



DRAFT INTERNATIONAL STANDARD ISO/DIS 15859-12

ISO/TC 20/SC 14

Secretariat:

Copyright notice

This ISO document is a Draft International Standard and is copyright-protected by ISO. Except as permitted under the applicable laws of the user's country, neither this ISO draft nor any extract from it may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, photocopying, recording or otherwise, without prior written permission being secured.

Requests for permission to reproduce should be addressed to either ISO at the address below or ISO's member body in the country of the requester.

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.ch
Web www.iso.ch

Reproduction may be subject to royalty payments or a licensing agreement.

Violators may be prosecuted.

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 3.

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 part of ISO 15859 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15859-12 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, 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

This International Standard specifies limits for the composition of carbon dioxide (CO₂) and establishes the fluid sampling and test methods for carbon dioxide intended for use in both flight hardware and equipment of space systems. The purpose of this International Standard is to establish uniform requirements for the composition, sampling, and test methods for carbon dioxide used in the servicing of launch vehicles, spacecraft, and ground support equipment.

Fluid operations at a spaceport or launch site may involve a number of operators and supplier/customer interfaces,

Space systems — Fluid characteristics, sampling and test methods —

Part 12: Carbon dioxide

1 Scope

This part of ISO 15859 specifies limits for the composition of carbon dioxide (CO₂) and defines the fluid sampling and applicable test methods for verification of carbon dioxide composition. This International Standard establishes acceptable composition, test, and sampling requirements. This International Standard applies to composition, sampling, and test methods for carbon dioxide intended for purging and pressurization in both space systems flight hardware and ground support facilities, systems, and equipment. This International Standard may be applied to influents carbon dioxide. Carbon dioxide may be of the gaseous or liquid type.

CAUTION — Carbon dioxide is an asphyxiant. Care should be taken to prevent high concentrations of gaseous carbon dioxide in confined spaces.

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 normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15859. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15859 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 8402:1994, *Quality management and quality assurance — Vocabulary*.

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 8402 and the following apply:

3.1

verification tests

analyses performed on the fluid in the container, or a sample thereof, which is representative of the supply

4 Composition

4.1 Limits

Unless otherwise provided in an applicable technical specification, the composition of carbon dioxide 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

Characteristic		Limit
Purity	volume fraction, %, min.	99
Water, at 21 °C and 760 mm Hg	mg per litre of gas, max.	0,092

4.2 Procurement

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

5 Fluid sampling

5.1 Plan

In order to ensure that the fluid composition complies with the limits specified in this International Standard, 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. Such plan shall specify:

- the sampling points;
- the sampling procedures;
- the sampling frequency;
- the sample size;
- the number of samples;
- the test methods;
- the responsibilities of any involved operator.

CAUTION — Carbon dioxide is an asphyxiant. Care should be taken to prevent high concentrations of gaseous carbon dioxide in confined spaces.

5.2 Responsibility for sampling

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

5.3 Sampling points

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

5.4 Sampling frequency

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

5.5 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.

5.6 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.

5.7 Storage container

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

5.8 Gaseous samples

Gaseous samples shall be a typical specimen of the carbon dioxide supply. For safety reasons, the sample container and sampling system must have a rated service pressure at least equal to the pressure in the supply container. 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 procedures;
- 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);
- c) by connecting the container being sampled directly to the analytical equipment using suitable pressure regulation to prevent over-pressurizing this equipment.

5.9 Rejection

When any sample of the fluid tested in accordance with Clause 6 of this International Standard fails to conform to the requirements specified herein, the fluid represented by the sample shall be rejected. Disposition of the rejected fluid shall be specified by the customer.

6 Test methods

6.1 General

The supplier will ensure, by standard practice, the quality level of carbon dioxide. If required, alternate test methods are described in Clause 6 of this International Standard. Other test methods not listed in this International Standard 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 carbon dioxide.

6.2 Parameters of analysis

The parameters for analytical techniques contained in this section are:

- a) purity shall be expressed as a percentage (%) by volume;
- b) calibration gas 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;
- e) analytical methods not listed in this International Standard are acceptable if agreed upon between the supplier and the customer.

6.3 Carbon dioxide purity

The carbon dioxide purity shall be determined by one of the following procedures:

- a) by a volumetric absorption (Orsat type) gas analysis apparatus;
- b) by a gas chromatograph capable of separating and determining the components of interest;
- c) by determining the amount of the aggregate impurities using other acceptable methods. The percent carbon dioxide is the value obtained when this amount, expressed as percent, is subtracted from 100.

6.4 Water content

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

- a) by an apparatus employing a detector tube filled with a color-reactive chemical. The degree of accuracy is dependent on the precision of the measurements and the analytical bias of the tube;
- b) by an electrolytic hygrometer having an indicator graduated in cubic centimetres per cubic metre on a range which is not greater than 10 times the specified maximum water content;
- c) by a dewpoint analyzer in which the temperature of a viewed surface is measured at the time moisture first begins to form;
- d) by a piezoelectric sorption hygrometer, of which the accuracy of analysis shall be plus or minus 0,1 cubic centimetre per cubic metre or 5 % of the reading, whichever is greater;
- e) by a metal oxide capacitor equipped analyzer on a range which is no greater than 10 times the specific maximum water content.