

First edition  
2022-08

---

---

# Automated liquid handling systems — Part 2: Measurement procedures for the determination of volumetric performance

*Systèmes automatisés de manipulation de liquides —*

*Partie 2: Procédures de mesure pour la détermination des  
performances volumétriques*



Reference number  
ISO 23783-2:2022(E)

© ISO 2022



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2022

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

This is a preview of ISO 23783-2:2022. [Click here to purchase the full version from the ANSI store.](#)

## Contents

	Page
<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Abbreviated terms</b> .....	<b>1</b>
<b>5 Measurement methods</b> .....	<b>2</b>
5.1 Overview of methods suitable for measuring ALHS performance.....	2
5.2 Photometric methods.....	9
5.2.1 Dual-dye ratiometric photometric method.....	9
5.2.2 Single-dye photometric method.....	9
5.2.3 Fluorescence method.....	9
5.3 Gravimetric methods.....	9
5.3.1 Single channel method.....	9
5.3.2 Regression analysis.....	10
5.4 Hybrid photometric/gravimetric method.....	10
5.5 Dimensional methods.....	10
5.5.1 Optical image analysis of droplets.....	10
5.5.2 Optical image analysis of capillaries.....	11
<b>6 Equipment and preparation</b> .....	<b>11</b>
6.1 Test equipment.....	11
6.2 Manually operated single- and multi-channel pipettes.....	12
6.3 Preparation for testing.....	12
<b>7 Thermal expansion</b> .....	<b>13</b>
<b>8 Traceability and measuring system uncertainty</b> .....	<b>13</b>
8.1 Traceability.....	13
8.2 Estimation of measuring system uncertainty.....	13
8.2.1 Whole system approach.....	13
8.2.2 Measurement model approach.....	13
<b>9 Reporting</b> .....	<b>14</b>
<b>Annex A (normative) Calculation of liquid volumes from balance readings</b> .....	<b>15</b>
<b>Annex B (normative) Dual-dye ratiometric photometric procedure</b> .....	<b>18</b>
<b>Annex C (normative) Single dye photometric procedure</b> .....	<b>24</b>
<b>Annex D (normative) Gravimetric procedure, single channel measurement</b> .....	<b>29</b>
<b>Annex E (normative) Gravimetric regression procedure</b> .....	<b>33</b>
<b>Annex F (normative) Photometric/gravimetric hybrid procedure</b> .....	<b>39</b>
<b>Annex G (normative) Optical image analysis of droplets</b> .....	<b>48</b>
<b>Annex H (normative) Fluorescence procedure</b> .....	<b>57</b>
<b>Annex I (normative) Optical image analysis of capillaries</b> .....	<b>70</b>
<b>Bibliography</b> .....	<b>76</b>

## 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 48, *Laboratory equipment*.

This first edition of ISO 23783-2, together with ISO 23783-1 and ISO 23783-3, cancels and replaces IWA 15:2015.

A list of all parts in the ISO 23783 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).

This is a preview of ISO 23783-2:2022. [Click here to purchase the full version from the ANSI store.](#)

## Introduction

Globalization of laboratory operations requires standardized practices for operating automated liquid handling systems (ALHS), communicating test protocols, as well as analysing and reporting of performance parameters. IWA 15:2015 was developed to provide standardized terminology, test protocols, and analytical methods for reporting test results. The concepts developed for, and described in, IWA 15 form the foundation of the ISO 23783 series.

Specifically, this document addresses the needs of:

- users of ALHS, as a basis for calibration, verification, validation, optimization, and routine testing of trueness and precision;
- manufacturers of ALHS, as a basis for quality control, communication of acceptance test specifications and conditions, and issuance of manufacturer's declarations (where appropriate);
- test houses and other bodies, as a basis for certification, calibration, and testing.

The tests established in this document should be carried out by trained personnel.