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FEATURING

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Design, Test, and Evaluation Resources

Product Reliability Resources

Conference Proceedings



**ANSI-ACCREDITED
STANDARDS DEVELOPING ORGANIZATION**

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Statement**

IEST is an international technical society of engineers, scientists, and educators that serves its members and the industries they represent (simulating, testing, controlling, and teaching the environments of earth and space) through education and the development of recommended practices and standards.



***Key to understanding,
innovation, and
professional growth
for today—and
tomorrow.***

**INSTITUTE OF
ENVIRONMENTAL
SCIENCES AND
TECHNOLOGY**

Arlington Place One
2340 S. Arlington Heights Rd.
Suite 620
Arlington Heights, IL
60005-4510
Phone: 847-981-0100
Fax: 847-981-4130
E-mail: information@iest.org
Website: www.iest.org

About IEST

The Institute of Environmental Sciences and Technology (IEST), founded in 1953, is a multidisciplinary, international society whose members are recognized for their contributions to the environmental sciences in the areas of contamination control in electronics manufacturing and pharmaceutical processes; design, test, and evaluation of commercial and military equipment; and product reliability issues associated with commercial and military systems.

The Institute of Environmental Sciences and Technology (IEST), a 501(c)(3) not-for-profit technical society, is the foremost organization addressing issues connected with contamination control. IEST is an ANSI-accredited standards-developing organization; Secretariat of ISO/Technical Committee (TC) 209 Cleanrooms and associated controlled environments; Administrator of the ANSI-accredited US Technical Advisory Group (TAG) to ISO/TC 209; and a founding member of the ANSI-accredited US TAG to ISO/TC 229 Nanotechnologies.

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Adobe 7.0 or higher is required to open our electronic documents. If needed, a current Adobe Reader can be downloaded for free from www.adobe.com.

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Actively engaged in a field related to IEST for more than two years.

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Graduated from undergraduate college or institution within the last two years (copy of diploma, degree, or certificate is required) or a current Graduate Degree student with less than two years in the industry (copy of student ID and course schedule is required).

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Student attending 12 or more hours of courses (not employed full-time). Copy of student ID and course schedule is required.

To join IEST and take advantage of the benefits of memberships in one of the premier technical societies in your field, please fill out the membership application opposite or visit www.iest.org to apply online.

IEST is a 501(c)(3) not-for-profit organization.

Membership dues are tax-deductible to the extent allowed by law.

TIP

Before you order from this catalog, check out the IEST member discount available on many of our professional resources.

If you are not yet a member, consider joining IEST before placing your order. You'll save money on this and future orders as well as on conference registrations!

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IEST chapters offer the ideal setting to connect locally with other professionals in your field at educational, social, and networking events.

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By completing this membership form, you agree to apply for IEST membership and to be governed by the bylaws of IEST. You also certify that all statements made on this form are accurate.

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GUIDE TO CONFERENCES

ESTECH

Held Each Spring

ESTECH, the annual technical meeting and exposition of IEST, provides a valuable educational experience through technical sessions and continuing education courses in the fields of design, test, and evaluation/product reliability; contamination control; and nanotechnology. Professional networking opportunities abound as attendees interact with leaders from these industries, academia, and government. Members of IEST Working Groups and other interested persons are encouraged to attend these Working Group meetings, where the latest Recommended Practices are discussed, developed, and updated. ESTECH features an Expo where suppliers of products and services showcase the latest industry-specific solutions.

IEST Fall Conference

Held Each Fall

The meeting includes IEST Working Group sessions as well as a variety of continuing education courses covering issues related to cleanrooms and controlled environments.

International Symposium on Product Quality and Integrity (RAMS)

Held Each Winter

The annual Reliability and Maintainability Symposium (RAMS) is the premier event in the reliability, availability, and maintainability engineering disciplines. Combining tutorials, presentations, CEUs, certifications, and networking into one week-long program, RAMS delivers cutting edge information to all technical industries.

Sponsored by AIAA, ASW, ECD, IEEE, IEST, IIE, RD, RS, SAE, SOLE, SRE, and SSS.

Aerospace Testing Seminar

Held Every 18 Months

The Aerospace Testing Seminar (ATS) provides a forum to communicate and exchange knowledge about the improvement and implementation of aerospace testing technology that will benefit current and future space programs.

Sponsored by The Aerospace Corporation, Space and Missile Systems Center and IEST.

Space Simulation Conference

*Held Every Other Fall
(Even-numbered Years)*

The Space Simulation Conference is a major international forum in space hardware environmental testing for research and development and qualification. It provides a unique opportunity for engineers, technicians, and scientists from industry, government, and academia to present and exchange information and ideas on simulating the space environment to develop and test space mission hardware.

Hosted by IEST and co-sponsored by NASA, AIAA, ASTM, Canadian Space Agency (CSA), and Johns Hopkins University Applied Physics Laboratory (JHUAPL).

IEST STANDARDS AND RECOMMENDED PRACTICES

Design, Test, and Evaluation and Product Reliability

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Document: 0135
Members: \$1140
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HANDBOOK OF IEST RECOMMENDED PRACTICES: **Design, Test, and Evaluation/Product Reliability Divisions**

Contains all currently published IEST Design, Test, and Evaluation and Product Reliability Recommended Practices listed in this catalog. Print version documents are contained in a three-ring binder to which additional RPs may be added as they are published. CD-ROM version contains single-user, non-revisable Adobe Acrobat PDF files.

Document: D009
Members: \$95
Nonmembers: \$155

ISBN 978-1-877862-58-8
20 pages; October 1999
Reviewed and validated:
July 2004

**Electronic
and Print**



IEST-RP-DTE009.1: VIBRATION SHAKER SYSTEM SELECTION

This RP features five sections designed to define an orderly approach that addresses the major issues involved in selecting a shaker for dynamic testing.

Document: D111
Members: \$180
Nonmembers: \$290

ISBN 978-0-9747313-1-5
43 pages; September 2004
**Electronic
and Print**



IEST-RP-DTE011.1: MECHANICAL SHOCK AND VIBRATION TRANSDUCER SELECTION

The purpose of this Recommended Practice is to provide guidelines for selecting transducers to measure shock and vibration in laboratory and field testing environments. Some special applications are not covered because of their unique nature and the rapid advancements taking place in their disciplines. These include a variety of biodynamic and biomechanical tests. Even in those applications not specifically addressed, however, these recommendations may be helpful.

DELIVERY NOTE: *Unless otherwise indicated, PDFs of individual documents will be sent to your e-mail the same business day when ordered by noon Central time. Handbooks will be supplied on a CD mailed to your physical address.*

Document: D012
 Members: \$230
 Nonmembers: \$340
 ISBN: 978-0-9787868-0-9
 321 pages; August 2006
 Electronic and CD-ROM



IEST-RD-DTE012.2: HANDBOOK FOR DYNAMIC DATA ACQUISITION AND ANALYSIS

This Reference Document provides guidelines for acquiring and analyzing structural or mechanical shock and vibration and acoustic and aerodynamic noise data from flight and ground tests for all categories of aerospace vehicles. *Supersedes previous versions of RP-DTE012.*

Document: D019
 Members: \$195
 Nonmembers: \$315
 ISBN 978-0-9841330-4-8
 10 Pages; April 2011
 Electronic and Print



IEST-RP-DTE019.1: VIBRATION CONTROLLER SELECTION

Included with the purchase of this RP is IEST-RD-DTE046.1: Terms Commonly Used in the Digital Analysis of Dynamic Data.

This RP provides rudimentary guidelines for those tasked with selecting a closed-loop digital shaker control system (DSCS) for use in vibration or shock testing, or both. The RP is concerned with single shaker operation only and assumes this system will be used for critical qualification of military or commercial products, for example, according to MIL-STD-810.

Document: D026
 Members: \$95
 Nonmembers: \$155
 ISBN 978-1-877862-84-7
 31 pages; January 2002
 Electronic and Print



IEST-RP-DTE026.1: USING MIL-STD-810(F), 519 GUNFIRE

This Recommended Practice provides guidelines for component and structure testing for the gunfire environment. It is structured to supplement guidelines provided in MIL-STD-810F and to provide for more realistic laboratory testing practices for gunfire environments. Four different procedures, three under "The Pulse Method" and one under "The Random Vibration Method," are described, as well as the limitations of test design.

Document: D032
 Members: \$250
 Nonmembers: \$360
 ISBN 978-0-9841330-2-4
 34 pages; October 2009
 Electronic and Print



IEST-RP-DTE032.2: PYROSHOCK TESTING TECHNIQUES

This RP provides an overview of pyroshock testing concepts and compares provisions from other pyroshock documents. Much of this document is devoted to acquisition and analysis of pyroshock data because proper time-history data acquisition and test specification development are common test industry problems. To avoid corrupted pyroshock data and resulting inaccurate pyroshock specifications, recommended practices for instrumentation and data acquisition systems are given. *Supersedes previous versions of RP-DTE032.*

Document: D040
 Members: \$105
 Nonmembers: \$175
 ISBN 978-1-877862-90-8
 20 pages; January 2003
 Electronic and Print



IEST-RP-DTE040.1: HIGH-INTENSITY ACOUSTICS TESTING

This RP is a high-level guide for practicing engineers and engineering managers to use when planning and executing an acoustic test program. A brief overview of the acoustic environment encountered by aeronautical and aerospace systems and the simulation that can be achieved in a HIAT chamber is followed by test philosophy, the description of a few typical test facilities, the discussion of test articles for various tests, the development of test specifications under different conditions, the requirement of instrumentation and data processing, and the procedures of test operation.

Document: D046
 Members: \$120
 Nonmembers: \$200
 ISBN 978-0-9841330-5-5
 20 pages; April 2011
 Electronic and Print



IEST-RD-DTE046.1: TERMS COMMONLY USED IN THE DIGITAL ANALYSIS OF DYNAMIC DATA

The purpose of this Reference Document (RD) is to define, clarify, and disseminate terminology appropriate for digital analysis of dynamic data as used in environmental testing. This RD is intended to assist those involved in recording, analyzing, displaying, or interpreting data relating to the dynamic properties of mechanical systems. Such data may include strain, vibration, sound pressure variations, and system electrical characteristics.

Document: PR01
 Members: \$155
 Nonmembers: \$255
 ISBN 978-1-877862-70-0
 73 pages; October 2003
 Print and CD-ROM



IEST-RP-PR001.1: MANAGEMENT AND TECHNICAL GUIDELINES FOR THE ESS PROCESS

This document supersedes and replaces Assemblies–ESS (1990), Assemblies–ESSEH Guidelines Supplement (1988), and Assemblies–Environmental Stress Screening Guidelines (1984).

This document discusses the process elements required to successfully implement Environmental Stress Screening (ESS), as well as the process steps necessary to keep the ESS process dynamic, such as successful planning, implementation of ESS, the collection of failure data, the analysis of failures, and implementation of corrective action.

Document: PR03
 Members: \$205
 Nonmembers: \$320
 ISBN:
 Print: 978-1-937280-06-2
 Electronic: 978-1-937280-07-9
 24 pages; September 2012



IEST-RP-PR003.1: HALT AND HASS

This Recommended Practice (RP) defines and describes HALT (Highly Accelerated Life Testing) and HASS (Highly Accelerated Stress Screening). This RP contains information on the philosophy behind the testing, generic examples of tests, the differences between standard testing equipment and equipment used for highly accelerated testing, fixturing considerations, alternative approaches, additional environments, and lessons learned. This style of testing takes a Qualitative approach (looking for the quality of the design and workmanship) rather than a Quantitative one (being able to use the results to calculate length of life in service). This RP may be used in conjunction with a test specification or as general guidance.

Document: 810G
 Members: \$95
 Nonmembers: \$155
 240 pages
 2nd Edition; February 2010
 Electronic download only
 (does not include MIL-STD-810)

THE HISTORY AND RATIONALE OF MIL-STD-810

The 240-page 2nd Edition of this popular treatise, first published in 2005, captures the thought process behind the evolution of *MIL-STD-810, Test Method Standard for Environmental Engineering Considerations and Laboratory Test*.

The new edition includes background and analysis to assist in the interpretation of the latest revision of the standard, MIL-STD-810G, published in October 2008. Author Herbert W. Egbert, a Fellow of IEST, was heavily involved in the development of revisions 810D through 810G. *The History and Rationale* provides a development history of test methods, rationale for many procedural changes, tailoring guidance for many test procedures, and insight into the future direction of the standard. The document also provides a practical reference for those wishing to submit comments concerning future editions of the Standard.

DTE / PR

MOST DOCUMENTS ARE AVAILABLE IN PRINT OR ELECTRONIC FORMAT

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ISO/TC 209 STANDARDS—ISO 14644 Series

Cleanrooms and associated controlled environments

| Document | Title | Status | Members | NonMembers |
|------------------|--|----------------------------|----------|------------|
| Document Set | ISO 14644 Series Handbook plus IEST Technical Guides <i>Notebook containing all available 14644 standards and all four IEST Technical Guides. (Does not include DIS documents or ISO 14644-10)</i> | | \$1015 | \$1270 |
| Document Set | ISO 14644 Series Handbook <i>Notebook containing all 14644 standards. (Does not include DIS documents or ISO 14644-10.)</i> | | \$799.20 | \$999 |
| ISO 14644-1 | Classification of air cleanliness | ANSI Standard 1999 | \$89.60 | \$112 |
| ISO/DIS 14644-1 | Classification of air cleanliness by particle concentration | DIS* Dec. 2010 | \$75 | \$75 |
| ISO 14644-2 | Specifications for testing and monitoring to prove continued compliance with 14644-1 | ANSI Standard 2000 | \$56 | \$70 |
| ISO/DIS 14644-2 | Specifications for monitoring and periodic testing to prove continued compliance with ISO 14644-1 | DIS* Dec. 2010 | \$75 | \$75 |
| ISO 14644-3 | Test methods | ANSI Standard 2005 | \$163.20 | \$204 |
| ISO 14644-4 | Design, construction and start-up | ANSI Standard 2001 | \$153.60 | \$192 |
| ISO 14644-5 | Operations | ANSI Standard Aug. 2004 | \$137.60 | \$172 |
| ISO 14644-6 | Vocabulary | ANSI Standard July 2007 | \$125.60 | \$157 |
| ISO 14644-7 | Separative devices (clean air hoods, gloveboxes, isolators, minienvironments) | ANSI Standard Nov. 2004 | \$153.60 | \$192 |
| ISO 14644-8 | Classification of air cleanliness by chemical concentration (ACC) | ANSI Standard 2013 | \$100.80 | \$126 |
| ISO 14644-9 | Classification of surface particle cleanliness | ANSI Standard 2012 | \$108 | \$135 |
| ISO 14644-10 | Classification of surface cleanliness by chemical concentration | Standard 2013 | \$120 | \$150 |
| ISO DIS 14644-12 | Classification of Air Cleanliness by Nanoscale Particle Concentration | DIS* April 2013 | \$70 | \$70 |
| | | | | |
| ISO 14698-1 | Biocontamination control—General principles and methods | Standard 2003 | \$150 | \$150 |
| ISO 14698-2 | Biocontamination control—Evaluation and interpretation of biocontamination data | Standard 2003 | \$90 | \$90 |

ISO/TC 209

Documents in the series are in various stages of development, such as Standard, ^{*}Draft International Standard (DIS) and ^{}Final Draft International Standard (FDIS). ISO documents are available in print or electronic format. For descriptions of standards and current pricing, visit www.iest.org. Refer to back of this catalog for ISO copyright restrictions.**

ABOUT ISO DOCUMENTS

- Documents in the ISO/TC 209—ISO 14644 series are in various stages of development, such as the Standard, Final Draft International Standard (FDIS), or Draft International Standard (DIS) stage.
- In addition, documents may be published as ISO Technical Reports (TR) or ISO Draft Technical Reports (DTR).
- ISO documents are available in print or electronic format.
- For descriptions of these ISO documents, see the following pages in the catalog or visit www.iest.org.
- For the most current document status and pricing information, visit www.iest.org.
- The chart on the following three pages illustrates the relationship between various ISO Standards and the corresponding IEST documents.
- Refer to back of this catalog to read the ISO General Terms and Conditions and the ISO General Copyright Statement.

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A customized network site license for your intranet ...
... allows your company to provide key personnel with ongoing access to the documents of your choice, including ISO National Standards, IEST Recommended Practices, and other IEST electronic documents.

For more details on an IEST CUSTOM E-LICENSE, see page 17.



QUICK REFERENCE GUIDE

| ISO/TC 209 DOCUMENT | PARALLEL IEST DOCUMENTS |
|---|--|
| ISO 14644-1 Classification of air cleanliness | <i>CC001: HEPA and ULPA Filters</i> <i>CC006: Testing Cleanrooms</i> <i>CC012: Considerations in Cleanroom Design</i> <i>CC019: Qualifications for Organizations Engaged in the Testing and Certification of Cleanrooms and Clean-Air Devices</i> <i>CC036: Testing Fan Filter Units (to be published)</i> |
| ISO 14644-2 Specifications for testing and monitoring to prove compliance with ISO 14644-1 | <i>CC001: HEPA and ULPA Filters</i> <i>CC002: Unidirectional Flow Clean-Air Devices</i> <i>CC006: Testing Cleanrooms</i> <i>CC007: Testing ULPA Filters</i> <i>CC012: Considerations in Cleanroom Design</i> <i>CC034: HEPA and ULPA Filter Leak Tests</i> <i>CC036: Testing Fan Filter Units (to be published)</i> |
| ISO 14644-3 Test methods | <i>CC006: Testing Cleanrooms</i> <i>CC007: Testing ULPA Filters</i> <i>CC008: High-Efficiency Gas-Phase Adsorber Cells</i> <i>CC013: Calibration Procedures and Guidelines for Selecting Equipment Used in Testing Cleanrooms</i> <i>CC014: Calibration and Characterization of Optical Airborne Particle Counters</i> <i>CC021: Testing HEPA and ULPA Filter Media</i> <i>CC034: HEPA and ULPA Filter Leak Tests</i> <i>CC036: Testing Fan Filter Units (to be published)</i> |
| ISO 14644-4 Design, construction, and start-up | <i>CC003: Garment System Considerations in Cleanrooms and Other Controlled Environments</i> <i>CC004: Evaluating Wiping Materials Used in Cleanrooms and Other Controlled Environments</i> <i>CC005: Gloves and Finger Cots Used in Cleanrooms and Other Controlled Environments</i> <i>CC006: Testing Cleanrooms</i> <i>CC007: Testing ULPA Filters</i> <i>CC008: High-Efficiency Gas-Phase Adsorber Cells</i> <i>CC012: Considerations in Cleanroom Design</i> <i>CC018: Cleanrooms Housekeeping - Operation and Monitoring Procedures</i> <i>CC019: Qualifications for Organizations Engaged in the Testing and Certification of Cleanrooms and Clean-Air Devices</i> <i>CC020: Substrates and Forms for Documentation in Cleanrooms</i> <i>CC021: Testing HEPA and ULPA Filter Media</i> <i>CC022: Electrostatic Charge in Cleanrooms and Other Controlled Environments</i> <i>CC024: Measuring and Reporting Vibration in Microelectronics Facilities</i> <i>CC026: Cleanroom Operations</i> <i>CC027: Personnel Practices and Procedures in Cleanrooms and Controlled Environments</i> <i>CC036: Testing Fan Filter Units (to be published)</i> |

| ISO/TC 209 DOCUMENT | PARALLEL IEST DOCUMENTS |
|---|--|
| <p>ISO 14644-5 Operations</p> | <p>CC003: <i>Garment System Considerations in Cleanrooms and Other Controlled Environments</i></p> <p>CC004: <i>Evaluating Wiping Materials Used in Cleanrooms and Other Controlled Environments</i></p> <p>CC005: <i>Gloves and Finger Cots Used in Cleanrooms and Other Controlled Environments</i></p> <p>CC008: <i>High-Efficiency Gas-Phase Adsorber Cells</i></p> <p>CC018: <i>Cleanroom Housekeeping—Operating and Monitoring Procedures</i></p> <p>CC019: <i>Qualifications for Organizations Engaged in the Testing and Certification of Cleanrooms and Clean-Air Devices</i></p> <p>CC020: <i>Substrates and Forms for Documentation in Cleanrooms</i></p> <p>CC022: <i>Electrostatic Charge in Cleanrooms and Other Controlled Environments</i></p> <p>CC026: <i>Cleanroom Operations</i></p> <p>CC027: <i>Personnel Practices and Procedures in Cleanrooms and Controlled Environments</i></p> |
| <p>ISO 14644-6 Vocabulary</p> | <p>CC001: <i>HEPA and ULPA Filters</i></p> <p>CC002: <i>Unidirectional Clean-Air Devices</i></p> <p>CC003: <i>Garment System Considerations in Cleanrooms and Other Controlled Environments</i></p> <p>CC004: <i>Evaluating Wiping Materials Used in Cleanrooms and Other Controlled Environments</i></p> <p>CC005: <i>Gloves and Finger Cots Used in Cleanrooms and Other Controlled Environments</i></p> <p>CC006: <i>Testing Cleanrooms</i></p> <p>CC007: <i>Testing ULPA Filters</i></p> <p>CC008: <i>High-Efficiency Gas-Phase Adsorber Cells</i></p> <p>CC011: <i>A Glossary of Terms and Definitions Relating to Contamination Control</i></p> <p>CC012: <i>Considerations in Cleanroom Design</i></p> <p>CC013: <i>Calibration Procedures and Guidelines for Select Equipment Used in Testing Cleanrooms and Other Controlled Environments</i></p> <p>CC014: <i>Calibrating Particle Counters</i></p> <p>CC016: <i>The Rate of Deposition of Nonvolatile Residue in Cleanrooms</i></p> <p>CC018: <i>Cleanrooms Housekeeping - Operation and Monitoring Procedures</i></p> <p>CC019: <i>Qualifications for Organizations Engaged in the Testing and Certification of Cleanrooms and Clean-Air Devices</i></p> <p>CC020: <i>Substrates and Forms for Documentation in Cleanrooms</i></p> <p>CC021: <i>Testing HEPA and ULPA Filter Media</i></p> <p>CC022: <i>Electrostatic Charge in Cleanrooms and Other Controlled Environments</i></p> <p>CC023: <i>Microorganisms in Cleanrooms</i></p> <p>CC024: <i>Measuring and Reporting Vibration in Microelectronics Facilities</i></p> <p>CC025: <i>Evaluation of Swabs Used in Cleanrooms (to be published)</i></p> <p>CC026: <i>Cleanroom Operations</i></p> <p>CC027: <i>Personnel Practices and Procedures in Cleanrooms and Controlled Environments</i></p> <p>CC028: <i>Minienvironments</i></p> <p>CC031: <i>Outgassing Performance Criteria for Cleanroom Materials</i></p> <p>CC032: <i>Flexible Packaging Materials for Use in Cleanrooms and Other Controlled Environments (to be published)</i></p> <p>CC034: <i>HEPA and ULPA Filter Leak Tests</i></p> <p style="text-align: right;">Continued on next page ►</p> |

| ISO/TC 209 DOCUMENT | PARALLEL IEST DOCUMENTS |
|--|--|
| ISO 14644-6 (continued) Vocabulary | <i>CC035: Design Considerations for Airborne Molecular Contamination Filtration Systems in Cleanrooms (to be published)</i> <i>CC036: Testing Fan Filter Units (to be published)</i> <i>CC040: Cleaning of Equipment Surfaces in the Cleanroom and Controlled Environments (to be published)</i> <i>CC041: Recovery Plan Following Disaster Disruption (to be published)</i> <i>CC042: Liquid Particle Counters (to be published)</i> <i>CC101: Forum on Air Cleanliness Technology (to be published)</i> <i>CC201: Forum for Nanoscale Research Facilities (to be published)</i> <i>CC901: IEST-STD-CC1246D: Product Cleanliness Levels and Contamination Control Program (to be published)</i> <i>CC902: MIL-HDBK-406: Contamination Control Technology: Cleaning Materials for Precision Pre-cleaning and Use in Cleanrooms and Clean Workstations;</i> <i>MIL-HDBK-407: Contamination Control Technology: Precision Cleaning Methods and Procedures (to be published)</i> |
| ISO 14644-7 Separative devices | <i>CC002: Unidirectional Clean-Air Devices</i> <i>CC008: High-Efficiency Gas-Phase Adsorber Cells</i> <i>CC012: Considerations in Cleanroom Design</i> <i>CC028: Minienvironments</i> <i>CC036: Testing Fan Filter Units (to be published)</i> |
| ISO 14644-8 Classification of airborne molecular contamination | <i>CC016: The Rate of Deposition of Nonvolatile Residue in Cleanrooms</i> <i>CC031: Outgassing Performance Criteria for Cleanroom Materials</i> |
| ISO 14644-9 Clean Surfaces | To Be Determined |
| ISO/TC 209 DOCUMENT | PARALLEL IEST DOCUMENTS |
| ISO 14698-1 Biocontamination control — General principles | <i>CC013: Calibration Procedures and Guidelines for Select Equipment Used in Testing Cleanrooms and Other Controlled Environments</i> <i>CC023: Microorganisms in Cleanrooms</i> |
| ISO 14698-2 Biocontamination control — Evaluation and interpretation of biocontamination data | <i>CC013: Calibration Procedures and Guidelines for Select Equipment Used in Testing Cleanrooms and Other Controlled Environments</i> <i>CC023: Microorganisms in Cleanrooms</i> |
| ISO 21501-4 Determination of particle size distribution— Single particle light interaction methods— Part 4: Light scattering airborne particle counter for clean spaces | <i>CC014: Calibration and Characterization of Airborne Particle Counters</i> |

ISO/TC 209 STANDARDS – ISO 14644 Series

Cleanrooms and Associated Controlled Environments

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Document: 200G
Members: \$1015
Nonmembers: \$1270
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ISO 14644 SERIES HANDBOOK plus IEST TECHNICAL GUIDES

Notebook containing all available national standards in the ISO 14644 series *plus* IEST Technical Guides. See descriptions on following pages.

- ISO 14644-1:1999: *Classification of air cleanliness*
 - ISO 14644-2:2000: *Specifications for testing and monitoring to prove continued compliance with 14644-1*
 - ISO 14644-3:2005 *Test methods*
 - ISO 14644-4:2001 *Design, construction and start-up*
 - ISO 14644-5:2004 *Operations*
 - ISO 14644-6:2007 *Vocabulary*
 - ISO 14644-7:2004 *Separative devices*
 - ISO 14644-8:2013 *Classification of air cleanliness of chemical concentration (ACC)*
 - ISO 14644-9:2012 *Classification of surface cleanliness by particle concentration*
 - IENT-G-CC1001: *Counting Airborne Particles for Classification and Monitoring of Cleanrooms and Clean Zones*
 - IENT-G-CC1002: *Determination of the Concentration of Airborne Ultrafine Particles*
 - IENT-G-CC1003: *Measurement of Airborne Macroparticles*
 - IENT-G-CC1004: *Sequential-Sampling Plan for Use in Classification of the Particulate Cleanliness of Air in Cleanrooms and Clean Zones*
- NOTE: ISO/DIS 14644-1, ISO/DIS 14644-2, ISO 14644-10 may be purchased separately.

Document: 199G
Members: \$799.20
Nonmembers: \$999
Electronic and Print



ISO 14644 SERIES HANDBOOK

Notebook containing all available national standards in the ISO 14644 American national standard series. See descriptions on following pages.

- ISO 14644-1:1999: *Classification of air cleanliness*
 - ISO 14644-2:2000: *Specifications for testing and monitoring to prove continued compliance with 14644-1*
 - ISO 14644-3:2005 *Test methods*
 - ISO 14644-4:2001 *Design, construction and start-up*
 - ISO 14644-5:2004 *Operations*
 - ISO 14644-6:2007 *Vocabulary*
 - ISO 14644-7:2004 *Separative devices*
 - ISO 14644-8:2013 *Classification of air cleanliness of chemical concentration (ACC)*
 - ISO 14644-9:2012 *Classification of surface cleanliness by particle concentration*
- NOTE: ISO/DIS 14644-1, ISO/DIS 14644-2, ISO 14644-10 may be purchased separately.

Document: 644S
Members: \$89.60
Nonmembers: \$112
18 pages; 1999
U.S. Title:
ANSI/IEST/ISO 14644-1:1999
Electronic and Print

ISO 14644-1: Classification of air cleanliness

This national Standard covers the classification of air cleanliness in cleanrooms and associated controlled environments. Classification in accordance with this standard is specified and accomplished exclusively in terms of concentration of airborne particles and is limited to a designated range of considered particle sizes for determination of particle concentration limits. ISO 14644-1 and 14644-2 supersede FED-STD-209E.

Document: 441D
Price: \$75
37 pages
DIS December 2010
Electronic and Print

ISO/DIS 14644-1: Classification of air cleanliness by particle concentration

This *Draft* International Standard covers the classification of air cleanliness in cleanrooms and associated controlled environments exclusively in terms of concentration of airborne particles of a designated size range.

The use of discrete-particle airborne counting and sizing instruments is the basis for determination of the concentration of airborne particles at designated sampling locations. This edition is the result of a systematic review and includes changes in response to user and expert feedback validated by international enquiry. The most significant change is the adoption of a more consistent statistical approach to the selection of number of sample locations and the evaluation of the data collected.

Document: 442S
Members: \$56
Nonmembers: \$70
7 pages; 2000
U.S. Title:
ANSI/IEST/ISO 14644-2:2000
Electronic and Print

ISO 14644-2: Specifications for testing and monitoring to proved continued compliance with ISO 14644-1

This national Standard specifies requirements for monitoring and periodic testing of a cleanroom or clean zone to prove its continued compliance with ISO 14644-1 for the designated classification of airborne particulate cleanliness. ISO 14644-1 and 14644-2 supersede FED-STD-209E.

Document: 442D
Price: \$75
8 pages
DIS December 2010
Electronic and Print

ISO/DIS 14644-2: Specifications for monitoring and periodic testing to prove continued compliance with ISO 14644-1

This *Draft* International Standard specifies requirements for testing and monitoring of a cleanroom or clean zone to prove its continued compliance with ISO 14644-1:2010 for the designated classification of air cleanliness by particle concentration. These requirements invoke the test described in ISO 14644-1:2010 for classification of a cleanroom or clean zone. Additional tests are also specified, to be carried out in accordance with the requirements of this part of ISO 14644. This part of ISO 14644 also specifies requirements for monitoring of a cleanroom or clean zone to provide evidence of its continued compliance with ISO 14644-1:2010 for the designated classification of airborne particulate cleanliness.

Document: 6443
Members: \$163.20
Nonmembers: \$204
65 pages; 2005
U.S. Title:
ANSI/IEST/ISO 14644-3:2005
Electronic and Print

ISO 14644-3: Test methods

This national Standard specifies test methods for designated classification of airborne particulate cleanliness and for characterizing the performance of cleanrooms and clean zones. The test methods recommend test apparatus and test procedures for determining performance parameters. For some of the tests, several different methods and apparatus are recommended to accommodate different end-use considerations. This part of ISO 14644 is not applicable to the measurement of products or of processes in cleanrooms or separative devices.

Which Versions of ISO 14644-1 and -2 Should I Use?

Review the Statistics

The contamination control community now finds itself choosing between the two versions of the cornerstone ISO cleanroom standards titled ISO 14644-1 and -2. Both the original Standard versions and the newly released Draft International Standard (DIS) versions may be used as trade reference per agreement between customers and suppliers. Which version you choose for reference is a decision that should be reviewed and addressed by the customer and supplier. The new versions incorporate new provisions for cleanroom sample locations.

The *Journal of the IEST* has issued a special edition featuring a peer-reviewed paper, developed by the experts of WG1 (the experts who developed the new revisions), that details the statistics behind the revised methods. It is recommended by the ISO Technical Committee that the industry view this statistics paper in conjunction with the DIS versions. It is also important to note that a Draft International Standard may undergo further revision before it is presented as a Final Draft International Standard (FDIS) and then published as a Standard.

IEST is conducting educational courses to inform the contamination control community about the revisions. Check the IEST website for updates on these courses or call IEST at (847) 981-0100 to be placed on the list for notification of the course dates and locations.

Which Versions of ISO 14644-1 and -2 Should I Use?

Use the Correct Title for Specification

While you may use either the Standard or DIS version of the documents, you should specify the correct title in any references. For example, if you are specifying to the initial versions that were published as ISO Standards and have been accepted as American National Standards under the IEST lead, you would specify to ISO 14644-1:1999 and ISO 14644-2:2000. If you review the DIS version and choose to specify to the draft, you should indicate that you are specifying to ISO/DIS 14644-1 (2010) and ISO/DIS 14644-2 (2010) to avoid confusion.

As with any monumental change, there will be discussion and questions. Watch the ISO pages of the IEST website for further developments.

Document: 444S
Members: \$153.60
Nonmembers: \$192
54 pages; 2001
U.S. Title:
ANSI/EST/ISO 14644-4:2001
Electronic and Print

ISO 14644-4: Design, construction, and start-up

This national Standard specifies requirements for the design and construction of cleanroom installations but does not prescribe specific technological or contractual means to meet these requirements. It is intended for use by purchasers, suppliers and designers of cleanroom installations and provides a checklist of important parameters of performance. Construction guidance is provided, including requirements for start-up and qualification. Basic elements of design and construction needed to ensure continued satisfactory operation are identified through the consideration of relevant aspects of operation and maintenance.

Document: 6445
Members: \$137.60
Nonmembers: \$172
46 pages; August 2004
U.S. Title:
ANSI/EST/ISO 14644-5:2004
Electronic and Print

ISO 14644-5: Operations

This national Standard specifies basic requirements for cleanroom operations. It is intended for those planning to use and operate a cleanroom. Aspects of safety that have no direct bearing on contamination control are not considered in this part of ISO 14644 and national and local safety regulations must be observed. This document considers all classes of cleanrooms used to produce all types of products. Therefore, this document is broad in application and does not address specific requirements for individual industries.

Refer to aback of this catalog for ISO copyright restrictions.

Document: 6446
Members: \$125.60
Nonmembers: \$157
34 pages; July 2007
U.S. Title:
ANSI/IEST/ISO 14644-6:2008
Electronic and Print

ISO 14644-6: Vocabulary

This national Standard is an ideal resource for anyone involved in contamination control. This part of ISO 14644 is a compendium of terms and definitions used in the ISO 14644 series: ISO 14644-1, 14644-2, 14644-3, 14644-4, 14644-5, 14644-7, 14644-8, 14698-1, and 14698-2.

Document: 6447
Members: \$153.60
Nonmembers: \$192
52 pages; October 2004
U.S. Title:
ANSI/IEST/ISO 14644-7:2004
Electronic and Print

ISO 14644-7: Separative devices (Clean air hoods, gloveboxes, isolators, minienvironments)

This national Standard specifies the minimum requirements for the design, construction, installation, testing and approval of separative devices in those respects where they differ from cleanrooms as described in ISO 14644-4 and 14644-5.

Document: 6448
Members: \$100.80
Nonmembers: \$126
18 pages; February 2013
U.S. Title:
ANSI/IEST/ISO 14644-8:2013
Electronic and Print

ISO 14644-8: Classification of air cleanliness by chemical concentration (ACC)

This national Standard covers the classification of airborne molecular contamination (AMC) in cleanrooms and associated controlled environments, in terms of airborne concentrations of specific chemical substances (individual, group or category) and provides a protocol to include test methods, analysis, and time weighted factors within the specification for classification. This part of ISO 14644 is not relevant for application in those industries, processes or production, where the presence of airborne molecular substances is not considered a risk to the product or process. It is not the intention of this part of ISO 14644 to describe the nature of airborne molecular contaminants.

Document: 146449
Members: \$108
Nonmembers: \$135
35 pages; October 2012
U.S. Title:
ANSI/IEST/ISO 14644-9:2012
Electronic and Print

ISO 14644-9: Classification of Surface Particle Cleanliness

This national Standard establishes the classification of cleanliness levels on solid surfaces by particle concentration in cleanrooms and associated controlled environment applications. This part of ISO 14644 applies to all solid surfaces, such as walls, ceilings, floors, working environments, tools, equipment and products. The classification of surface cleanliness by particle concentration (SCP) is limited to particles between 0.05 µm and 500 µm. Recommendations on testing and measuring methods, as well as information about surface characteristics, are provided in the annexes.

Document: 1464410
Members: \$120
Nonmembers: \$150
34 pages; March 2013
Electronic and Print

ISO 14644-10: Classification of surface cleanliness by chemical concentration

This standard defines the classification system for cleanliness of surfaces in cleanrooms with regard to the presence of chemical compounds or elements (including molecules, ions, atoms, and particles). This standard is applicable to all solid surfaces in cleanrooms and associated controlled environments such as walls, ceilings, floors, working environment, tools, equipment, and devices.

Refer to back of this catalog for ISO copyright restrictions.

Document: 64412
Members: \$70
Nonmembers: \$70
24 pages; DIS April 2013
Electronic and Print

ISO DIS 14644-12: CLASSIFICATION OF AIR CLEANLINESS BY NANOSCALE PARTICLE CONCENTRATION

This Draft International Standard covers the classification of air cleanliness by particles (ACP) in terms of concentration of airborne nanoscale particles. For classification purposes, only populations of particles with a lower size limit of 0.1 microns (100 nm) or less - "nanoscale" - are considered. The classification given in this document is for use mainly in "in operation" states. This classification extrapolates the particulate classification equation specified in 14644-1 into the nanoscale (< 100 nm) region.

ISO/TC 209 STANDARDS – ISO 14698 Series

Document: 6921
Price: \$150
36 pages; 2003
Electronic and Print

ISO 14698-1: Biocontamination control Part 1: General principles and methods

This International Standard describes the principles and basic methodology of a formal system of biocontamination control (Formal System) for assessing and controlling biocontamination when cleanroom technology is applied for that purpose. This part of ISO 14698 specifies the methods required for monitoring risk zones in a consistent way and for applying control measures appropriate to the degree of risk involved. In zones where risk is low, it can be used as a source of information.

Document: 698S
Price: \$90
16 pages; 2003
Electronic and Print

ISO 14698-2 Biocontamination control Part 2: Evaluation and interpretation of biocontamination data

This part of ISO 14698 gives guidance on basic principles and methodological requirements for all microbiological data evaluation, and the estimation of biocontamination data obtained from sampling for viable particles in zones at risk, as specified by the system selected.

ISO/TC 209

Refer to back of this catalog for ISO copyright restrictions.

IEST TECHNICAL GUIDES

Document: 2001
 Members: \$85
 Nonmembers: \$150
 ISBN 978-1-877862-74-8
 10 pages; 1999
 Electronic and Print



IEST-G-CC1001: COUNTING AIRBORNE PARTICLES FOR CLASSIFICATION AND MONITORING OF CLEANROOMS AND CLEAN ZONES

Technical Guide 1001 launches the series of Guides, with general coverage of methods for sampling air in clean environments using a discrete-particle counter (DPC) to determine concentrations of airborne particles. The protocols presented are applicable for any cleanroom occupancy state and apply to classification (in accordance with ISO 14644-1), as well as monitoring (in accordance with ISO 14644-2). Several terms specific to counting procedures are defined. This document also provides detailed setup procedures to complement the concise provisions of section B.4.3 of ISO 14644-1. A sample format is provided for systematic data reporting in conjunction with ISO 14644-1 and ISO 14644-2.

Document: 2002
 Members: \$85
 Nonmembers: \$150
 ISBN 978-1-877862-75-5
 12 pages; 1999
 Electronic and Print



IEST-G-CC1002: DETERMINATION OF THE CONCENTRATION OF AIRBORNE ULTRAFINE PARTICLES

Technical Guide 1002 supplements the coverage of procedures for determining the concentration of ultrafine particles provided by ISO 14644-1. Procedures presented in this Guide are suitable for classification (in accordance with ISO 14644-1) and monitoring (in accordance with ISO 14644-2) of cleanroom and clean zone environments that would typically qualify as ISO Class 4 or cleaner. This Guide describes the apparatus and procedures necessary for determining the U descriptor and provides guidelines and an example format for reporting data.

Document: 2003
 Members: \$85
 Nonmembers: \$150
 ISBN 978-1-877862-76-2
 12 pages; 1999
 Electronic and Print



IEST-G-CC1003: MEASUREMENT OF AIRBORNE MACROPARTICLES

Technical Guide 1003 covers the realm of macroparticles, the particles of concern for operations involving the "other end" of the controlled environment spectrum. This Guide contains descriptions of apparatus and procedures

for classification (in accordance with ISO 14644-1) and monitoring (in accordance with ISO 14644-2) of clean environments requiring control of airborne contaminants in the macroparticle size range.



TECHNICAL GUIDE PACKAGE

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Document: 200A
 Members: \$255
 Nonmembers: \$450
 Electronic and Print

Document: 2004
 Members: \$85
 Nonmembers: \$150
 ISBN 978-1-877862-77-9
 16 pages; 1999
 Electronic and Print



IEST-G-CC1004: SEQUENTIAL-SAMPLING PLAN FOR USE IN CLASSIFICATION OF PARTICULATE CLEANLINESS OF AIR IN CLEANROOMS AND CLEAN ZONES

Technical Guide 1004 expands the coverage of sequential sampling introduced in ISO 14644-1. By applying sequential-sampling procedures in lieu of standard sampling procedures, significant savings of sampling time, perhaps as much as 80 percent, can be achieved when classifying the cleanliness of very clean air in cleanrooms and clean zones. The procedure is most appropriate for environments having air cleanliness that qualifies as ISO Class 4 or cleaner when tested in accordance with ISO 14644-1.

IEST STANDARDS AND RECOMMENDED PRACTICES

Contamination Control

Document: 0107
 Members: \$2125
 Nonmembers: \$3400
 CD-ROM and Print



HANDBOOK OF IEST RECOMMENDED PRACTICES Contamination Control Division

Contains all currently published Institute of Environmental Sciences and Technology Contamination Control Recommended Practices listed in this catalog. In addition, the Handbook contains A Glossary of Terms and Definitions Relating to Contamination Control; *IEST-STD-CC1246: Product Cleanliness Levels – Applications, Requirements, and Determination*; introductory material, and a table of contents. Print version documents are contained in two three-ring binders to which additional RPs may be added as they are published. CD-Rom version contains a single-user, non revisable Adobe Acrobat PDF file.

Document: USP
 Members: \$1600
 Nonmembers: \$2470
 CD-ROM and Print



HANDBOOK OF USP 797

This Handbook contains ISO Standards and IEST Recommended Practices to assist clinical and pharmaceutical personnel as well as cleanroom design and operations professionals in implementing controlled environments that comply with the requirements of USP Chapter 797 “Pharmaceutical Compounding – Sterile Preparations” (USP 797). USP 797 requires compounding pharmacies to determine the risk level of the compounding done in their facilities and to perform the compounding in cleanrooms or other controlled environments as specified for the risk level. The Handbook includes the following documents: ISO 14644-1, ISO 14644-2, ISO 14644-4, ISO 14644-5, ISO 14644-7, IEST-RP-CC001, IEST-RP-CC002, IEST-RP-CC003, IEST-RP-CC006, IEST-RP-CC007, IEST-RP-CC012, IEST-RP-CC018, IEST-RP-CC020, IEST-RP-CC023, IEST-RP-CC026, and IEST-RP-CC027.

Document: 1606
 Members: \$895
 Nonmembers: \$1405
 CD-ROM and Print



HANDBOOK ON AIR FILTRATION

Covers a broad range of applications for users who require removal of airborne particulate contamination for maximum air cleanliness. Includes the following Recommended Practices relating to air filtration in cleanrooms and other controlled environments: IEST-RP-CC001: HEPA and ULPA Filters; IEST-RP-CC002: Unidirectional Flow Clean-Air Devices; IEST-RP-CC006: Testing Cleanrooms; IEST-RP-CC007: Testing ULPA Filters; IEST-RD-CC011: A Glossary of Terms and Definitions Relating to Contamination Control; IEST-RP-CC021: Testing HEPA and ULPA Filter Media. IEST-RP-CC034: HEPA and ULPA Filter Leak Tests.

Document: CC00
 Members: \$865
 Nonmembers: \$1410
 CD-ROM and Print



HANDBOOK OF CLEANROOM PRACTICES

This handbook was compiled to facilitate the design and implementation of a comprehensive cleanroom management program based on the recommendations and best practices of contamination control experts in the industries served by IEST. Contains seven IEST Recommended Practices relating to cleanroom practices and operation: IEST-RP-CC003: Garment System Considerations in Cleanrooms and Other Controlled Environments; IEST-RP-CC004: Evaluating Wiping Materials Used in Cleanrooms and Other Controlled Environments; IEST-RP-CC005: Gloves and Finger Cots Used in Cleanrooms and Other Controlled Environments; IEST-RP-CC018: Cleanroom Housekeeping—Operating and Monitoring Procedures; IEST-RP-CC026: Cleanroom Operations; IEST-RP-CC027: Personnel Practices and Procedures in Cleanrooms and Controlled Environments; and IEST-RP-CC032: Flexible Packaging Materials for Use in Cleanrooms and *Other Controlled Environments*.



Document: 0187
 Members: \$205
 Nonmembers: \$320
 ISBN 978-0-9787868-9-2
 30 pages; July 2010
 Electronic and Print



IEST-RP-CC001.5: HEPA AND ULPA FILTERS

This Recommended Practice (RP) covers basic provisions for HEPA and ULPA filters as a basis for agreement between customers and suppliers. The RP describes 11 levels of filter performance and six grades of filter construction. Filters that meet the requirements of this RP are suitable for use in clean air devices and cleanrooms that fall within the scope of ISO 14644 and for use in supply air and contaminated exhaust systems that require extremely high filter efficiency (99.97% or higher) for submicrometer (μm) particles. Supersedes previous editions of IEST-RP-CC001.

Document: 0216
 Members: \$160
 Nonmembers: \$265
 ISBN 978-0-9747313-1-5
 32 pages; 2009
 Electronic and Print



IEST-RP-CC002.3: UNIDIRECTIONAL FLOW CLEAN-AIR DEVICES

This RP provides definitions, procedures for evaluating performance, and major requirements of unidirectional-flow, clean-air devices. In this edition, the section on types of devices has been expanded with descriptions and illustrations of 11 configurations. The section on testing has been updated and reorganized into three main categories: primary, secondary, and manufacturer-level tests. *Supersedes previous editions of RP-CC002.*

Document: 0033
 Members: \$255
 Nonmembers: \$395
 ISBN:
 Print: 978-0-915414-77-2
 Electronic: 978-0-915414-69-7
 48 + 20-pp supplement November 2011



IEST-RP-CC003.4: GARMENT SYSTEM CONSIDERATIONS IN CLEANROOMS AND OTHER CONTROLLED ENVIRONMENTS

This Recommended Practice (RP) addresses the gowning of personnel as a critical aspect of cleanroom contamination control. The latest edition includes a new 20-page supplement, *Guide to Measuring Cleanroom Garments*, which provides recommended garment measurement specifications. The RP provides non-mandatory guidance for the selection, specification, maintenance, and testing of apparel and accessories appropriate for use in nonaseptic and aseptic cleanrooms. *Supersedes previous editions of RP-CC003.*

Document: 0043
 Members: \$120
 Nonmembers: \$200
 ISBN 978-1-877862-98-4
 28 pages; August 2004
 Electronic and Print



IEST-RP-CC004.3: EVALUATING WIPING MATERIALS USED IN CLEANROOMS AND OTHER CONTROLLED ENVIRONMENTS

This RP describes methods for testing wiping materials in two broad categories: function and cleanliness. One section is dedicated to functional tests for absorbency capacity and rate. Other sections cover tests for wiper contamination, including enumeration of releasable particles, quantitative analysis of unspecified extractable matter, and methods for sampling and quantifying bioburden. *Supersedes previous editions of RP-CC004.*

Document: 0053
 Members: \$120
 Nonmembers: \$200
 ISBN: 978-1-877862-94-6
 20 pages; September 2003
 Reviewed and Validated:
 September 2006
 Electronic and Print



IEST-RP-CC005.3: GLOVES AND FINGER COTS USED IN CLEANROOMS AND OTHER CONTROLLED ENVIRONMENTS

This RP describes parameters and tests that apply to gloves and finger cots, using, whenever possible, standard tests approved by the American Society for Testing and Materials (ASTM) or government agencies. Where no such tests have been developed by these bodies, appropriate new tests have been devised. The specific intended use of the glove or finger cot being evaluated will determine which tests are appropriate for determining its acceptance or nonacceptance. *Supersedes previous editions of RP-CC005.*

Document: 0063
 Members: \$165
 Nonmembers: \$270
 ISBN 978-1-877862-99-1
 27 pages; August 2004
 Electronic and Print



IEST-RP-CC006.3: TESTING CLEANROOMS

This RP provides standardized test procedures for determining cleanroom and clean zone performance. It is intended to assist with preparing detailed specifications for cleanroom procurement and for assuring operational compliance. Performance tests are recommended for cleanrooms in three operational phases. Data gathered through testing can be used to establish baselines, track trends, and justify repairs. The test methods may also be used for periodic monitoring of cleanroom performance. *Supersedes previous editions of RP-CC006.*

Document: 0197
 Members: \$135
 Nonmembers: \$220
 ISBN 978-0-9787868-4-7
 30 pages; October 2007
 Electronic and Print



IEST-RP-CC007.2: TESTING ULPA FILTERS

This test procedure covers production testing of filters for particle penetration and pressure drop of ultralow penetration air filters (ULPA). The penetration range of the procedure is 0.001% to 0.0001%, using particle counters. The procedure describes equipment, aerosol properties, processes, and calculations for determining the efficiency of ultralow penetration air filters, using particle counters. The procedure may be applied to production applications. Guidelines are provided for constructing a suitable test duct and sampling system. Also provided are test criteria for quantifying penetration in the range of 0.001% to 0.0001%, using test aerosol particles in the size range of 0.1 to 0.2 μm . *Supersedes previous editions of RP-CC007.*

Document: 0198
 Members: \$100
 Nonmembers: \$165
 ISBN 978-0-9787868-2-3
 23 pages; October 2007
 Electronic and Print



IEST-RP-CC008.2: HIGH-EFFICIENCY GAS-PHASE ADSORBER CELLS

This RP covers the design and testing of modular gas-phase adsorber cells in single pass or recirculating air-cleaning systems where the need for high-efficiency removal of gaseous contaminants is a requirement. Three types of modular cells are discussed in detail, including new material on Type IV (vee-bed) cells. The RP incorporates allowable materials, design, construction, quality assurance requirements, and packaging and shipping. *Supersedes previous editions of RP-CC008.*

Document: 0183
 Members: \$120
 Nonmembers: \$155
 ISBN 978-1-877862-28-1
 32 pages; November 2002
 Electronic and Print



IEST-RD-CC011.2: A GLOSSARY OF TERMS AND DEFINITIONS RELATING TO CONTAMINATION CONTROL

This document defines terms relating to contamination control and contains lists of frequently used abbreviations and acronyms. It also contains a list of IEST Recommended Practices and lists the RPs by subject area. The terms and definitions included in this document generally have distinctive meanings within the context of contamination control. *Supersedes IES-CC011-85T.*

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Document: 0199
 Members: \$180
 Nonmembers: \$290
 ISBN 978-0-9787868-1-6
 62 pages; July 2007
 Electronic and Print



IEST-RP-CC012.2: CONSIDERATIONS IN CLEANROOM DESIGN

This RP reviews factors to consider in the design of cleanroom facilities, provides a framework to establish performance criteria, and includes details on specific processes and systems. A new section on energy efficiency helps users evaluate initial costs and life-cycle costs and includes a table of energy-conserving steps. The document also covers contamination control procedures for the construction phase. *Supersedes previous editions of RP-CC0012.*

Document: 0200
 Members: \$205
 Nonmembers: \$320
 ISBN:
 Print: 978-1-937280-05-5
 Electronic: 978-1-937280-04-8
 40 pages; August 2012



IEST-RP-CC013.3: CALIBRATION PROCEDURES AND GUIDELINES FOR SELECTING EQUIPMENT USED IN TESTING CLEANROOMS AND OTHER CONTROLLED ENVIRONMENTS

This Recommended Practice (RP) covers procedures for calibrating and verifying instruments used to characterize cleanrooms and for other high-efficiency particulate air (HEPA) filtration testing devices. The RP includes general procedures for calibrating aerosol generators, photometers, anemometers, airflow capture hoods, temperature measurement systems and devices, pressure and vacuum gauges, polymicrosphere (PSL) generators, aerosol diluters, and condensation nuclei counters. The RP also provides guidance for determining intervals of calibration. *Supersedes previous editions of RP-CC013.*

Document: CC14
 Members: \$205
 Nonmembers: \$320
 ISBN 978-0-9841330-3-1
 40 pages; August 2010
 Electronic and Print



IEST-RP-CC014.2: CALIBRATION AND CHARACTERIZATION OF OPTICAL AIRBORNE PARTICLE COUNTERS

This RP covers procedures for calibrating and characterizing the performance of optical particle counters (OPCs) that detect and measure the size of single particles in air and other gases. These procedures are intended for use by OPC manufacturers, specialized test houses, and OPC users who maintain calibration and testing facilities to determine the sizing and counting accuracy of these instruments. *Supersedes previous editions of RP-CC014.*

Document: 0203
 Members: \$100
 Nonmembers: \$165
 ISBN 978-1-877862-87-8
 20 pages; November 2002
 Reviewed and Validated:
 April 2006
 Electronic and Print



IEST-RP-CC016.2: THE RATE OF DEPOSITION OF NONVOLATILE RESIDUE IN CLEANROOMS

This RP provides a uniform method and basis for determining the rate of deposition of nonvolatile residue (NVR) on surfaces in cleanrooms. In the design of the heating, ventilating, and air conditioning system, the selection of suitable filters, and the selection of materials used in the construction of the cleanroom, the requirements for the rate of deposition of NVR should be specified by the user. Designers of cleanrooms should consider the maximum deposition rates suggested by this RP when the deposition of NVR can affect the performance of products. *Supersedes previous editions of IEST-RP-CC016.*

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Document: 0206
 Members: \$180
 Nonmembers: \$295
 ISBN 978-0-9787868-3-0
 27 pages; July 2007
 Electronic and Print



IEST-RP-CC018.4: CLEANROOM HOUSEKEEPING— OPERATING AND MONITORING PROCEDURES

This RP provides guidance for maintaining a cleanroom at the level for which it was designed. It is intended as a guide for establishing appropriate housekeeping procedures essential for the overall contamination control program of the cleanroom. Test procedures are provided for use in establishing the frequency of housekeeping, monitoring the effectiveness of the housekeeping, and helping to determine appropriate levels of surface cleanliness for specific cleanrooms. Incorporated in the RP is a new surface cleaning efficiency test method for nonviable particles that provides an automated measurement of surface cleanliness as it pertains to the efficiency of a wiping material to remove liquid contaminants from a surface. *Supersedes previous editions of RP-CC018.*

Document: 0219
 Members: \$155
 Nonmembers: \$255
 ISBN 978-0-9747313-5-3
 16 pages; January 2006
 Electronic and Print



IEST-RP-CC019.1: QUALIFICATIONS FOR ORGANIZATIONS ENGAGED IN THE TESTING AND CERTIFICATION OF CLEANROOMS AND CLEAN-AIR DEVICES

This RP defines recommended qualifications for organizations engaged in the testing and certification of cleanrooms, clean-air devices, HEPA- and ULPA-filtered systems, and associated components. The document also establishes professional categories for personnel performing testing and levels of competence to be demonstrated by the personnel.

Document: 0207
 Members: \$130
 Nonmembers: \$215
 ISBN 978-1-877862-48-9
 12 pages; November 2002
 Electronic and Print



IEST-RP-CC020.2: SUBSTRATES AND FORMS FOR DOCUMENTATION IN CLEANROOMS

This RP applies to substrates and forms used in cleanrooms for the purpose of documentation. Specifically included are copy paper, writing paper, labels, tags, self-adhesive notes, perforated and punched forms, envelopes, bound materials, and all printed versions thereof. This document provides appropriate methods for assessing the cleanliness of these items insofar as their suitability for use in cleanrooms is concerned. *Supersedes previous editions of RP-CC020.*

Document: 0208
 Members: \$205
 Nonmembers: \$320
 ISBN 978-0-9841330-1-7
 28 pages; December 2009
 Electronic and Print



IEST-RP-CC021.3: TESTING HEPA AND ULPA FILTER MEDIA

This RP discusses test methods for physical and filtration properties of high-efficiency particulate air (HEPA) and ultra low penetration air (ULPA) filtration media. Applications of this document include acceptance criteria for test methods, test aerosol and particle size, and test face velocity. The RP details methods for testing resistance to airflow, ULPA filter media penetration, thickness, impact score tensile strength, and other tests. *Supersedes previous editions of RP-CC021.*

Document: 0209
 Members: \$100
 Nonmembers: \$165
 ISBN 978-1-877862-88-5
 32 pages; January 2004
 Reviewed and Validated:
 July 2008
 Electronic and Print



IEST-RP-CC022.2: ELECTROSTATIC CHARGE IN CLEANROOMS AND OTHER CONTROLLED ENVIRONMENTS

This RP discusses methods for specifying and evaluating the effectiveness of techniques for controlling electrostatic charge. This document describes typical control systems and their applications, and lists methods of testing and measurement of charge generation, charge neutralization, resistivity of surfaces and materials, and static field attenuation. *Supersedes previous editions of RP-CC022.*



Document: 0210
 Members: \$155
 Nonmembers: \$255
 ISBN 978-0-9747313-6-0
 31 pages; January 2006
 Electronic and Print



IEST-RP-CC023.2: MICROORGANISMS IN CLEANROOMS

This RP provides guidelines for the control and quantitative measurement of viable contamination in the air and on surfaces in environments that require control of such contamination. This includes areas designated as aseptic and those considered nonsterile. The procedures and techniques employed to achieve the desired level of microbial control are dependent on the level of bioburden that can be tolerated. This RP presents an introduction to the currently accepted methods for bioburden control and environmental monitoring as well as the devices available for the quantification of airborne and surface viable contamination. This document also describes disinfectants, their lethality spectrum, and techniques for their application. *Supersedes previous editions of RP-CC023.*

Document: 0211
 Members: \$130
 Nonmembers: \$215
 ISBN 978-1-877862-24-3
 20 pages; December 2002
 Electronic and Print



IEST-RP-CC024.1: MEASURING AND REPORTING VIBRATION IN MICROELECTRONICS FACILITIES

Equipment used in the manufacture, measurement, and inspection of integrated circuits is sensitive to vibration and sound. It is therefore necessary to establish levels of vibration sensitivity for them and to ensure that vibrations occurring in the facility or at the site at which they are located are below those levels. This RP is intended to provide guidance in the microelectronics industry. It may also be applicable in pharmaceutical and biological research, metrology laboratories, and other contexts in which vibration control is important.

Document: 0262
 Members: \$160
 Nonmembers: \$265
 ISBN 978-1-877862-97-7
 24 pages; September 2004
 Electronic and Print



IEST-RP-CC026.2: CLEANROOM OPERATIONS

This RP presents guidelines for maintaining cleanroom integrity at all times, including during routine maintenance, modifications, and equipment replacement. The document provides a basis for preparing standard operating procedures for any cleanroom. It also outlines test procedures for verifying cleanliness of cleanroom apparatus and surfaces. *Supersedes previous editions of RP-CC026.*

Document: 0220
 Members: \$165
 Nonmembers: \$270
 ISBN 978-0-9747313-7-7
 27 pages; April 2006
 Electronic and Print



IEST-RP-CC027.2: PERSONNEL PRACTICES AND PROCEDURES IN CLEANROOMS AND CONTROLLED ENVIRONMENTS

This RP provides a basis for establishing personnel procedures and the development of training programs for cleanrooms and other contamination-controlled environments. *Supersedes previous editions of RP-CC027.*

Document: 2013
 Members: \$125
 Nonmembers: \$210
 ISBN 978-1-877862-83-0
 28 pages; May 2002
 Electronic and Print



IEST-RP-CC028.1: MINIENVIRONMENTS

This RP provides a framework for describing minienvironments for microelectronics and similar applications. It is intended to stimulate discussion of specifications and configurations for a specified application between the supplier and customer.

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Document: 0214
 Members: \$130
 Nonmembers: \$215
 ISBN 978-1-877862-93-9
 44 pages; June 2004
 Electronic and Print



IEST-RP-CC029.1: AUTOMOTIVE PAINT-SPRAY APPLICATIONS

This RP provides guidelines and recommended procedures for controlling dirt contamination (particles, fibrous material, etc.) in controlled environments used for paint spraying.

Document: CC31
 Members: \$195
 Nonmembers: \$315

ISBN:
 Electronic: 978-0-9841330-9-3
 Print: 978-0-9841330-8-6
 14 pages; September 2011



IEST-RP-CC031.3: METHOD FOR CHARACTERIZING OUTGASSED ORGANIC COMPOUNDS FROM CLEANROOM MATERIALS AND COMPONENTS

This RP describes a method for characterizing organic compounds outgassed from materials or components exposed to air or gases in cleanrooms and other controlled environments. New to the latest revision is a 4-page table listing materials of construction found in cleanrooms, generic classes of organic compounds known to outgas from these materials, and examples of problems caused by certain organic compounds. The RP is relevant to industries that may experience adverse production yields as a result of gaseous organic contamination. This document provides both a semiquantitative determination and a qualitative identification of a large range of compounds detectable by dynamic headspace gas chromatography-mass spectrometry (GC-MS). *Supersedes previous editions of RP-CC031.*

Document: CC32
 Members: \$155
 Nonmembers: \$255

ISBN 978-0-9787868-6-1
 10 pages; June 2009
 Electronic and Print



IEST-RP-CC032.1: FLEXIBLE PACKAGING MATERIALS FOR USE IN CLEANROOMS AND OTHER CONTROLLED ENVIRONMENTS

This RP provides guidance for the selection of flexible packaging materials for use with products manufactured or processed in cleanrooms and other controlled environments. The RP covers acceptable materials, seals, material properties, compatibility of packaged product environment, and related topics. A useful table helps narrow the flexible packaging choices based on the product protection requirements. Test methods for particle release, biological tests, organic and inorganic extractable matter, and nonvolatile residue also are presented.

Document: 0218
 Members: \$205
 Nonmembers: \$320

ISBN 978-0-9841330-0-0
 42 pages; July 2010
 Electronic and Print



IEST-RP-CC034.3: HEPA AND ULPA FILTER LEAK TESTS

This RP covers definitions, equipment, and procedures for leak-testing HEPA and ULPA filters in the factory as they are produced, at the job site before they are installed, and after they are installed in cleanrooms and in unidirectional-flow, clean-air devices. When used in conjunction with other RPs, including IEST-RP-CC001, IEST-RP-CC002, IEST-RP-CC006, IEST-RP-CC007, IEST-RP-CC021, and IEST-RP-CC028, This RP may be used to define the basis of an agreement between customer and supplier in the specification and procurement of HEPA and ULPA filters, and in the testing of unidirectional-flow, clean-air devices and cleanrooms. *Supersedes previous editions of RP-CC034.*

Document: C35E
 Members: \$145
 Nonmembers: \$250

ISBN 978-0-9787868-8-5
 24 pages; July 2009
 Electronic and Print



IEST-G-CC035.1: DESIGN CONSIDERATIONS FOR AMC FILTRATION SYSTEMS IN CLEANROOMS

This Guideline provides information for designing filtration systems to eliminate trace amounts (less than 1 ppmv) of airborne molecular contamination (AMC) from the air supplied to cleanrooms and other controlled environments. The document covers applications, potential points of use, filtration methods, construction materials, performance comparison, and follow-up assessment. Also discussed are secondary impacts of the filters on the HVAC system and exterior impacts on the filtration system.



Document: C421
 Members: \$205
 Nonmembers: \$320
 ISBN:
 Print: 978-0-915414-47-5
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 32 pages; October 2011



IEST-RP-CC042.1: SIZING AND COUNTING OF SUBMICROMETER LIQUID-BORNE PARTICLES USING OPTICAL DISCRETE-PARTICLE COUNTERS

This Recommended Practice (RP) addresses the sizing and counting of submicrometer liquid-borne particles using optical discrete-particle counters with a focus on applications in the semiconductor, flat-panel display, and data storage industries. Liquid-borne particle measurement involves many technical challenges that can substantially affect results in both sizing and counting of particles. This RP is intended as a single source covering those challenges and solutions and provides a handy reference for professionals in this field.

Document: 0461
 Members: \$215
 Nonmembers: \$335
 ISBN:
 Print: 978-1-937280-11-6
 Electronic: 978-1-937280-10-9
 16 pages; April
 Electronic and Print



IEST-RP-CC046.1 Controlled Environments (Aerospace, Non-cleanroom)

This Recommended Practice (RP) provides non-cleanroom contamination control criteria to support successful performance of products and associated subassemblies, targeted for suppliers of aerospace products. The document provides a minimum set of requirements and controls for processes and facilities associated with the assembly, integration, and testing of high-reliability aerospace products that are not required to be produced in cleanrooms. The criteria discussed are intended to assist manufacturers in implementing production methods and process controls, including minimum facility environmental controls, not including room airborne particle fallout quantification.

Document: 1246
 Members: \$240
 Nonmembers: \$380
 ISBN:
 Print: 978-1-937280-09-3
 Electronic: 978-1-937280-08-6
 20 pages; February 2013
 Electronic and Print



IEST-STD-CC1246E: PRODUCT CLEANLINESS LEVELS—APPLICATIONS, REQUIREMENTS, AND DETERMINATION

This standard provides methods for specifying and determining product cleanliness levels for contamination-critical products. The emphasis is on contaminants that can impact product performance. The requirements set forth in this standard are intended for use in procurement and design contracts for those items where contamination control limits for parts, components, or fluids are necessary to ensure reliability and performance. This standard provides mutually agreed-upon limits for defining significant surface cleanliness and liquid cleanliness with respect to particles and molecular residue.

Document: NA200
 Members: \$240
 Nonmembers: \$380
 ISBN:
 Print: 978-1-937280-01-7
 Electronic: 978-1-937280-00-0
 48 pages; July 2013
 Electronic and Print



IEST-RP-NANO200.1: PLANNING OF NANOSCALE SCIENCE AND TECHNOLOGY FACILITIES: GUIDELINES FOR DESIGN, CONSTRUCTION, AND START-UP

This Recommended Practice (RP) provides an overview of factors involved in the design, start-up, and operation of facilities in the field of nanotechnology. The overview focuses on the unique considerations related to planning, design, construction, and start-up that typically confront owners, designers, and users of the advanced-technology facilities supporting research or production at the nanometer scale. Intended as an executive-level summary, this document provides guidance in the planning and decision-making processes required for establishing facilities involved in nanoscale research and production as well as subcellular-scale biological research. This document represents a collaborative effort of representatives from the design, construction, and user communities, along with equipment providers and owner groups.

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