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Space systems — Human-life activity support systems and equipment integration in space flight — Techno-medical requirements for space vehicle human habitation environments — Requirements for the air quality affected by harmful chemical contaminants

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Symbols and abbreviated terms **3**
5 Application of this document in space programs **3**
5.1 General 3
5.2 This document applicability 3
5.3 Specific program requirements 3
5.4 Monitoring of the flight program compliance to this document 3
5.5 Verification of program requirements 3
6 Air quality control according to contaminants **3**
6.1 General 3
6.2 Substance estimation by toxicological group 6
6.3 Evaluation of toxic contaminants 6
6.4 Requirements for non-metallic materials and their selection for use in manned modules 6
7 Air quality control according for carbon dioxide **7**
8 Air quality control during ground processing for MSC and habitable modules **7**
9 Air quality control in emergency situations (caused by emission of large amounts of pollutants) **7**
Annex A (normative) **Daily rates of human excreted harmful gaseous contaminants** **9**
Bibliography **10**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operation.*

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Introduction

This document regulates operation of systems removing harmful air contaminants from manned spacecraft and habitable modules, necessary for crew life support on a space mission.

This document is considered to be the 3rd level standard according to ISO 17763 and ISO 16157 (which is the 2nd level standard). It is also a part of the latter document.

This document establishes requirements for measurements of air quality affected by harmful chemical contaminants. Systems that remove harmful air contaminants out of manned spacecraft and habitable modules (as a part of life crew support system) sustain the process of air quality control.

The document's goals are:

— to elaborate integrated technical and medical requirements for air quality and harmful chemical contaminants for designers who develop systems of harmful air contaminants' removal from astronaut-inhabited aircrafts and modules;

— to maintain air quality for astronauts (control of harmful chemical contaminants); and

— to elaborate integrated technical and medical requirements for medical staff in order to control air quality and harmful chemical contaminants in it and support a crew life system.

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Space systems — Human-life activity support systems and equipment integration in space flight — Techno-medical requirements for space vehicle human habitation environments — Requirements for the air quality affected by harmful chemical contaminants

1 Scope

This document is a 3rd level standard with respect to ISO 17763 and is a 2nd level standard with respect to ISO 16157.

This document establishes environmental conditions for spacecraft air quality, including harmful chemical contaminants and requirements for harmful air contaminants' removal systems.

NOTE These systems support stated environmental conditions.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17763, *Space systems — Human-life activity support systems and equipment integration in space flight*[1)]

ISO 16157, *Space systems — Human-life activity support systems and equipment integration in space flight — Techno-medical requirements for space vehicle crew habitation environments*[2)]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
human habitation environment in spacecraft
complex issue that involves material, energy and information flows, as well as elements formed in SC habitable compartments

Note 1 to entry: Such elements are derived from life activity processes, human social-labour processes, space factors, space mobility, and hardware functioning processes, including the ones designed to arrange humans' interaction with the habitation environment in order to provide specified conditions for human life activity in space flights.

[SOURCE: ISO 17763, 3.1]

1) Under preparation.

2) Under preparation.

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3.2
human living conditions in SC
complex of human habitation environment parameters in SC, providing health maintenance, human safety and keeping of his ability to work at a level needed to execute the planned work program

[SOURCE: ISO 17763, 3.2]

3.3
techno-medical requirements for human habitation environments
complex of biomedical, hygiene/sanitary, ergonomic and design issues

Note 1 to entry: Those requirements take into account physiological and social-psychological human needs in the process of hardware development and operation in order to guarantee specified living conditions aboard space systems.

[SOURCE: ISO 17763, 3.3]

3.4
manned (habitable) spacecraft
MSC
spacecraft, spaceship, space station, Lunar or planetary base with pressurized components inside which human habitation environment is maintained

[SOURCE: ISO 16157, 3.4]

3.5
life support systems
LSS
systems supporting mass and energy exchange between space traveller's body and habitable environment inside MSC

[SOURCE: ISO 16157, 3.5]

3.6
extravehicular activity
EVA
spacesuited activities outside MSC

[SOURCE: ISO 16157, 3.6]

3.7
harmful chemical contaminants
gaseous contaminants in habitable environment of a manned spacecraft or module, causing toxic effect on humans

3.8
limiting permissible concentration
LPC
safe concentration of harmful (toxic) substance in the air at a given mission duration for nominal conditions

Note 1 to entry: This concentration determines a «zero risk» level.

3.9
maximum allowable concentration
MAC
safe concentration of toxic substance in the air at a given mission duration for off-nominal conditions and emergency situations

Note 1 to entry: This concentration determines an «acceptable risk» level

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3.10
maximum permissible concentration for single dose
MPC_{SD}
concentration of toxic substance in the air in emergency situations for single dose and different duration, which guaranty human health maintenance

4 Symbols and abbreviated terms

CAS (CAS#)	Chemical Abstracts Service Registry Number www.cas.org for chemicals unique identification
SS	Space Systems
SC	Spacecraft

5 Application of this document in space programs

5.1 General

Implementation of space programs and integration with human life activity shall be considered at all levels — from individual components to full integration.

5.2 This document applicability

All requirements stated in this document, unless otherwise specified, shall be applicable to all phases of the flight program.

5.3 Specific program requirements

Each human space flight program shall establish its specific requirements for development of this document. These requirements shall be verifiable.

5.4 Monitoring of the flight program compliance to this document

Each human space flight program shall be a subject to permanent monitoring to verify compliance with this document, including design, development, tests, and operation.

5.5 Verification of program requirements

Each human space flight program shall be verified for requirements in accordance with this document.

6 Air quality control according to contaminants

6.1 General

This document is a third level standard with respect to first level standard ISO 17763 and second level standard ISO 16157.

All human-life activity support systems and equipment integration in space flight shall be in accordance with the requirements of ISO 17763, ISO 16157 and this document.

This document covers all space missions with in-flight stay duration continuously up to 3 years.

This document contains environmental parameters specifications for flights with a human continuous stay for a week, a month, a year and three years in nominal conditions, and for a human continuous stay in case of emergency up to 1 h, 6 h and 24 h.

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