INTERNATIONAL STANDARD

ISO 15859-11

First edition
2004-06-01

Space systems — Fluid characteristics, sampling and test methods —

Part 11: Ammonia

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

Partie 11: Ammoniac

Reference number
ISO 15859-11:2004(E)

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Published in Switzerland

Foreword

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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 15859-11 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 11: Ammonia

1 Scope

This part of ISO 15859 specifies limits for the composition of ammonia (NH_3) and establishes the sampling and test requirements applicable for the verification of the ammonia composition.

This part of ISO 15859 is applicable to sampling and test methods for ammonia used in both flight hardware and ground support facilities, systems, and equipment. This part of ISO 15859 is applicable to ammonia 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 7103, *Liquefied anhydrous ammonia for industrial use — Sampling — Taking a laboratory sample*

ISO 7104, *Liquefied anhydrous ammonia for industrial use — Determination of water content — Gas chromatographic method*

ISO 7105, *Liquefied anhydrous ammonia for industrial use — Determination of water content — Karl Fischer method*

ISO 7106, *Liquefied anhydrous ammonia for industrial use — Determination of oil content — Gravimetric and infra-red spectrometric methods*

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

3 Terms and definitions

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

3.1
indirect method
method of measuring fluid purity by indirect means, which consists in measuring the total volume fraction or mass fraction (in %) of aggregate impurities and subtracting this total from 100

3.2
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

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

Table 1 — Composition limits

Component		Limit
Ammonia purity[a]	mass fraction, %, min.	99,99
Water	µg/g, max.	50
Oil	µg/g, max.	6
Total nonvolatile residue		b
Chlorides	µg/g, max.	1
Fluorides		b

[a] Determined by indirect method.

[b] Record and report only.

5 Procurement

The ammonia specified in Clause 1 should be procured in accordance with an applicable national standard.

6 Fluid sampling

CAUTION — Ammonia, in the liquid or gaseous form, is toxic. Care should be taken in the handling and storage of ammonia to prevent contact with the human body and with materials that are not compatible with ammonia.

6.1 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.

Sampling may be performed in accordance with ISO 7103 or with 6.2 to 6.10.

6.2 Responsibility for sampling

Unless otherwise provided in an applicable technical specification, the ammonia delivered to the flight vehicle interface shall be sampled and verified by the supplier responsible for providing the ammonia 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.

6.3 Sampling points

Unless otherwise specified, sampling shall be conducted at the fluid storage site or the flight vehicle interface.

6.4 Sampling frequency

Sampling shall be performed annually or in accordance with a time agreed upon by the supplier and the customer.

6.5 Sample size

The quantity in a single sample container shall be sufficient to perform the analysis for the limiting characteristics. If a single sample does not contain a sufficient quantity to perform all of the analyses for the required quality verification test, additional samples shall be taken under similar conditions.

6.6 Number of samples

The number of samples shall be in accordance with one of the following:

a) one sample per storage container;

b) any number of samples agreed upon by the supplier and the customer.

6.7 Storage container

Unless otherwise provided by the applicable sampling plan, the fluid storage container shall not be refilled after the sample is taken.

6.8 Gaseous samples

Gaseous samples shall be a typical specimen from the gaseous ammonia supply. Samples shall be obtained in accordance with one of the following.

a) By filling the sample container and storage containers at the same time, on the same manifold, and under the same conditions and with the same procedure.

b) By withdrawing a sample from the supply container through a suitable connection into the sample container. No pressure regulator shall be used between the supply and the sample containers. (Suitable valves are permissible.) For safety reasons, the sample container and sampling system shall have a rated service pressure at least equal to the pressure in the supply container.

c) By connecting the container being sampled directly to the analytical equipment using suitable pressure regulation to prevent over-pressurizing this equipment.

6.9 Liquid samples (vaporized)

Vaporized liquid samples shall be a typical specimen from the liquid ammonia supply. Samples shall be obtained in accordance with one of the following.

a) By vaporizing, in the sampling line, liquid from the supply container.

b) By flowing liquid from the supply container into or through a suitable container in which a representative liquid sample is collected and then completely vaporized.

6.10 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 ammonia. If required, alternate test methods are described in 7.3 to 7.8. 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 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 ammonia.

7.2 Parameters of analysis

The parameters for analytical techniques contained in 7.3 to 7.8 are the following:

a) purity shall be expressed as a percentage by mass (mass fraction, %) unless otherwise specified;

b) calibration standards containing the applicable gaseous 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 operated in accordance with the manufacturer's instructions.

7.3 Ammonia purity

The ammonia purity shall be determined by the indirect method, that is by measuring the aggregate water and oil impurities, as a percentage by mass, and subtracting this aggregate quantity from 100.

7.4 Water content

The water content shall be determined by one of the following procedures.

a) By a gas chromatographic method in accordance with ISO 7104.

b) By a Karl Fischer method in accordance with ISO 7105.

7.5 Oil content

The oil content shall be determined by an infrared spectrometric method in accordance with ISO 7106.

7.6 Nonvolatile residue content

The nonvolatile residue contents shall be determined by the infrared spectrometric method in accordance with ISO 7106, except that the separatory funnel and filtration steps shall be deleted. Identify the residue constituents by the infrared spectrometric method.

7.7 Chloride content

The chloride content shall be determined by an ion chromatographic method.

7.8 Fluoride content

The fluoride content shall be determined by an ion chromatographic method.