

This document is a preview generated by EVS

Stationary source emissions - Bioaerosols and biological agents - Sampling of bioaerosols and collection in liquids - Impingement method

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

See Eesti standard EVS-EN 17359:2020 sisaldab Euroopa standardi EN 17359:2020 ingliskeelset teksti.	This Estonian standard EVS-EN 17359:2020 consists of the English text of the European standard EN 17359:2020.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 12.08.2020.	Date of Availability of the European standard is 12.08.2020.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile [standardiosakond@evs.ee](mailto:standardiosakond@evs.ee).

ICS 13.040.20

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:  
Koduleht [www.evs.ee](http://www.evs.ee); telefon 605 5050; e-post [info@evs.ee](mailto:info@evs.ee)

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage [www.evs.ee](http://www.evs.ee); phone +372 605 5050; e-mail [info@evs.ee](mailto:info@evs.ee)

ICS 13.040.20

English Version

## Stationary source emissions - Bioaerosols and biological agents - Sampling of bioaerosols and collection in liquids - Impingement method

Émissions de sources fixes - Bioaérosols et agents biologiques - Prélèvement des bioaérosols et collecte dans les liquides - Méthode d'impaction par bullage

Emissionen aus stationären Quellen - Bioaerosole und biologische Agenzien - Probenahme von Bioaerosolen und Abscheidung in Flüssigkeiten - Impinger-Methode

This European Standard was approved by CEN on 5 July 2020.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

# Contents

	Page
European foreword.....	5
<b>1 Scope.....</b>	<b>6</b>
<b>2 Normative references.....</b>	<b>6</b>
<b>3 Terms and definitions.....</b>	<b>7</b>
<b>4 Symbols and abbreviations.....</b>	<b>11</b>
<b>5 Principle of method.....</b>	<b>13</b>
<b>6 Theoretical fundamentals.....</b>	<b>14</b>
<b>6.1 Isokinetic sampling.....</b>	<b>14</b>
<b>6.2 Determination of concentration and load of the microorganisms.....</b>	<b>14</b>
<b>7 Device and materials.....</b>	<b>16</b>
<b>7.1 General.....</b>	<b>16</b>
<b>7.2 Device and methods for measurement of the exhaust air parameters for the calculation of the main volume flow.....</b>	<b>16</b>
<b>7.2.1 General.....</b>	<b>16</b>
<b>7.2.2 Device for determination of the exhaust air velocity.....</b>	<b>16</b>
<b>7.2.3 Device for determination of pressure, temperature and humidity.....</b>	<b>17</b>
<b>7.3 Device for the sampling of bioaerosols.....</b>	<b>17</b>
<b>7.3.1 General.....</b>	<b>17</b>
<b>7.3.2 Material properties.....</b>	<b>18</b>
<b>7.3.3 Entry nozzle, bend and sampling probe.....</b>	<b>18</b>
<b>7.3.4 Emission impinger.....</b>	<b>18</b>
<b>7.3.5 Suction device and device for measurement of the gas volume or respectively the gas volume flow.....</b>	<b>20</b>
<b>8 Sampling.....</b>	<b>20</b>
<b>8.1 General.....</b>	<b>20</b>
<b>8.2 Preparation of the sampling equipment.....</b>	<b>20</b>
<b>8.2.1 General.....</b>	<b>20</b>
<b>8.2.2 Preparation of the emission impinger.....</b>	<b>20</b>
<b>8.2.3 Preparation of the entry nozzle and the sampling probe.....</b>	<b>21</b>
<b>8.2.4 Determination of appropriate sampling probe and sampling flow.....</b>	<b>21</b>
<b>8.3 Performing bioaerosol sampling.....</b>	<b>24</b>
<b>8.3.1 Leak test and sampling.....</b>	<b>24</b>
<b>8.3.2 Recovery of deposits upstream of the emission impinger.....</b>	<b>25</b>
<b>8.3.3 Determination of the mass of the sampling liquid.....</b>	<b>26</b>
<b>8.3.4 Field blank value.....</b>	<b>26</b>
<b>8.3.5 Analytical blank value.....</b>	<b>27</b>
<b>8.4 Transport and storage.....</b>	<b>27</b>
<b>9 Analysis.....</b>	<b>27</b>
<b>10 Evaluation.....</b>	<b>27</b>
<b>10.1 General.....</b>	<b>27</b>
<b>10.2 Transfer of the results by the analytical laboratory.....</b>	<b>28</b>
<b>10.3 Sample gas volume during sampling.....</b>	<b>28</b>
<b>10.4 Microorganism number calculation.....</b>	<b>30</b>
<b>10.5 Load calculation.....</b>	<b>31</b>

<b>11</b>	<b>Performance characteristics</b> .....	<b>31</b>
<b>11.1</b>	<b>Measurement uncertainty</b> .....	<b>31</b>
<b>11.2</b>	<b>Parameters for the determination of measuring uncertainty in practice</b> .....	<b>32</b>
<b>12</b>	<b>Maintenance and quality assurance</b> .....	<b>37</b>
<b>13</b>	<b>Sampling efficiency and limits of the method</b> .....	<b>37</b>
<b>14</b>	<b>Interferences</b> .....	<b>38</b>
	<b>Annex A (informative) Practical example for moulds and bacteria</b> .....	<b>39</b>
<b>A.1</b>	<b>General</b> .....	<b>39</b>
<b>A.2</b>	<b>Determination of the measurement points</b> .....	<b>39</b>
<b>A.3</b>	<b>Devices and materials</b> .....	<b>39</b>
<b>A.3.1</b>	<b>General</b> .....	<b>39</b>
<b>A.3.2</b>	<b>Devices and methods for measurement of the exhaust air parameters for the calculation of the main volume flow</b> .....	<b>39</b>
<b>A.3.2.1</b>	<b>General</b> .....	<b>39</b>
<b>A.3.2.2</b>	<b>Devices for determination of the exhaust air velocity</b> .....	<b>39</b>
<b>A.3.2.3</b>	<b>Devices for determination of pressure, temperature and humidity</b> .....	<b>40</b>
<b>A.3.3</b>	<b>Devices for sampling of bioaerosols</b> .....	<b>40</b>
<b>A.3.3.1</b>	<b>General</b> .....	<b>40</b>
<b>A.3.3.2</b>	<b>Material properties</b> .....	<b>40</b>
<b>A.3.3.3</b>	<b>Entry nozzle, bend and sampling probe</b> .....	<b>40</b>
<b>A.3.3.4</b>	<b>Emission impinger</b> .....	<b>40</b>
<b>A.3.3.5</b>	<b>Measurement system for isokinetic sample volume flow abstraction</b> .....	<b>40</b>
<b>A.4</b>	<b>Sampling process</b> .....	<b>40</b>
<b>A.4.1</b>	<b>General</b> .....	<b>40</b>
<b>A.4.2</b>	<b>Preparation of the sampling equipment</b> .....	<b>40</b>
<b>A.4.2.1</b>	<b>General</b> .....	<b>40</b>
<b>A.4.2.2</b>	<b>Preparation of the emission impinger</b> .....	<b>41</b>
<b>A.4.2.3</b>	<b>Preparation of the entry nozzle, band and sampling probe</b> .....	<b>41</b>
<b>A.4.3</b>	<b>Measurement of the exhaust air parameters for isokinetic sampling</b> .....	<b>41</b>
<b>A.4.4</b>	<b>Sampling</b> .....	<b>42</b>
<b>A.4.4.1</b>	<b>General</b> .....	<b>42</b>
<b>A.4.4.2</b>	<b>Recovery of deposits upstream of the emission impinger</b> .....	<b>42</b>
<b>A.4.4.3</b>	<b>Field blank value</b> .....	<b>42</b>
<b>A.4.5</b>	<b>Transport and storage</b> .....	<b>43</b>
	<b>Annex B (informative) Measurement uncertainty</b> .....	<b>49</b>
<b>B.1</b>	<b>General</b> .....	<b>49</b>
<b>B.2</b>	<b>Determination of measurement uncertainty</b> .....	<b>49</b>

<b>B.2.1</b>	<b>Moulds</b> .....	<b>49</b>
<b>B.2.2</b>	<b>Mesophilic bacteria</b> .....	<b>50</b>
<b>B.2.3</b>	<b>Total cell count</b> .....	<b>50</b>
<b>B.2.4</b>	<b>Measurements in the bioaerosol test channel</b> .....	<b>50</b>
<b>B.3</b>	<b>Field blank value</b> .....	<b>51</b>
<b>Annex C (normative)</b>	<b>Summary of the requirements to the emission measurement</b> .....	<b>52</b>
<b>Annex D (informative)</b>	<b>Sample protocol for sampling and analysis</b> .....	<b>54</b>
<b>D.1</b>	<b>Sampling</b> .....	<b>54</b>
<b>D.2</b>	<b>Analysis</b> .....	<b>55</b>
	<b>Bibliography</b> .....	<b>56</b>

## European foreword

This document (EN 17359:2020) has been prepared by Technical Committee CEN/TC 264 "Air quality", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2021, and conflicting national standards shall be withdrawn at the latest by February 2021.

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

This document contains specifications for active sampling of bioaerosols from exhaust air flowing through a defined cross-section of a stack. It defines general principles that have to be taken into account during an isokinetic sampling campaign for bioaerosols by bubbling the exhaust air through a specific impinger designed for emission measurements.

In this document the application with culturable organisms is specified but the same principle might be applicable for non-cultural based methods (e.g. molecular and/or enzyme-based methods).

The impinger is designed to allow a sample volume flow of 1 m<sup>3</sup>/h to 1,8 m<sup>3</sup>/h, or 16 l/min to 30 l/min, respectively, and has been tested with regard to various microorganisms within broad concentration ranges [1; 2; 3; 4].<sup>1</sup>

## 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.

EN 1040:2005, *Chemical disinfectants and antiseptics - Quantitative suspension test for the evaluation of basic bactericidal activity of chemical disinfectants and antiseptics - Test method and requirements (phase 1)*

EN 13284-1:2017, *Stationary source emissions - Determination of low range mass concentration of dust - Part 1: Manual gravimetric method*

EN 15259:2007, *Air quality - Measurement of stationary source emissions - Requirements for measurement sections and sites and for the measurement objective, plan and report*

CEN/TS 16115-1, *Ambient air quality - Measurement of bioaerosols - Part 1: Determination of moulds using filter sampling systems and culture-based analyses*

EN ISO 16911-1, *Stationary source emissions - Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method (ISO 16911-1)*

EN ISO 20988:2007, *Air quality - Guidelines for estimating measurement uncertainty (ISO 20988:2007)*

---

<sup>1</sup> This method is accepted by convention as reference method for determination of total emissions under application of an out stack configuration according to EN 13284-1.