



**BSR/ASHRAE Addendum c to  
ANSI/ASHRAE Standard 185.1-2015**

**Public Review Draft**

**Proposed Addendum c to Standard  
185.1-2015, Method of Testing UV-C  
Lights for Use in Air-Handling Units or  
Air Ducts to Inactivate Airborne  
Microorganisms**

**First Public Review (November 2019)  
(Draft shows Proposed Changes to Current Standard)**

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(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

This addendum serves two purposes. The first is to correct the airflow rate to 2000 cfm. The second is to provide guidance in the QA testing to make sure that test labs are performing the tests in the same way.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

4.1.2 Temperature within the test duct shall be  $21^{\circ}\text{C} \pm 2.2^{\circ}\text{C}$  ( $70^{\circ}\text{F} \pm 4^{\circ}\text{F}$ ), relative humidity shall be between 40% to 60%, and ~~airflow rate~~ velocity shall be 3400 cmh (2000 cfm), which corresponds to 2.54 m/s (500 fpm) ~~2.39 ± 0.1 mps (470 ± 20 fpm)~~. Test air shall be discharged outdoors, indoors, or recirculated.

## 5. APPARATUS QUALIFICATION TESTING

- 5.1 Apparatus Qualification Tests.** Apparatus qualification tests shall verify quantitatively that the test rig and sampling procedures are capable of providing reliable bioaerosol measurements. Table 1 shows system qualification measurement requirements. All tests shall be performed as detailed in Section 5 of ASHRAE 52.2 except as noted here. Tests already performed to meet the ASHRAE 52.2 requirements at 0.93 m<sup>3</sup>/s (1970 cfm) will be considered adequate except as noted.
- 5.2 Velocity Uniformity in the Test Duct.** The velocity uniformity test shall comply with ANSI/ASHRAE Standard 52.2<sup>1</sup> and shall be performed at an air velocity rate of 2.5439 mps ± 0.05 mps (470/500 fpm ± 10 fpm).
- 5.3 Bioaerosol Concentration Uniformity in the Test Duct.** Bioaerosol uniformity shall be conducted per the instructions for the Concentration Uniformity test in Section 5.3 of ANSI/ASHRAE 52.2<sup>1</sup> using an inert tracer particle. Particle concentrations shall be measured in the range of 1 to 5 μm. The aerosol for this test shall be injected in the same location that the bioaerosol will be.
- 5.4 Inert Downstream Mixing of Aerosol.** This test shall be performed per the instructions for the downstream mixing test specified in Section 5 of ASHRAE 52.2. Data for particles above 5 μm may be ignored in the calculations as the bioaerosols used in 185.1 will be below 5 μm.
- 5.5 100% Efficiency Test.** A bioaerosol efficiency test using either acceptable organism shall be run using a HEPA or ULPA filter as the test device to ensure that the test duct and sampling system are capable of providing a >99% efficiency measurement. The test procedures of Section 6 of ASHRAE Standard 185.1 shall be used.
- 5.5.6 Duct Leakage Test.** A duct leakage test shall be conducted per Section 5.9 of ANSI/ASHRAE 52.2<sup>1</sup> with the exception that ~~of~~ the test acceptability level will be determined based on anticipated duct pressure during actual testing. The duct pressure shall be based on the values expected being conducted at a ~~with an air cleaner, light baffles, and any other items that must be in the rig during a standard test at an~~ air velocity of 2.5439 mps (500/470 fpm) with an additional 500 Pa (2 in. of water). This test is performed by sealing the duct at inlet HEPA filter bank and at the ASME flow nozzle locations, followed by metering in air to achieve a steady duct pressure. The flow rate of the metering air (equal to the leakage flow) is measured for a range of duct pressures.
- 5.5.7 No Light Control Test.** A lights-on/lights-off test shall be performed for each test device ~~per the correlation test of Section 5.8 of ANSI/ASHRAE Standard 52.2<sup>1</sup>~~ and will to confirm any bioaerosol baseline losses within the test duct. ~~If the device blocks a substantial portion of the duct cross section, a A test shall be performed without a test device in place~~ may be performed instead of the lights-off test to check the adequacy of the overall duct, sampling, measurement, and aerosol generator. The no device test will be performed as a quality check against the lights-off test with the bioaerosols and to confirm the bioaerosol nonkill removal efficiency of the UV-based systems. This test must be done in conjunction with each lights-on test and for each microorganism. The procedures described in Section 6 shall be used for this test with the exception that the lamps will be off or the device will be out of the duct.

**5.8 OPC Zero Count Test shall be performed per Section 5 of ASHRAE 52.2.**

**5.9 OPC Sizing Accuracy Test shall be performed per Section 5 of ASHRAE 52.2.**

**TABLE 1 System Qualification Measurement Requirements**

<b>Parameter</b>	<b>Control Limit</b>
Air velocity uniformity Based on traverse measurements over a nine-point cross-sectional grid at the test flow rate. The velocity measurements shall be made with an instrument having an accuracy of 10% with 0.05m/s (approximately 10 fpm) resolution.	CV <sup>a</sup> < 10%  CV < 15%
Inert aerosol concentration uniformity Based on traverse measurements over a nine-point cross-sectional grid at the test flow rate. Performed upstream of the test section.	CV < 10%
Inert downstream mixing Based on nine-point perimeter injection grid at the test section and center-of-duct readings at the downstream probe locations.	Efficiency >99%
100% efficiency test Based on HEPA filter test.	
100% penetration (correlation test)	<del>Particle</del> <i>Acceptable</i>
<i>Size Range</i>	<i>Penetration Range</i>
0.3 to 1 µm	0.90 to 1.10
1 to 3 µm	0.80 to 1.20
3 to 10 µm	0.70 to 1.30
OPC <sup>b</sup> upper concentration limit <del>Based on limiting the concentration to below the level corresponding to the onset of coincidence error.</del>	<del>No predetermined level, but must be established prior to testing.</del>
Aerosol generator response time.	No predetermined level.
Duct leakage Ratio of leak rate to test flow rate. <del>Determined by sealing the duct at inlet HEPA filter bank and at the ASME flow nozzle locations, followed by metering in air to achieve a steady duct pressure. The flow rate of the metering air (equal to the leakage flow) is measured for a range of duct pressures.</del>	Ratio <1.0%
OPC zero count check	<10 counts per sample.
OPC sizing accuracy check Based on sampling aerosolized monodisperse polystyrene latex (PSL spheres of known size).	Relative maximum must appear in the appropriate sizing channel.
Aerosol neutralizer activity (if radioactive source is used).	Radioactivity must be detected.

a.CV = coefficient of variance.

b.OPC = optical particle counter.