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**Recommended Environments for
Standards Laboratories**

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Preface

This preface, as well as all footnotes and annexes, is included for information purposes and is not part of ISA-TR52.00.01-2006.

This document has been prepared as part of the service of ISA—the Instrumentation, Systems, and Automation Society—toward a goal of uniformity in the field of instrumentation. To be of real value, this document should not be static but should be subject to periodic review. Toward this end, the Society welcomes all comments and criticisms and asks that they be addressed to the Secretary, Standards and Practices Board; ISA; 67 Alexander Drive; P. O. Box 12277; Research Triangle Park, NC 27709; Telephone (919) 549-8411; Fax (919) 549-8288; E-mail: standards@isa.org.

This project began with Task Force No.1 on Environmental Standards as organized by the Measurement Standards Division in 1959. A report was published in the February 1961 issue of the ISA Journal, entitled "Recommended Environments for Standards Laboratories." In 1962 the Measurement Standards Instrumentation Division organized the F-6 Environmental Committee. The Committee's report was published in the October 1964 issue of ISA Transactions, entitled "Recommended Environments for Standards Laboratories."

The committee known as the RP 52 Committee on Recommended Environments for Standards Laboratories was organized by the Metrology Division in 1966. This committee conducted a panel discussion meeting at the 23rd Annual ISA Conference (1968) in New York City. The purpose was to review the 1964 Recommendations and to elicit new information from the audience on experience gained from environmental control of standards laboratories.

From a resume of this panel discussion it was possible for the committee members to formulate a revision of the 1964 Recommendations in light of new information. As an additional step, a reedited version of the panel discussion was sent to 29 members of the National Conference of Standards Laboratories (NCSL) in order to gain further information. Selection for this survey was made from among the total membership in NCSL on the basis of extended experience with operation of a standards laboratory where environmental control was a factor of concern and interest. From responses of a portion of the 29 members selected, it was possible for the committee to have additional information at hand as an aid in revising the 1964 Recommendations. The result of this somewhat lengthy process of revision was the original ISA-RP52.1-1975 document.

The SP52 committee has updated the existing references within this document and also added references to NSTL RP-14, *Guide to Selecting Standards-Laboratory Environments*, where appropriate in this version published as a technical report.

The ISA Standards and Practices Department is aware of the growing need for attention to the metric system of units in general, and the International System of Units (SI) in particular, in the preparation of instrumentation standards. The Department is further aware of the benefits to USA users of ISA standards of incorporating suitable references to the SI (and the metric system) in their business and professional dealings with other countries. Toward this end, this Department will endeavor to introduce SI-acceptable metric units in all new and revised standards, recommended practices, and technical reports to the greatest extent possible. *Standard for Use of the International System of Units (SI): The Modern Metric System*, published by the American Society for Testing & Materials as IEEE/ASTM SI 10-97, and future revisions, will be the reference guide for definitions, symbols, abbreviations, and conversion factors.

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The original ISA Standards Committee on Recommended Environments for Standards Laboratories, RP 52, operated within the ISA Standards and Practices Department, Whitney B. Miller, Vice-President. The persons listed below served as members of this committee.

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To those who contributed to the panel discussion meeting at the 23rd Annual ISA Conference (1968) in New York City, and to certain members of the National Conference of Standards Laboratories who contributed comments in the revised Recommendations, their assistance in the formulation of ISA-RP52.1-1975 is gratefully acknowledged.

In addition to the RP 52 committee members, the following served as a Board of Review for ISA-RP52.1-1975.

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This technical report was approved for publication by the Standards and Practices Board on 29 December 2006.

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1 Purpose

The measured value assigned to a standard or measurement instrument has the essential qualification that the assigned value was valid at the specific time and under the specific conditions of the calibration. No assurance is made regarding the future value or the value under different conditions. If the device is physically stable with time, and if a sufficient history is compiled under environmental conditions that are compatible with the previous calibration, the confidence level of the assigned value increases. If the specific conditions of measurements are not repeated when the device is again calibrated, any variables introduced can create substantial uncertainty. With this fact in mind, it is obvious that there is a need for knowing and maintaining the environmental factors associated with the various types of measurement standards and instruments. Aside from the necessity of securing repeatable measurements, environmental controls help to reduce the number of tedious corrections necessary in making measurements that are affected by adverse environments.

2 Scope

The usual concept that working standards are less accurate than reference standards and that the environmental requirements are less demanding is the basis for this technical report. The same concept carries over, in general, in differentiating between Type I and Type II laboratories. It should be emphasized that this technical report is intended to apply to Echelon II laboratories only (see Clause 3). Moreover, this technical report serves primarily as a guideline to the design, construction, and operation of standards laboratories and, thus, is not to be construed as mandatory requirements. In many cases satisfactory repeatability of calibrations can be obtained even though the environment does not comply fully with this technical report.

For additional information, see ISAO/R 554, *Standard Atmospheres*, NCSL RP-7, *Laboratory Design*, and NCSL RP-14, *Guide to Selecting Standards-Laboratory Environments*.

3 Definitions

3.1 Echelon I: The National Bureau of Standards: this echelon has custody of the national standards and calibrates lower-level standards by comparison with them.

3.2 Echelon II: All levels between Echelon I and Echelon III: typical agencies included in this echelon are the standards laboratories of industrial concerns, universities, the Department of Defense, and commercial calibration laboratories. In some cases Echelon II is divided into two levels. *The standards used in the upper level (Type I) are calibrated by comparison with standards of Echelon I.* In general, the standards in the lower level (Type II) are used to calibrate standards in Echelon III.

3.3 Echelon III: The level at which measuring instruments are calibrated prior to use by the user: typical agencies in this level are the production line test departments and service departments of instrument manufacturers, and the repair and calibration facilities of instrument users. In general, the standards in this echelon will have been calibrated against standards in Echelon II.

4 Environmental conditions

4.1 Acoustic noise

Applicable Laboratory: All laboratories.

Requirements:

Types I and II: The maximum level for noise is 45 decibels as measured on a sound level meter using the A or 40-dB weighting network.

4.2 Dust particle count

See also NCSL RP-14, Section 8.

4.2.1 Applicable laboratory: Dimensional, optical, and micromass

Requirements:

Type I: Less than 4×10^5 particles larger than $1 \mu\text{m}$ per cubic metre of room volume. Less than 2×10^6 particles larger than $0.5 \mu\text{m}$ per cubic metre. No particles larger than $50 \mu\text{m}$.

Type II: Less than 7×10^6 particles larger than $1 \mu\text{m}$ per cubic metre. Less than 4×10^7 particles larger than $0.5 \mu\text{m}$ per cubic metre. No particles larger than $50 \mu\text{m}$.

4.2.2 Applicable laboratory: All other types

Requirements:

Type I and Type II: Less than 7×10^6 particles larger than $1 \mu\text{m}$ per cubic metre. Less than 4×10^7 particles larger than $0.5 \mu\text{m}$ per cubic metre. No particles larger than $50 \mu\text{m}$.

4.3 Electrical and magnetic fields (shielding)

See also NCSL RP-14, Section 9.

4.3.1 Applicable laboratory: Pressure-Vacuum, force, acceleration, dimensional, optical, and flow

Requirements:

Types I and II: No special requirements except for electronic measuring instrument which should be shielded locally and guarded by self-shielding or small screened enclosures.

4.3.2 Applicable laboratory: Temperature, dc, low-frequency, high-frequency, and microwave

Requirements:

Types I and II: $100 \mu\text{V/m}$, maximum radiation field strength, dc ground bus to ground, less than 2Ω resistance, ac ground to ground, less than 5Ω resistance.

4.4 Laboratory air pressure

See also NCSL RP-14, Section 5.

Applicable Laboratory: All types.

Requirements:

Types I and II: Maintain positive pressure of 10 pascals (newtons per square metre), (0.1 millibar), (0.05 inch of water) in the laboratory.

4.5 Lighting

See also NCSL RP-14, Section 7.

Applicable Laboratory: All types.

Requirements:

Types I and II: 1000 lux (lumens per square metre), (approx. 100-foot candles) at bench level or reading surface.