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Standard Guide for Selecting Instruments and Methods for Measuring Air Quality in Aircraft Cabins[1]

This standard is issued under the fixed designation D6399; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers information and guidance for the selection of instrumentation and test methods for measuring air quality in aircraft passenger cabins as well as in areas limited to flightcrew access.

1.2 This guide assumes that a list of pollutants to be measured, or analytes of interest, which are present, or may be present, in aircraft cabins is available.

1.3 This guide provides information and guidance to identify levels of concern pertaining to public and occupational exposures to relevant air pollutants. This guide does not address levels of concern, if any, related to degradation of materials or aircraft components because of the presence of air pollutants.

1.4 Based on levels of concern for public and occupational exposures for each pollutant of interest, this guide provides recommendations for developing three aspects of data quality objectives (*a*) detection limit; (*b*) precision; and (*c*) bias.

1.5 This guide summarizes information on technologies for measurement of different groups or classes of air pollutants to provide a basis for selection of instruments and methods. The guide also identifies information resources on types of available measurement systems.

1.6 This guide provides general recommendations for selection of instruments and methods. These recommendations are based on concepts associated with data quality objectives discussed in this guide and the information on available instruments and methods summarized in this guide.

1.7 This guide is specific to chemical contaminants and does not address bioaerosols, which may be present in the cabin environment.

1.8 This guide does not provide details on use or operation of instruments or methods for the measurement of cabin air quality.

1.9 This guide does not provide information on the design of a monitoring strategy, including issues such as frequency of measurement or placement of samplers.

1.10 Users of this guide should be familiar with, or have access to, individuals who have a background in (*a*) use of instruments and methods for measurement of air pollutants and (*b*) principles of toxicology and health-effects of environmental exposure to air pollutants.

1.11 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.12 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

1.13 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

[1] This guide is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.05 on Indoor Air.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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D1914 Practice for Conversion Units and Factors Relating to Sampling and Analysis of Atmospheres
D3162 Test Method for Carbon Monoxide in the Atmosphere (Continuous Measurement by Nondispersive Infrared Spectrometry)
D3631 Test Methods for Measuring Surface Atmospheric Pressure
D4023 Terminology Relating to Humidity Measurements (Withdrawn 2002)[3]
D4490 Practice for Measuring the Concentration of Toxic Gases or Vapors Using Detector Tubes
D4861 Practice for Sampling and Selection of Analytical Techniques for Pesticides and Polychlorinated Biphenyls in Air
D5149 Test Method for Ozone in the Atmosphere: Continuous Measurement by Ethylene Chemiluminescence
D5156 Test Methods for Continuous Measurement of Ozone in Ambient, Workplace, and Indoor Atmospheres (Ultraviolet Absorption)
D5197 Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)
D5466 Test Method for Determination of Volatile Organic Compounds in Atmospheres (Canister Sampling Methodology)
D6196 Practice for Choosing Sorbents, Sampling Parameters and Thermal Desorption Analytical Conditions for Monitoring Volatile Organic Chemicals in Air
D6245 Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation
D7034 Guide for Deriving Acceptable Levels of Airborne Chemical Contaminants in Aircraft Cabins Based on Health and Comfort Considerations

2.2 *Other Standards:*
14 CFR 25 Airworthiness Standards[4]
29 CFR 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories[4]
40 CFR 50 National Ambient Air Quality Standards[4]
40 CFR 53 Ambient Air Monitoring Reference and Equivalent Methods[4]
40 CFR 60 Standards of Performance for New Stationary Sources—Appendix A: Test Methods[4]
RTCA/DO-160 Environmental Conditions and Test Procedures for Airborne Equipment[5]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminology D1356.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *analyte, n*—designated chemical species to be measured by a monitor or to be identified and quantitated by an analyzer.

3.2.2 *bioaerosol, n*—airborne material of biological origin, including viable microorganisms, pollens, spores, bacteria, viruses, allergens, and biological debris.

3.2.3 *ceiling limit, n*—a maximum allowable air concentration, established by the Occupational Safety and Health Administration (OSHA), that must not be exceeded during any part of the workday.

3.2.4 *concentration range, n*—a semiquantitative term referring to the extreme uppermost portion of the distribution of anticipated measurements. ~~This term (and the dose or risk analogues) traditionally refers to the portion of the distribution that conceptually falls above about the 98th percentile of the distribution, but is not higher than the highest individual measurement.~~

3.2.4.1 *Discussion*—

This term (and the dose or risk analogues) traditionally refers to the portion of the distribution that conceptually falls above about the 98th percentile of the distribution, but is not higher than the highest individual measurement.

3.2.5 *data quality objectives (DQOs), n*—qualitative and quantitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or decisions derived from environmental data. ~~Minimum DQOs include method detection limit, precision, and bias.~~

3.2.5.1 *Discussion*—

Minimum DQOs include method detection limit, precision, and bias.

3.2.6 *level of concern, n*—an exposure level or concentration that is not to be exceeded by regulation or, for unregulated pollutants, an exposure level or concentration that is believed to be associated with odor, sensory irritation, and other adverse health or toxic effects.

[3] The last approved version of this historical standard is referenced on www.astm.org.
[4] Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, http://www.access.gpo.gov.
[5] Available from Radio Technical Commission for Aeronautics (RTCA), 1150 18th NW, Suite 910, Washington, DC 20036, https://www.rtca.org.

3.2.7 *lowest-observed-adverse-effect level (LOAEL), n*—the lowest ~~exposure at which there is a significant increase in an observable effect.~~dose of a chemical in a study or group of studies that produce statistically or biologically significant increases in frequency or severity of adverse effects between the exposed population and its appropriate control.

3.2.7.1 *Discussion*—

See *A Review of the Reference Dose and Reference Concentration Processes* (**1**).[6]

3.2.8 *no-observed-adverse-effect level (NOAEL), n*—the ~~highest exposure among all the available experimental studies at which no adverse health or toxic effect is observed.~~dose of chemical at which there are no statistically or biologically significant increases in frequency or severity of adverse effects seen between the exposed population and its appropriate control.

3.2.8.1 *Discussion*—

Effects may be produced at this dose, but they are not considered to be adverse. See *A Review of the Reference Dose and Reference Concentration Processes* (**1**).

~~3.2.9 *overall uncertainty (OU), n*—quantity used to characterize, as a whole, the statistical uncertainty of a measurement result compared to a true or accepted value. The overall uncertainty is expressed as a percentage that combines bias and precision. For a given statistical confidence level (Nσ), the overall percent uncertainty may be calculated using the following formula:~~

$$OU = \left(\frac{\left| \bar{X} - X_{REF} \right| + N\sigma}{X_{REF}} \right) \times 100 \quad (1)$$

~~where:~~

~~$\bar{X}$ = mean value of results of a number (n) of repeated measurements,~~
~~X_{ref} = true or accepted reference value of measurement result,~~
~~σ = standard deviation of a number (n) of repeated measurements, and~~
~~N = number of standard deviations from the mean. N generally takes value of 1, 2 or 3 corresponding to 68 %, 95 %, and 99 % confidence intervals, respectively. Since the desired confidence interval is often 90 % or more, a value of 1.7 or higher typically is used for N.~~

~~For example, given a precision and bias of ±10 %, and a desired confidence interval of 95 %, the overall uncertainty using Eq 1 will be 30 %.~~

~~3.2.10 *permissible exposure limit (PEL), n*—the OSHA-mandated time-weighted-average (TWA) concentration of a chemical in air that must not be exceeded during any 8-h workshift or 40-h work week.~~

3.2.9 *safety factor, n*—a dimensionless number, greater than unity, to account for incomplete understanding of errors encountered in extrapolating exposure or health effects derived for one set of conditions or basis to another.

3.2.10 *spacecraft maximum allowable concentrations (SMACs), n*—developed by the National Aeronautics and Space Administration and the Committee on Toxicology from the National Research Council, based on exposure duration of 1 h to 180 days.

~~3.2.13 *short-term-exposure limit (STEL), n*—American Conference of Governmental Industrial Hygienists (ACGIH)-recommended 15-min TWA air concentration for a chemical which should not be exceeded at any time during a workday, even if the 8-h TWA concentration is within the threshold limit value (TLV).~~

~~3.2.14 *threshold limit value (TLV), n*—ACGIH-recommended TWA air concentration of a chemical for a normal 8-h workday and a 40-h workweek, to which nearly all workers may be repeatedly exposed without adverse effects.~~

4. Summary of Guide

4.1 This guide provides procedures and recommendations for the selection of test methods and equipment suited to measuring air quality in aircraft cabins.

4.2 Major steps in the selection process include identifying one or more levels of concern for each analyte to be monitored, selecting the most appropriate level of concern for each analyte, defining minimum data quality objectives that are compatible with the level of concern, defining desirable operating characteristics that are compatible with the aircraft cabin environment, and selecting instruments and test methods that meet these objectives.

5. Significance and Use

5.1 This guide may be used to identify instruments and methods for measuring air quality in aircraft cabins. Such measurements may be undertaken to:

[6] The bold face numbers in parentheses refer to the list of references at the end of this standard.

5.1.1 Conduct monitoring surveys to characterize the aircraft cabin environment and to assess environmental conditions. Results of such measurements could then be compared with relevant standards or guidelines for assessment of health and comfort of passengers and flight attendants.

5.1.2 Investigate passenger and flight attendant complaints; or

5.1.3 Measure and compare the performance of new materials and systems for the aircraft cabin environment.

6. Identify ~~and Select~~ Levels of Concern

6.1 Identification ~~and selection~~ of the level of concern for each analyte of interest is ~~the most important basis~~ essential for defining data quality objectives. The level of concern for each analyte is ~~defined~~identified from review of applicable regulations, standards, and ~~guidelines using procedures described below in~~ guidelines.~~6.2 and 6.3~~.

6.2 Use the following sources to compile levels of concerns for each analyte[7] identified for ~~monitoring:~~ monitoring. Additional sources may apply outside of the US:

6.2.1 FAA Airworthiness Standards (14 CFR 21), which specify acceptable exposure levels for ozone, carbon dioxide, carbon monoxide, and cabin pressure that explicitly apply to the aircraft cabin environment;

6.2.2 Spacecraft Maximum Allowable Concentrations (SMACs), which have been defined for chemicals under exposure conditions ranging from 1 h to 180 days for the space program;

6.2.3 The Clean Air Act (40 CFR Part 50), which specifies acceptable limits for general population exposure to criteria pollutants (ozone, carbon monoxide, oxides of nitrogen, sulfur dioxide, particulate matter, and lead), and also regulates population exposure to emissions of nearly 200 hazardous air pollutants;

6.2.4 The Occupational Safety and Health Act of 1970 (29 CFR 1910), which establishes PELs and ceiling concentrations to protect workers against the health effects of exposure to approximately 200 hazardous substances;

6.2.5 ACGIH *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Values*, which gives TLVs and STELs to define acceptable limits for workplace exposure.

6.2.6 AIHA *Odor Thresholds for Chemicals with Established Occupational Health Standards* is a peer-reviewed document that contains odor thresholds for a wide variety of chemicals.

6.2.7 For analytes not covered by items 6.2.1 – 6.2.6, specialized databases may be consulted to develop levels of concern. Such resources include the Agency for Toxic Substances and Disease Registry (ATSDR), the Health Effects Assessment Summary Tables (HEAST), the Integrated Risk Information System (IRIS), and the Registry of Toxic Effects of Chemical Substances (RTECS) (~~1~~2)~~).~~. Interpretation of these information resources requires input from a qualified toxicologist.

6.2.8 Table 1 gives an example of compilation of levels of concern for selected contaminants.

6.3 ~~Use the following approach~~Refer to Guide D7034 ~~to prioritize and select~~ for procedures to develop exposure scenarios and to define and calculate appropriate levels of concern for ~~each analyte~~the population ~~identified from the above sources of data:~~under consideration and the types of health impacts being assessed, for example, cancer effects, chronic non-cancer effects, acute effects, and odor concerns.

~~6.3.1 Since regulations applicable to the aircraft cabin environment are developed based on the knowledge and data specific to that environment, give the highest priority to levels of concern that are part of such regulations (for example, FAA Airworthiness Standards). Similarly, available consensus-developed guidelines for cabin air quality should be also given high priority because these are developed considering the effects of air pollutants on passengers and flight attendants in the aircraft cabin environment.~~

~~6.3.2 Guidelines developed for the spacecraft environment such as the SMACs developed for long-term exposures, such as the 180-day exposure period, should be considered at the next level of priority. The 180-day SMACs are based on health-effect considerations over such extended periods of time and are applicable to astronauts. These are considered as the next best alternative to cabin air quality standards or guidelines for passengers and flight attendants because the relative susceptibility of passengers (that is, general public) as compared to astronauts (that is, healthy worker population) is balanced against the duration of exposure (that is, 180-day continuous exposure for astronauts versus intermittent exposure over much shorter periods of time for passengers or even flight attendants).~~

~~6.3.3 The next level of priority is for environmental standards such as ambient air quality standards that are developed considering health effects of exposures to air contaminants by the public.~~

~~6.3.4 The next level of priority is for standards or guidelines for occupational exposures. It should be pointed out that, while the aircraft cabin environment includes exposure of the general public (passengers) and occupational exposure (flight attendants) in the same airspace, the limits of exposure for the public should be used, as those are more stringent. The reason for stringency is that the public includes segments of more susceptible populations such as children, as compared to healthy workers that are included in considerations for occupational exposures.~~

~~6.3.5 If a workplace standard is the only basis for defining a level of concern associated with passenger exposure, then a safety factor should be considered to account for uncertainties. Sources of uncertainty include (*a*) extrapolating toxicological data from~~

[7] Preparing a list of analytes of interest, if not available, requires considerable effort such as review of results of past studies on cabin air quality, assessment of sources of air contaminants, and consultation with toxicologists and health effects specialists (for example, physicians and epidemiologists) to assess potential causes of suspected or actual health effects or symptoms. As stated in the scope, the development of a list of analytes is not within the scope of this guide.

TABLE 1 Compilation Table of Levels of Concern for Various Air Pollutants and Parameters

Parameters Measured	Level of Concern[A]	Comment
~~CO_2~~	~~30 000 ppmv~~	~~ACGIH STEL[A]~~
CO_2	30 000 ppm	ACGIH STEL[B]
	~~30 000 ppmv~~	~~FAA Airworthiness Standards (Title 14 CFR 25)~~
	30 000 ppm	FAA Airworthiness Standards (Title 14 CFR 25)
	~~13 000 ppmv~~	~~1-24 h to SMACs[B]~~
	13 000 ppm	1–24 h to SMACs[C]
	~~7 000 ppmv~~	~~7-180 d SMACs[B]~~
	7 000 ppm	7–180 d SMACs[C]
	~~5 000 ppmv~~	~~ACGIH TLV[A], OSHA PEL (Title 29 CFR 1910)~~
	5 000 ppm	ACGIH TLV[B], OSHA PEL (Title 29 CFR 1910)
	~~1 000 ppmv~~	~~Guide 6245~~
	1 000 ppm	Guide 6245
~~CO~~	~~50 ppmv~~	~~OSHA PEL (Title 29 CFR 1910)~~
CO	50 ppm	OSHA PEL (Title 29 CFR 1910)
	~~35 ppmv~~	~~1-h NAAQS (Title 40 CFR 50)~~
	35 ppm	1-h NAAQS (Title 40 CFR 50)
	~~25 ppmv~~	~~ACGIH TWA[A]~~
	25 ppm	ACGIH TWA[B]
	~~9 ppmv~~	~~8-h NAAQS (Title 40 CFR 50)~~
	9 ppm	8-h NAAQS (Title 40 CFR 50)
O_2	20.95 % at 2.4 km ~~km (8000 ft) cabin~~ (8000 ft) cabin altitude equivalent to partial pressure of 16 kPa	FAA Airworthiness Standards (Title 14 CFR 25)
~~O_3~~	~~0.25 ppmv~~	~~FAA Airworthiness Standards (Title 14 CFR 25)~~
O_3	0.25 ppm	FAA Airworthiness Standards (Title 14 CFR 25)
	~~0.1 ppmv~~	~~FAA Airworthiness Standards~~
	0.1 ppm	FAA Airworthiness Standards
	~~0.12 ppmv~~	~~1-h NAAQS (Title 40 CFR 50)~~
	0.12 ppm	1-h NAAQS (Title 40 CFR 50)
	~~0.1 ppmv~~	~~OSHA PEL (Title 29 CFR 1910)~~
	0.1 ppm	OSHA PEL (Title 29 CFR 1910)
	~~0.08 ppmv~~	~~8-h NAAQS (Title 40 CFR 50)~~
	0.07 ppm	8-h NAAQS (Title 40 CFR 50)
Particulate matter		
PM_{10}	150 μg m^{-3}	24-h NAAQS (Title 40 CFR 50)
	50 μg m^{-3}	Annual NAAQS (Title 40 CFR 50)
~~$PM_{2.5}$~~	~~65 μg m^{-3}~~	~~24-h NAAQS (Title 40 CFR 50)~~
$PM_{2.5}$	35 μg m^{-3}	24-h NAAQS (Title 40 CFR 50)
	15 μg m^{-3}	Annual NAAQS (Title 40 CFR 50)
Organic compounds	Chemical-specific	
		~~OSHA PEL (Title 29 CFR 1910)~~
		OSHA PEL (Title 29 CFR 1910)
	~~1-100 ppmv to < 0.01 ppmv~~	~~SMACs[B]~~
	Consult listed sources	SMACs[C]
	~~to < 0.01 ppmv~~	~~ATSDR[C]~~
	ATSDR[D]	
	~~to < 0.01 ppmv~~	~~AIHA odor thresholds[D]~~
	AIHA odor thresholds[E]	
Cabin air pressure		FAA Airworthiness Standards (Title 14 CFR 25)
	75.1 kPa	2.4 km pressure altitude
	37.6 kPa	7.6 km pressure altitude

[A] Level of concern may need to be adjusted for cabin pressure. See 8.5.
[B] *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure*, American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 1997.
[C] *Spacecraft Maximum Allowable Concentrations for Selected Airborne ~~Contaminants.~~ Contaminants,* ~~Vols.~~ Vols 1–3, Committee on Toxicology, National Research Council, National Academy of Sciences, Washington, DC, ~~1994-96.~~1994–1996.
[D] Agency for Toxic Substances and Disease Registry (ATSDR), *Minimal Risk Levels for Hazardous Substances*, U.S. Public Health Service, Atlanta, GA. 1997.
[E] *Odor Thresholds for Chemicals with Established Occupational Health Standards*, American Industrial Hygiene Assoc., 1993.

~~controlled animal testing to estimated health effects in humans, (*b*) extrapolating lowest-observed-adverse-effect levels (LOAEL) to a no-observed-adverse-effect level (NOAEL), and (*c*) variations in individual responses. Regulatory agencies usually require safety factor values of 10, 100, or 1000 in different situations. If the NOAEL has been derived from high-quality data in humans, then a factor less than 10 may be appropriate provided test conditions are similar to conditions under investigation. If the NOAEL~~

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~~is derived from less similar or less reliable studies, then a factor such as 100 or 1000 may be required (2). The selection and use of a safety factor should be done by a qualified toxicologist or health-effects specialist and the scientific rationale for the selected safety factor(s) must be documented.~~

~~6.4 Table 2 illustrates levels of concern selected based on the above approach.~~

7. Define Minimum Data Quality Objectives

7.1 For each analyte, specify minimum data quality objectives in terms of concentration range, method detection limit, precision, and bias.

7.1.1 Specify an upper limit of the concentration range that is at least twice the level of concern.

7.1.2 Specify the precision and bias necessary to achieve acceptable statistical confidence when comparing a measured value with the level of concern. The 99 % confidence level is commonly used as a basis for comparison. For example, given a level of concern of 100 ~~ppmv~~ppm and considering a measurement system having 10 % precision, the 99 % confidence interval (that is, 3 standard deviations) extends from 70 ~~ppmv~~ppm to 130 ~~ppmv.~~ppm. Thus, a measured value of 69 ~~ppmv~~ppm would be interpreted with 99 % confidence as being below the level of concern. On the other hand, a value of 71 ~~ppmv~~ppm would be interpreted with 99 % confidence as being indistinguishable from the level of concern.

7.1.3 Specify the method detection limit (MDL) such that the MDL is well below the level of concern, considering the ~~overall uncertainty:~~ bias:

$$MDL \le \frac{LOC \times (1 - (OU/100))}{m} \quad (2)$$

where:

MDL = method detection limit,
LOC = level of concern,
~~OU = overall uncertainty (Eq 1), and~~
= mean value of results of a number (n) of repeated measurements,
X_{ref} = true or accepted reference value of measurement result,
σ = standard deviation of a number (n) of repeated measurements, and
N = number of standard deviations from the mean. N generally takes value of 1, 2 or 3 corresponding to 68 %, 95 %, and 99 % confidence intervals, respectively. Since the desired confidence interval is often 90 % or more, a value of 1.7 or higher typically is used for N.
m = a variable whose value should be at least 2 to give sufficient ability to distinguish the level of concern from a non-detectable value (see example below).

~~Given a level of concern at 100 ppmv and an overall uncertainty of 30 %, for example, the level of concern minus the overall uncertainty would be at 70 ppmv. Using a value of 2 for m in Eq 2 will specify a MDL of 35 ppmv, which is about one-third of the level of concern. Using a more conservative value of 5 for m will result in a more stringent MDL of 14 ppmv.~~

7.1.4 When considering multiple levels of concern for a particular analyte (as could occur when interest is focused on odor threshold effects as well as compliance with regulatory criteria), use the smaller value to define the MDL, and use the larger value to define the upper limit of the concentration range.

8. Define Desirable Operating Characteristics

8.1 Define desirable operating characteristics for equipment based on practical details of the monitoring objectives as well as the level of experience, resources, and facilities available to the performing organization. Consider the following factors in making final decisions regarding selection of instrumentation and methods:

8.1.1 ~~*Mode–active*~~*Mode*—active (requiring a pump or aspirator to convey sample) or passive (relying on diffusion),

8.1.2 ~~*Output–continuous,*~~*Output*—continuous, point-in-time, or time-weighted average,

8.1.3 ~~*Record–electronic*~~*Record*—electronic signal, field observation, or laboratory report,

8.1.4 ~~*Mobility–handheld*~~*Mobility* ~~(< 1kg), portable (< 5kg),~~ —handheld (<1kg), portable (<5kg), or stationary (>5kg),

8.1.5 ~~*Power–battery,*~~*Power*—battery, standard alternating current, or mechanical,

8.1.6 ~~*Calibration–standard*~~*Calibration*—standard atmospheres, co-located references, laboratory procedures or factory procedures, or both, and

8.1.7 *Ancillary* ~~*Data–temperature,*~~*Data*—temperature, relative humidity, and air pressure may be required to adjust data to a common basis (for example, sea-level equivalent).

8.2 All electronic equipment operated in the aircraft cabin must be certified for electromagnetic compatibility with avionic systems (see, for example, RTCA/DO-160).

8.3 Instrumentation selected for aircraft cabin monitoring must be sufficiently stable to allow for acceptable operation for 8 or more h. Calibrations and zero/span checks may be conducted in a ground facility before and after a flight. Calibrations generally are not performed aboard the aircraft because the use of pressurized gases and the handling of toxic materials is prohibited in the aircraft cabin.

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