

*Institute of Environmental Sciences and Technology*

## **IEST-RP-CC007.4**

Contamination Control Division

Recommended Practice 007.4

# **Testing HEPA and ULPA Filters**



827 W. Linden Office Square, Suite 400  
Scottsdale, IL 60173  
Phone: (847) 981-0100 • Fax: (847) 981-4130  
E-mail: [information@iest.org](mailto:information@iest.org) • Web: [www.iest.org](http://www.iest.org)

---

This Recommended Practice was prepared by and is under the jurisdiction of Working Group 007 of the IEST Contamination Control Division (WG-CC007). The following WG voting members contributed to the development of this edition of this Recommended Practice.

R. Vijayakumar, WG-CC007 Chair, AERFIL

Taguhi Arakelian, Jet Propulsion Laboratory

Eugene Bryan, QVA Test Solutions, LLC

Tony Caughron, TEC Services Inc.

Keith Flyzik, Steris Corporation

Nick Karlowsky, Filtech, Inc.

Donna Kasper, Hollingsworth & Vose

Don Largent, AAF Flanders

Timothy McDiarmid, Air Techniques International

Mark Renn, AAF Flanders

Matt Smyers, Technical Safety Services

Andrew Stillo, Camfil USA, Inc.

The Working Group also wishes to acknowledge the contributions of members who prefer to remain anonymous.

Copyright © 2023 by the Institute of Environmental Sciences and Technology

First printing, June 2023

ISBN: 978-1-937280-58-1 (Electronic format)

ISBN: 978-1-937280-57-4 (Print format)

**PROPOSAL FOR IMPROVEMENT:** The Working Groups of the Institute of Environmental Sciences and Technology are continually working on improvements to their Recommended Practices and Reference Documents. Suggestions from users of these documents are welcome. If you have a suggestion regarding this document, please use the online Proposal for Improvement form found on the IEST website at [www.iest.org](http://www.iest.org).

Institute of Environmental Sciences and Technology  
1827 Walden Office Square, Suite 400  
Schaumburg, IL 60173  
Phone: (847) 981-0100 • Fax: (847) 981-4130  
E-mail: [information@iest.org](mailto:information@iest.org) • Web: [www.iest.org](http://www.iest.org)

---

**NOTICE AND DISCLAIMER:** This Recommended Practice is published by the Institute of Environmental Sciences and Technology (IEST) to advance the technical and engineering sciences. Use of this document is entirely voluntary, and determination of its applicability and suitability for any particular use is solely the responsibility of the user. Use of this Recommended Practice does not imply any warranty or endorsement by IEST.

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among all persons participating in the development of this document.

IEST standards, recommended practices, and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and seeks out the views of persons who have an interest in the topic covered by this publication. While IEST administers the process to promote fairness in the development of consensus, the organization does not write the document and does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in IEST standards, recommended practices, and guideline publications.

IEST disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. IEST disclaims and makes no guaranty or warranty, express or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of the particular purposes or needs of users of the document. IEST does not guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, IEST is not undertaking to render professional or other services for or on behalf of any person or entity, nor is IEST undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

IEST has no power, nor does it undertake to police or enforce compliance with the contents of this document. IEST does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety related information in this document shall not be attributable to IEST and is solely the responsibility of the certification maker of the statement.

---

## UPDATES INCLUDED IN THIS PUBLICATION

The text on discharge methods for charged media has been revised. The discussions on charged media and aerosol for discharge have been split for clarity.

The section on efficiency from scan measurements has added clarification on the size range data required. The governing equations have been corrected and/or clarified.

The section on testing filters with media having MPPS <100nm (usually ePTFE) is revised to note that it is valid only for overall efficiency and not scanned efficiency. Explanation on the recommendation to use the alternate size at 0.1-0.2 $\mu$ m has been added since the efficiency in this size range is expected to be lower than the that between 0.2-0.3  $\mu$ m since it is closer the MPPS of these filters.

---

# IEST-RP-CC007.4

## CONTENTS

### SECTION

1	SCOPE AND LIMITATIONS .....	6
2	REFERENCES.....	7
3	TERMS AND DEFINITIONS .....	8
4	TEST SYSTEM.....	10
5	SYSTEM QUALIFICATION AND CALIBRATION.....	15
6	TEST PROCEDURE .....	19
7	DATA REDUCTION (SECTION A5) .....	21
8	REPORTING AND MARKING.....	23

### FIGURES

FIGURE 1—BLOCK DIAGRAM OF A HEPA/ULPA FILTER TEST SYSTEM.....	11
---	----

### TABLES

TABLE A1. UPPER AND LOWER CONFIDENCE LIMITS FOR UPSTREAM AND DOWNSTREAM COUNTS.....	28
TABLE B1. MINIMUM FREQUENCY OF CALIBRATION.....	33

### APPENDIXES

APPENDIX A—FACTORS INFLUENCING MEASURED PENETRATION .....	24
APPENDIX B—RECOMMENDED CALIBRATION INTERVALS.....	33
APPENDIX C—CONSIDERATIONS FOR HEPA/ULPA FILTERS INCORPORATING CHARGED MEDIA .....	34
APPENDIX D—FILTER EFFICIENCY DETERMINATION WHEN FILTER MPPS IS EQUAL OR BELOW 0.1 $\mu\text{M}$ .....	36
APPENDIX E—DETERMINING THE FILTER MEAN EFFICIENCY IN THE FACTORY FROM LEAK SCAN DATA PER IEST-RP-CC034.....	38
APPENDIX F—PARTICLE DETECTION AND PARTICLE SIZE DISTRIBUTION.....	40
APPENDIX G—BIBLIOGRAPHY.....	42

# Testing HEPA and ULPA Filters

## IEST-RP-CC007.4

### 1 SCOPE AND LIMITATIONS

#### 1.1 Scope

This Recommended Practice (RP) describes the equipment, aerosol properties, processes, and calculations for determining the efficiency of HEPA, ULPA, and super ULPA filters in the factory, using particle counters. The procedure may be applied to production applications. This RP provides guidelines for constructing a suitable test duct and sampling system. Also provided are test criteria for quantifying penetration in the range of 0.030% to 0.00010%, between particles in the size range of 0.1 to 0.3  $\mu\text{m}$ .

#### 1.2 Limitations

Filters tested per IEST-RP-CC007 are typically factory-tested with uniform airflow across the filter. Ducted filters, fan filter units (FFUs), and poorly designed inlet housings for in-line filters may result in non-uniform media air velocity that can possibly reduce the *in situ* filter efficiency.

#### 1.3 Application of Method

Application of this RP is by mutual agreement between the customer and the supplier. To apply this RP, the agreement should also include:

- a) Acceptance criteria for penetration and pressure drop
- b) The test aerosol
- c) The test volume flow rate

Before testing filters, with a penetration level below 0.0005%, according to this RP, the most penetrating particle size (MPPS) should be determined. The determination can be made for the filter medium in flat sheet form, provided that the test is conducted with an aerosol as defined in section 4.2.9.

The test is performed at the same velocity as the average velocity through the medium in the assembled filter at the test volume flow rate.

**CAUTION** Testing in accordance with this RP may involve hazardous materials, operations, and equipment. This RP does not purport to address the safety problems associated with its use. It is the responsibility of the user to consult and establish appropriate safety and health practices and to determine the applicability of regulatory limitations before use of this RP.

The methodology described in this RP may be applied for particle-counter testing of filters outside the efficiency and particle size range covered in the document.