INTERNATIONAL STANDARD

ISO 15859-10

First edition
2004-06-01

Space systems — Fluid characteristics, sampling and test methods —

Part 10: Water

Systèmes spatiaux — Caractéristiques, échantillonnage et méthodes d'essai des fluides —

Partie 10: Eau

Reference number
ISO 15859-10:2004(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15859-10 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 15859 consists of the following parts, under the general title *Space systems — Fluid characteristics, sampling and test methods*:

— *Part 1: Oxygen*

— *Part 2: Hydrogen*

— *Part 3: Nitrogen*

— *Part 4: Helium*

— *Part 5: Nitrogen tetroxide propellants*

— *Part 6: Monomethylhydrazine propellant*

— *Part 7: Hydrazine propellant*

— *Part 8: Kerosine propellant*

— *Part 9: Argon*

— *Part 10: Water*

— *Part 11: Ammonia*

— *Part 12: Carbon dioxide*

— *Part 13: Breathing air*

Introduction

Fluid operations at a spaceport or launch site may involve a number of operators and supplier/customer interfaces, from the fluid production plant to the delivery to the launch vehicle or spacecraft. The purpose of ISO 15859 is to establish uniform requirements for the components, sampling and test methods of fluids used in the servicing of launch vehicles, spacecraft and ground support equipment. The fluid composition limits specified are intended to define the purity and impurity limits of the fluid for loading into the launch vehicle or spacecraft. The fluid sampling and test methods are intended to be applied by any operator. The fluid sampling and test methods are acceptable methods for verification of the fluid composition limits.

Space systems — Fluid characteristics, sampling and test methods —

Part 10: Water

1 Scope

This part of ISO 15859 specifies limits for the composition of water and establishes the sampling and test requirements applicable for the verification of the water composition.

This part of ISO 15859 is applicable to only potable water and high-purity demineralized or deionized water, used for cooling and servicing of space systems as well as both flight hardware and ground servicing, system and equipment, of the following types.

— Type HP: high purity;

— Type P: potable (drinking).

It is not applicable to other types of water that may be provided to a space system. This part of ISO 15859 is applicable to influents only within the specified limits herein.

This part of ISO 15859 is applicable to any sampling operation required to ensure that, when the fluid enters the launch vehicle or spacecraft, the fluid composition complies with the limits provided hereafter or with any technical specification agreed to for a particular use.

2 Normative references

The following referenced documents are indispensable for the application 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 5666, *Water quality — Determination of mercury*

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes*

ISO 5667-2, *Water quality — Sampling — Part 2: Guidance on sampling techniques*

ISO 5667-3, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of water samples*

ISO 5667-5, *Water quality — Sampling — Part 5: Guidance on sampling of drinking water and water used for food and beverage processing*

ISO 5961, *Water quality — Determination of cadmium by atomic absorption spectrometry*

ISO 6332, *Water quality — Determination of iron — Spectrometric method using 1,10-phenanthroline*

ISO 6333, *Water quality — Determination of manganese — Formaldoxime spectrometric method*

ISO 7027, *Water quality — Determination of turbidity*

ISO 7887, *Water quality — Examination and determination of colour*

ISO 7888, *Water quality — Determination of electrical conductivity*

ISO 8245, *Water quality — Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)*

ISO 8288, *Water quality — Determination of cobalt, nickel, copper, zinc, cadmium and lead — Flame atomic absorption spectrometric methods*

ISO 9000, *Quality management systems — Fundamentals and vocabulary*

ISO 9174, *Water quality — Determination of chromium — Atomic absorption spectrometric methods*

ISO 9964-2, *Water quality — Determination of sodium and potassium — Part 2: Determination of potassium by atomic absorption spectrometry*

ISO 9964-3, *Water quality — Determination of sodium and potassium — Part 3: Determination of sodium and potassium by flame emission spectrometry*

ISO 9965, *Water quality — Determination of selenium — Atomic absorption spectrometric method (hydride technique)*

ISO 10523, *Water quality — Determination of pH*

ISO 11885, *Water quality — Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9000 and the following apply.

3.1
verification test
analysis performed on the fluid in the container, or a sample thereof, which is representative of the supply, permitting the verification of fluid composition limits

4 Chemical composition and properties

Unless otherwise provided in an applicable technical specification, the composition of water delivered to the flight vehicle interface shall be in accordance with the limits given in Tables 1 and 2 when tested in accordance with the applicable test methods.

5 Procurement

The types of water specified in Clause 1 should be procured in accordance with an applicable national standard.

Table 1 — Chemical composition

Components		Limits	
		Type HP	Type P
Total solids	mg/l, max.	10	100
Total organic carbon	mg/l, max.	—	1
Chlorides	µg/g, max.	1,0	1,0
Ionic species, mg/l, max.	Cadmium	—	0,005
	Chromium (hexavalent)	—	0,05
	Copper	—	1,0
	Iron	—	0,3
	Lead	—	0,015
	Manganese	—	0,05
	Mercury	—	0,002
	Nickel	—	0,1
	Potassium	—	10,0
	Selenium	—	0,05
	Silver	—	0,05
	Zinc	—	5,0
Dissolved gas		—	No free gas when subjected to 1 atm at 37 °C
Iodine	mg/l, max.	—	10

Table 2 — Properties

Properties		Limits	
		Type HP	Type P
Sterility		—	Free of viable micro-organisms[a]
Conductivity at 25 °C	$\Omega^{-1}cm^{-1}$, max.	$2{,}0 \times 10^{-5}$	$3{,}3 \times 10^{-6}$
pH at 25 °C		8,0	5,0 to 8,0
Taste		—	None
Odour		—	None
Turbidity		—	None
Colour		—	None
Surface tension at 20 °C	dyn/cm	72,72 ± 1,0	—

[a] Report viable microorganism count.

6 Fluid sampling

6.1 General

Sampling of water shall conform to the requirements of ISO 5667-1, ISO 5667-2, ISO 5667-3 and ISO 5667-5.

6.2 Plan

In order to ensure that the fluid composition complies with the limits specified in this part of ISO 15859, a fluid sampling plan should be established by all the involved operators, from the production to the space vehicle interface, and approved by the final user. Sampling activities and test methods shall comply with all safety regulations and rules applicable to that task. This plan shall specify

— the sampling points,

— the sampling procedures,

— the sampling frequency,

— the sample size,

— the number of samples,

— the test methods, and

— the responsibilities of any involved operator.

6.3 Responsibility for sampling

Unless otherwise provided in an applicable technical specification, the water delivered to the flight vehicle interface shall be sampled and verified by the supplier responsible for providing the water to the flight vehicle. The supplier may use his/her or any other resources suitable for the performance of the verification tests specified herein unless otherwise directed by the customer.

6.4 Rejection

When any sample of the fluid tested in accordance with Clause 7 fails to conform to the requirements specified herein, the fluid represented by the sample shall be rejected. Disposal of the rejected fluid shall be specified by the customer.

7 Test methods

7.1 General

The supplier will ensure, by standard practice, the quality level of water. The standard practices and detailed control procedures for the test methods described in the following subclauses shall be in accordance with nationally or internationally recognized and accepted laboratory methods for the examination of water. If required, alternate test methods are described in 7.3 to 7.16. Other test methods not listed in this part of ISO 15859 are acceptable if agreed upon between the supplier and the customer.

These tests are a single analysis or a series of analyses performed on the fluid to ensure the reliability of the storage facility to supply the required quality level. This can be verified by analysis of representative samples of the fluid from the facility at appropriate intervals as agreed upon between the supplier and the customer. Tests may be performed by the supplier or by a laboratory agreed upon between the supplier and the customer.

The analytical requirements for the tests shall include the determination of all limiting characteristics of water.

7.2 Parameters of analysis

The parameters for analytical techniques contained in 7.3 to 7.16 are the following:

a) impurities shall be expressed as milligrams per litre (mg/l) unless otherwise specified;

b) calibration standards containing the applicable liquid components may be required to calibrate the analytical instruments used to determine the limiting characteristic levels of fluid;

c) if required by the customer, the accuracy of the measuring equipment used in preparing these standards shall be traceable to an established institute for standards;

d) analytical equipment shall be calibrated and operated in accordance with the manufacturer's instructions.

7.3 Conductivity

The conductivity shall be determined by the methods specified in ISO 7888.

7.4 pH

The pH shall be determined by electrometric measurement in accordance with ISO 10523.

7.5 Total solids

The total solids shall be determined by evaporation of a well-mixed sample. The increase in mass over that of the empty dish represents the total solids.

7.6 Total organic carbon (TOC)

The total organic carbon shall be determined by one of the methods specified in ISO 8245.

7.7 Chloride content

The chloride content shall be determined by one of the following methods.

a) Argentometric method.

b) Mercuric nitrate method.

c) Potentiometric method.

d) Automated ferricyanide method.

e) Ion chromatographic method.

7.8 Taste

Taste shall be determined by human gustatory sensation. One of the following methods shall be used.

a) The flavour threshold test (FTT).

b) The flavour rating assessment (FRA).

c) The flavour profile analysis (FPA).

7.9 Odour

Odour shall be determined by the human sense of smell. A sample of water is diluted with odour-free water until a dilution is obtained that has the least definitely perceptible odour. The test is made by two or more persons. One makes dilutions and the others determine odour intensity. Samples are tested in generally increasing concentration of odorant, although not in consecutive sequence of dilutions, until the odour is perceived. The persons making the test select the odorous sample from among three flasks, two of which contain odour-free water. Odour is measured without regard to the presence of suspended matter or immiscible substances in the sample. Cognizance is taken of the fact that there is no absolute odour value and that the test is to be used for comparison only. The test is carried out at 40 °C.

7.10 Turbidity

The turbidity shall be determined by ISO 7027.

7.11 Colour

Colour shall be determined after turbidity has been removed by currently accepted methods. The colour shall then be determined by ISO 7887.

7.12 Surface tension

The surface tension shall be determined by instrumental measurement utilizing a tensiometer. The tensiometer measures the force required to detach a ring from the surface of the water sample.

7.13 Ionic species content

7.13.1 Cadmium

The cadmium content shall be determined by one of the following methods.

a) Flame atomic absorption spectrometric method in accordance with ISO 5961 or ISO 8288.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Dithizone method.

7.13.2 Chromium (hexavalent)

The chromium (hexavalent) content shall be determined by one of the following methods.

a) Atomic absorption spectrometric method for total chromium in accordance with ISO 9174.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Colorimetric method.

d) Ion chomatography method.

7.13.3 Copper

The copper content shall be determined by one of the following methods.

a) Flame atomic absorption spectrometric method in accordance with ISO 8288.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Neocuproine method.

d) Bathocuproine method.

7.13.4 Iron

The iron content shall be determined by one of the following methods.

a) Atomic absorption spectrometric method.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Phenanthroline spectrometric method in accordance with ISO 6332.

7.13.5 Lead

The lead content shall be determined by one of the following methods.

a) Flame atomic absorption spectrometric method in accordance with ISO 8288.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Dithizone method.

7.13.6 Manganese

The manganese content shall be determined by one of the following methods.

a) Atomic absorption spectrometric method in accordance with ISO 6333.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Gravimetric method.

d) Calculation method.

7.13.7 Mercury

The mercury content shall be determined by one of the following methods.

a) Cold vapour atomic absorption method in accordance with ISO 5666.

b) Dithizone method.

c) Inductively coupled argon plasma atomic emission spectroscopy method.

7.13.8 Nickel

The nickel content shall be determined by one of the following methods.

a) Flame atomic absorption spectrometric method in accordance with ISO 8288.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

7.13.9 Potassium

The potassium content shall be determined by one of the following methods.

a) Atomic absorption spectrometric method in accordance with ISO 9964-2.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Flame photometric method in accordance with ISO 9964-3.

d) Potassium-selective electrode method.

7.13.10 Selenium

The selenium content shall be determined by one of the following methods.

a) Thermal decomposition of selenium hydride/atomic absorption spectrometric method in accordance with ISO 9965.

b) Colorimetric method.

c) Fluorometric method.

d) Determination of volatile selenium.

e) Determination of nonvolatile organic selenium compounds.

f) Electrothermal atomic absorption spectrometric method.

g) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

7.13.11 Silver

The silver content shall be determined by one of the following methods.

a) Atomic absorption spectrometric method.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Dithizone method.

7.13.12 Zinc

The zinc content shall be determined by one of the following methods.

a) Flame atomic absorption spectrometric method in accordance with ISO 8288.

b) Inductively coupled plasma atomic emission spectroscopy method in accordance with ISO 11885.

c) Dithizone method I.

d) Dithizone method II.

e) Zincon method.

7.14 Sterility

The sterility shall be determined by performing the following verification tests.

a) Total microbial count in accordance with an epifluorescence microscopic method.

b) Total coliform count in accordance with one of the following procedures:

   1) multiple-tube fermentation technique;

   2) presence-absence (P-A) coliform test;

   3) membrane filter (MF) technique;

   4) chromogenic substrate coliform test.

c) If any sample is total coliform-positive, the system shall analyse the total coliform-positive culture medium to determine if faecal coliforms or Escherichia coli are present. Faecal coliforms/Escherichia coli shall be determined using EC medium, A-1 medium, or the EC-MUG medium techniques.

7.15 Dissolved gas

The dissolved gas shall be determined by the purge-and-trap gas chromatography/mass spectroscopy method.

7.16 Iodine content

The iodine content shall be determined by one of the following methods.

a) Leuco crystal violet method.

b) Catalytic reduction method.

ICS 49.140

Price based on 9 pages