



STANDARD

ANSI/ASHRAE Standard 185.1-2020
(Supersedes ANSI/ASHRAE Standard 185.1-2015)
Includes ANSI/ASHRAE addenda listed in Appendix I

Method of Testing UV-C Lights for Use in Air-Handling Units or Air Ducts to Inactivate Airborne Microorganisms

See Informative Appendix I for approval dates.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE® website (<https://www.ashrae.org/continuous-maintenance>).

The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

© 2020 ASHRAE

ISSN 1041-2336



Cognizant TC: 2.9, Ultraviolet Air and Surface Treatment
SPLS Liaison: Thomas E. Cappellin

Stephen B. Martin, Jr.*, *Chair*
Katja D. Auer
Larry Fletcher*

Henry T. Greist*
Kathleen Owen*
Dean A. Saputa*

Richard L. Vincent*

* Denotes members of voting status when the document was approved for publication

ASHRAE STANDARDS COMMITTEE 2020–2021

Drury B. Crawley, *Chair*
Rick M. Heiden, *Vice Chair*
Els Baert
Charles S. Barnaby
Robert B. Burkhead
Thomas E. Cappellin
Douglas D. Fick
Walter T. Grondzik
Susanna S. Hanson
Jonathan Humble

Srinivas Katipamula
Gerald J. Kettler
Essam E. Khalil
Malcolm D. Knight
Jay A. Kohler
Larry Kouma
Cesar L. Lim
James D. Lutz
Karl L. Peterman
Erick A. Phelps

David Robin
Lawrence J. Schoen
Steven C. Sill
Richard T. Swierczyna
Christian R. Taber
Russell C. Tharp
Theresa A. Weston
Craig P. Wray
Jaap Hogeling, *BOD ExO*
William F. McQuade, *CO*

Connor Barbaree, *Senior Manager of Standards*

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus Standard developed under the auspices of ASHRAE. *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this Standard as an ANS, as “substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution.” Compliance with this Standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Senior Manager of Standards of ASHRAE should be contacted for

- a. interpretation of the contents of this Standard,
- b. participation in the next review of the Standard,
- c. offering constructive criticism for improving the Standard, or
- d. permission to reprint portions of the Standard.

DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

CONTENTS

ANSI/ASHRAE Standard 185.1-2020 Method of Testing UV-C Lights for Use in Air-Handling Units or Air Ducts to Inactivate Airborne Microorganisms

SECTION	PAGE
Foreword	2
1 Purpose.....	2
2 Scope.....	2
3 Definitions	3
4 Test Apparatus and Procedures	3
5 Apparatus Qualification Testing	5
6 Bioaerosol Testing	6
7 Determination of Performance	7
8 Reporting Results	9
9 Normative References	9
Informative Appendix A: Test Organism	10
Informative Appendix B: Limitations	11
Informative Appendix C: Safety.....	12
Informative Appendix D: Environmental Considerations	13
Informative Appendix E: Microorganism Susceptibility to UV-C Irradiation.....	14
Informative Appendix F: Technical Issues Regarding Aerosol.....	15
Informative Appendix G: Dosage Calculation.....	16
Informative Appendix H: Informative References.....	17
Informative Appendix I: Addenda Description and Information	18

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

© 2020 ASHRAE

1791 Tullie Circle NE · Atlanta, GA 30329 · www.ashrae.org · All rights reserved.

ASHRAE is a registered trademark of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
ANSI is a registered trademark of the American National Standards Institute.

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Test standards form the foundation for air-cleaner selection in the ventilation industry. U.S. Environmental Protection Agency (USEPA) literature states that the most important need in the area of ultraviolet germicidal irradiation (UVGI) is industry standards to rate installed devices. Standards for testing and reporting on products under controlled conditions are essential to users and specifiers so that they can compare products, predict levels of performance under specified operating conditions with reasonable certainty, and determine appropriate UVGI efficiencies for specific situations.

Historically, standards for testing air cleaners have been developed in response to the needs of the day. Protection of machinery and coils came first, then reduction of soiling. Concerns about indoor air quality and respirable particles, protection of products during manufacturing, and protection of HVAC equipment prompted development of test standards based on particle size. In 2005, interest in controlling airborne infectious contaminants or viable species that produce chemical contaminants as metabolic byproducts led to the formation of Standing Standards Project Committee (SSPC) 185 to develop a method of test to determine inactivation rates of airborne microorganisms in air-handling units and air ducts.

This is a test-method standard, and its results are to be used to directly compare UVGI equipment on a standardized basis irrespective of their application. Results are also used to give the design engineer an easy-to-use basis for specifying UV devices or estimating the relative performance of UVGI for a given application. It is possible that an industry organization may use this test method as the basis for an application standard in which they might require testing at conditions different than those required here. This test specifies two organisms for testing but allows other organisms to be used as long as the test reports are correctly labeled.

The 2020 revision to Standard 185.1 reflects changes to the last version of the method to specify the airflow for the test as 3400 m³/h (2000 cfm), revisions to the QA section to make the tests clearer, and significant revisions to the calculations to better reflect bioaerosol testing reality.

Informative notes are used throughout this standard to provide nonmandatory guidance for the user in addition to the nonmandatory guidance found in informative appendices. Informative notes are not part of the standard.

This test method may also be used to test air-cleaning devices that do not use ultraviolet technology, as long as the device being tested can be installed in the testing duct system described in this method. Test reports should note that results were from a modified test and include the specific device tested and modifications made to the method. Work is underway to develop a bioaerosol test method that will allow more comprehensive testing of additional air-cleaning devices.

1. PURPOSE

This standard establishes a test method for evaluating the efficacy of UV-C lights for their ability to inactivate airborne microorganisms.

2. SCOPE

2.1 This standard describes a method of laboratory testing to measure the performance of UV-C lights used in general ventilating systems.

2.2 The method of test measures the performance of UV-C lights to inactivate selected indicator microorganisms in the airstream. The standard defines procedures for generating the bioaerosols required for conducting the test. It also provides a method for counting the airborne bioaerosols upstream and downstream of the UV-C light in order to calculate inactivation efficiency for each microorganism.

2.3 This standard also establishes performance specifications for the equipment required to conduct the tests, defines methods of calculating and reporting results obtained from the test data, and establishes a reporting system to be applied to UV-C lights covered herein.