STANDARD

ANSI/ASHRAE Addenda c, d, and f to
ANSI/ASHRAE Standard 161-2007

Air Quality within Commercial Aircraft

These addenda were approved by the ASHRAE Standards Committee on January 26, 2013; by the ASHRAE Board of Directors on January 29, 2013; and by the American National Standards Institute on January 30, 2013.

These addenda were approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site (www.ashrae.org) or in paper form from the Manager of Standards.

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Manager of Standards of ASHRAE should be contacted for:

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c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

(This foreword is not part of this addendum. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Flame retardants are used extensively throughout aircraft for safety reasons, but there are health concerns associated with exposure to some of the chemical compounds used. Potential exposure of cabin occupants to these substances may come through dermal contact with materials containing the flame retardants and through inhalation of dust that includes flame retardants. This addendum provides requirements and information about flame retardants to minimize exposure.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum c to Standard 161-2007

Add a new Section 8.18 as shown below.

8.18 Flame Retardants

	Control Measures
Design	i) Foams, fabrics, and carpets that contain less-toxic flame retardants, as compared to polybrominated diphenyl ethers (PBDEs), tris(1,3-dichloro-2-propyl) phosphate (TDCP) for example, shall be considered, provided that these alternative products still meet the flammability standards of 14 CFR 25.853 (compartment interiors) and 14 CFR 25.856 (thermal/acoustic insulation materials).
	ii) Nontoxic alternatives to flame retardants are preferred, including materials that are less prone to fire hazard, such as untreated natural fibers. Using barrier fabrics or wrappings for foams is also preferred.
Maintenance	i) A flame retardant exposure control program should be developed and implemented for workers assigned to clean the cabin and install/refurbish cabin interiors. The program should minimize exposure to PBDEs and other flame retardants by teaching best work practices. Special care should be exercised when cleaning high dust areas, emptying vacuum bags, replacing old foam cushions, and laying carpet.

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FOREWORD

This addendum adds requirements and information about refrigerants to the standard. These refrigerants are used in vapor-compression refrigeration units and in vapor-compression cooling systems that are used on some aircraft for galley cooling and other applications. Typically, vapor compression systems are not used for cabin environmental control systems on aircraft within the scope of this standard.

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Addendum d to Standard 161-2007

Add a new Section 8.19 as shown below.

8.19 Refrigerants

Control Measures	
Design	i) Design measures to minimize the potential for failures that may lead to leakage of refrigerant should be evaluated. The toxicity and ozone-depleting potential of refrigerants shall be considered.
Maintenance	i) Employees shall be trained and air-conditioning certified to use appropriate safety practices to prevent equipment damage and to minimize contact with refrigerants and the potential for their release.

Add a new Section A3.19 in informative Appendix A as shown below. Renumber the existing sections in Section A3 accordingly.

A3.19 Refrigerants. In most aircraft, regardless of size, refrigerants in vapor cycle air-conditioning units are used to cool food and beverages. In smaller aircraft, this technology is also sometimes used for cabin cooling. Airline crew and passengers may be exposed to these refrigerants if there is a leak, and maintenance crews may be exposed when servicing the systems. For galley cooling units, R-134a is currently the most commonly used refrigerant. Exposure concerns have been raised, both for materials safety and occupant health (FAA 1994). For example, gaskets, seals, motor windings, and insulation may deteriorate after contact with R-134a. Similar concerns have been raised about some possible replacement refrigerants. Reviews on the health hazards associated with exposure to R-134a are mixed. One human inhalation study reported no adverse effects over a range of exposures considerably higher and longer duration than recommended exposure guidelines (Emmens 2001). Conversely, some adverse health effects have also been reported for human inhalation of R-134a during controlled conditions, even though the exposures were within published exposure guidelines (USAF 1997). Dizziness and loss of concentration as well as skin and eye irritation have also been reported at concentrations within published exposure guidelines. Central nervous system depression, irregular heart beat, and even death by asphyxiation have been reported with exposure to especially high concentrations (EPA 2009). In the U.S., substitutes to R-134a are being studied for use in automobiles to harmonize with European initiatives (Monforte and Caretto 2009; EPA 2008a, 2008b). Human toxicity and flammability studies are necessary prior to using alternative refrigerants on commercial aircraft.

Add a new Section A4 as shown below.

A4. APPENDIX A REFERENCES

Emmens, H.H., et al. 2000 Human safety and pharmacokinetics of the CFC alternative propellants HFC 134a (1,1,1,2-Tetrafluoroethane) and HFC 227 (1,1,1,2,3,3,3-Heptafluoropropane) following whole-body exposure. *Regulatory, Toxicology, and Pharmacology* 32:22–35.

EPA. 2008a Refrigerant safety. Ozone Layer Protection, Alternatives/SNAP. U.S. Environmental Protection Agency, Washington, D.C.

EPA. 2008b. As posted in Federal Register, Vol.73, No. 114, Thursday, June 12, 2008; P. 33304. U.S. Environmental Protection Agency, Washington, D.C.

FAA. 2004. 1058.18—Chlorofluorocarbons and halon use at FAA facilities. Regulations and policies, U.S. Federal Aviation Administration, Washington, D.C. www.faa.gov/documentLibrary/media/order/energy_orders/1050.18.pdf

EPA. 2009. As posted in Federal Register Vol. 74, No. 1, Friday, January 2, 2009. Rules and regulations, pp 21–29. http://epa.gov/fedrgstr/EPA-AIR/2009/January/Day-02/a31225.htm.

Monforte, R., L. Caretto, L. 2009. Safety issues in the application of a flammable refrigerant gas in MAC systems from the OEM perspective. Report No. 2009-01-0541, SAE International, Warrendale, PA.

USAF. 1997. Human inhalation of halon 1301, HFC-134a and HFC-227ea for collection of pharmacokinetic data. Report No. AL/OE-TR-1997-0116. Toxicology Division, Wright-Patterson Air Force Base, United States Air Force Armstrong Laboratory.

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FOREWORD

This addendum is intended to reflect the fact that at least one new aircraft design does not use bleed air for cabin ventilation and pressurization and that this or similar approaches offer a way to reduce or eliminate the potential for bleed air contamination from lubricating oil or hydraulic fluid.

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Addendum f to Standard 161-2007

Revise Item "i" in the Design category of Control Measures in Section 8.2, as follows.

8.2 General

Control Measures	
Design	i) The APU ~~inlet~~ and engine~~s~~ inlets can potentially be ~~an~~ entry point~~s~~ for hydraulic fluid, fuel, oil, and deicing fluid. Means to limit the ingestion of these fluids should be evaluated during the design phase (prevention through design). One example is the use of dedicated compressors for outside air supply, rather than the more traditional bleed air systems, which may minimize the potential entry of engine/APU contaminants into the cabin air. Other ~~Previous~~design considerations that have been implemented include ~~included~~changing the location of the APU inlet and/or ~~the~~ installing~~installation of~~ a physical barrier either around or in front of the inlet to physically divert contaminants from entering the inlet (e.g., raise the APU inlet off the surface of the ~~aircraft, install~~ aircraft or install a diverter ahead of the APU inlet).~~dam that is flush against the belly of the aircraft forward of the APU inlet).~~ Airlines and manufacturers should consider the necessity and feasibility of applying these measures to the fleet.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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About ASHRAE

ASHRAE, founded in 1894, is an international organization of some 50,000 members. ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning, and refrigeration to serve humanity and promote a sustainable world through research, standards writing, publishing, and continuing education.

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