ISO 2023 – All rights reserved