INTERNATIONAL STANDARD

ISO 14624-6

FIrst edition
2006-04-15

Space systems — Safety and compatibility of materials —

Part 6: Determination of reactivity of processing materials with aerospace fluids

Systèmes spatiaux — Sécurité et compatibilité des matériaux — Partie 6: Détermination de la réactivité des matériaux de traitement avec les fluides aérospatiaux

Reference number
ISO 14624-6:2006(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

Contents

Page

Foreword ... iv

Introduction ... v

1 Scope ... 1

2 Normative references ... 1

3 Terms and definitions ... 1

4 Safety precautions ... 2
4.1 Laboratory facilities ... 2
4.2 Protective clothing ... 2

5 Test procedure ... 2
5.1 Inspection of sample on receipt ... 2
5.2 Preparation of sample ... 2
5.3 Test methods ... 4

Annex A (informative) **Examples of forms** ... 10

Bibliography ... 12

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.

ISO 14624-6 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 14624 consists of the following parts, under the general title *Space systems — Safety and compatibility of materials*:

— *Part 1: Determination of upward flammability of materials*

— *Part 2: Determination of flammability of electrical-wire insulation and accessory materials*

— *Part 3: Determination of offgassed products from materials and assembled articles*

— *Part 4: Determination of upward flammability of materials in pressurized gaseous oxygen or oxygen-enriched environments*

— *Part 5: Determination of reactivity of system/component materials with aerospace propellants*

— *Part 6: Determination of reactivity of processing materials with aerospace fluids*

— *Part 7: Determination of permeability and penetration of materials to aerospace fluids*

Introduction

The purpose of this part of ISO 14624 is to identify changes resulting from exposure of a material to an aerospace fluid that renders either the material unsuitable for use or produces an exothermic reaction that may result in a fire.

Space systems — Safety and compatibility of materials —

Part 6: Determination of reactivity of processing materials with aerospace fluids

1 Scope

This part of ISO 14624 specifies test equipment and techniques used to identify interactions resulting from exposure of a material to an aerospace fluid.

This part of ISO 14624 can be used to determine the reactivity of processing materials with aerospace fluids either through intent or casual exposure. It provides a means to determine the effects of minor amounts of fluids, such as a splash or spill, on materials used in ground support processing operations.

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 4599, *Plastics — Determination of resistance to environmental stress cracking (ESC) — Bent strip method*

ISO 4954, *Steels for cold heading and cold extruding*

ISO 14951-3, *Space systems — Fluid characteristics — Part 3: Nitrogen*

3 Terms and definitions

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

3.1
aerospace fluid
fluid that is commonly used in the fabrication, development and processing of materials and in the production of aerospace and ground support equipment and propellants

EXAMPLES Cleaning agents, lubricants and solvents.

3.2
aerospace material
material used in the fabrication and/or production of ground support and flight components and systems

3.3
degradation
adverse physical or chemical change in a substance

3.4
exothermic reaction
chemical reaction that generates heat

3.5
ground support equipment
equipment used in the processing and preparation of flight hardware

3.6
immersion test
test in which the fluid covers the entire sample for the duration of the test

3.7
reaction
chemical change in which a substance decomposes, combines with other substances, or interchanges constituents with other substances

3.8
test conclusions
those results that are reported on the reactivity test report form

4 Safety precautions

4.1 Laboratory facilities

Many aerospace fluids are considered to be toxic chemicals. These chemicals shall only be opened and used inside an approved laboratory hood.

4.2 Protective clothing

Personal protective clothing shall be worn by personnel when performing these tests. The minimum protections required are fluid-compatible gloves, laboratory apron, and face shield or goggles.

5 Test procedure

5.1 Inspection of sample on receipt

When received, the test material shall be accompanied by proper identification. The minimum information required is the manufacturer, trade name, composition, specification, generic name and batch/lot number. A visual inspection shall be performed and any anomalies shall be noted. Table A.1 shows a suitable material identification form.

5.2 Preparation of sample

5.2.1 General

The sample shall be tested in the intended use form (such as sheets or foams) and in the as-received thickness. Samples for the immersion test shall have a surface area of (250 ± 5) mm^2.

5.2.2 Sample cleaning

Samples shall be cleaned and dried to the end-use specifications. Contamination on the surfaces of solid, nonporous samples shall be removed by washing with deionized water and mild detergent, rinsing with deionized water, and drying with filtered, gaseous nitrogen. Particulates on the surfaces of solid, porous samples shall be removed with filtered, gaseous nitrogen meeting the requirements of ISO 14951-3.

5.2.3 Sample inspection

The sample shall be inspected to ensure it is at the specified worst-case thickness. Flaws and any residual contamination shall be noted. If the flaws result from sample preparation at the test facility, new samples shall be prepared. Samples with flaws that inordinately increase the surface area to bulk mass ratios shall not be tested. Samples shall be weighed and individually identified.

5.2.4 Test sample configuration

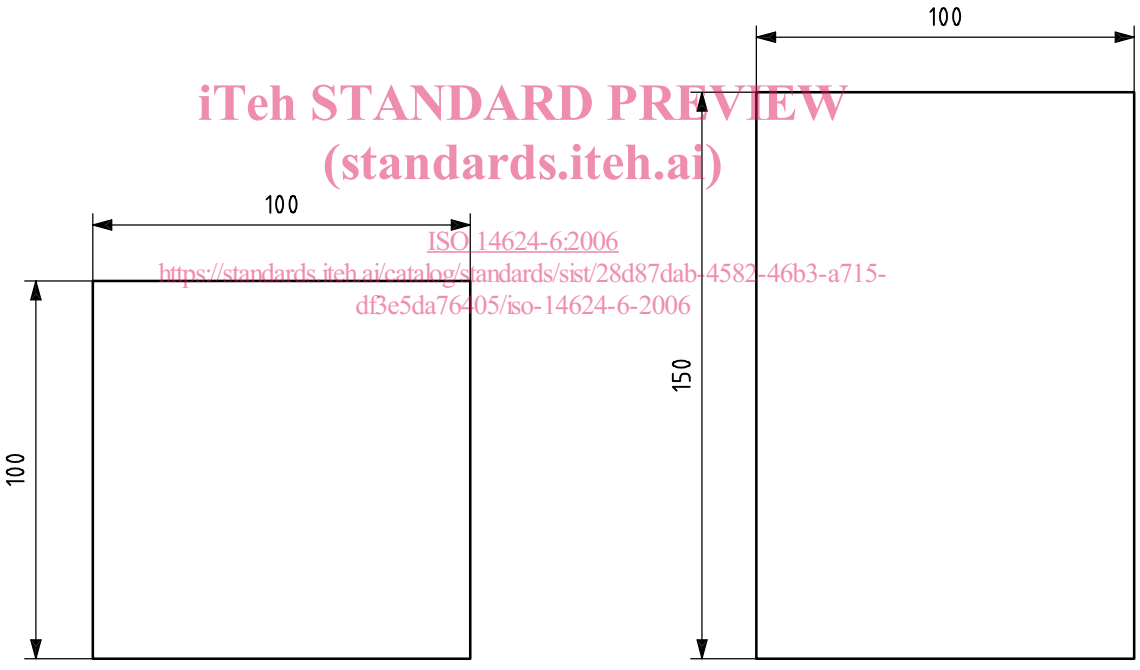
5.2.4.1 Sheets, film, and fabrics

Material being tested for chemical reactivity shall be cut in the form of a 100-mm square sample in the use thickness (see Figure 1). To determine changes in the mechanical properties of a material, the sample shall be cut in the form of a 100 mm by 150 mm rectangle (see Figure 1). For non-isotropic materials, the 100 mm by 150 mm samples shall be cut from both the machine (warp) and transverse (fill) directions.

5.2.4.2 Adhesives and coatings

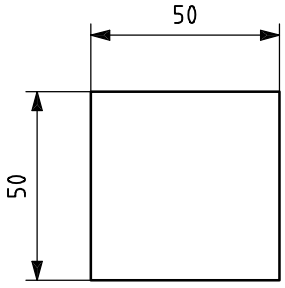
Adhesives and coatings shall be applied in a thickness equivalent to normal use on aluminium foil and cured, if necessary, in accordance with the manufacturer's instructions.

Dimensions in millimetres



a) Reactivity/penetration test specimen

b) Mechanical test specimen



c) Exothermic test specimen

Figure 1 — Test specimen dimensions

5.2.4.3 Tapes

Tapes shall be applied on aluminium foil, a watch glass or Petri dish in the as-received condition and thickness.

5.2.4.4 Greases and gels

Greases and gels shall be applied on aluminium foil, watch glass or Petri dish in a thickness equivalent to normal use. They shall be cured, if required, in accordance with the manufacturer's instructions.

5.2.4.5 Liquids

Liquids shall be tested by placing 1 ml in the bottom of a 20 ml glass laboratory beaker.

5.2.4.6 Non-standard configurations

Complex shapes such as O-rings, cables, pipes, shall be tested in a configuration consistent with the intended use. Samples shall be cleaned as specified in 5.2.2.

5.3 Test methods

5.3.1 Reactivity test

5.3.1.1 General

This test is used to determine a possible material reaction and/or degradation when exposed to propellants or other liquids of interest.

5.3.1.2 Test procedure

The test procedure shall be as follows.

a) Place a test specimen sample of the test material (see Figure 1) on a watch glass or in a Petri dish and place a thermocouple in contact with the middle of the specimen. The thermocouple shall be jacketed with glass or other inert material to minimize any reaction with the test fluid or the material being tested. Since the evaporation of the test fluid can mask a reaction, a differential thermocouple scheme using one thermocouple in contact with the sample and another thermocouple in contact with the test fluid may be more definitive.

b) Add the test fluid, approximately 1 ml of the specified test fluid, to the centre of the sample, taking care not to expose the edges of the sample to the fluid to prevent wicking.

c) Allow the test fluid to remain in contact with the sample for the specified exposure time. (The test exposure time of the fluid on the test material shall be determined by the expected use-time of the material.)

d) Add test fluid as required to maintain a liquid film on the test sample during the specified exposure time.

e) Carefully observe the test sample and thermocouple readout throughout the duration of the test.

f) At the end of the specified exposure time, carefully blot the liquid from the sample and rinse the sample with running water for 60 s. Blotting and rinsing shall be performed with knowledge of the blotting material compatibility of the test fluid. Rinsing shall be performed in accordance with the environmental regulations governing disposal of the test fluid.

g) Allow the test sample to dry under flowing air or nitrogen for 24 h prior to final evaluation.

5.3.1.3 Report

The report shall consist of the following as a minimum (an example of a suitable form for reporting the results of this test is shown in Table A.2):

a) name of the test material, supplier, and manufacturer;

b) test temperature, any temperature change, duration, and sample thickness before and after the test;

c) any reactivity observed during the exposure, such as burning, smoking, bubbling, frothing, charring, solubility, swelling or fracture of the sample;

d) any changes in the condition of the sample after the exposure, such as colour, flexibility, rigidity, surface condition, transparency, pitting, hardness, tackiness, friability or powder formation;

e) test conclusions.

5.3.2 Penetration test

5.3.2.1 General

This test is used to determine both the possible liquid penetration and chemical reactivity of materials when exposed to aerospace fluids or other chemicals of interest. This test shall not be performed if the material failed the reactivity test.

5.3.2.2 Test procedure

The test procedure shall be as follows.

a) Place an appropriately sized sample of the test material (see Figure 1) over a beaker.

b) Add approximately 1 ml of the specified test fluid to the centre of the sample, taking care not to expose the edges of the sample to the fluid and start the stopwatch.

c) Allow the test fluid to remain in contact with the sample for the specified exposure time.

d) Add test fluid as required to maintain a liquid film on the test sample during the specified exposure time.

e) Carefully observe for the first fallen droplet at the bottom of the beaker and note the time of occurrence.

f) For materials used for protective garments, observe for initial wetness underneath the test sample and note the time of occurrence.

NOTE Atmospheric condensation could occasionally form underneath a sample during a test, giving a false indication of penetration. In such an event, verification can be made by applying a hypergol-compatible blotter that is known to discolour when in contact with a hypergolic fluid.

g) Carefully blot the liquid from the sample at the end of the specified exposure time.

h) Rinse the sample with running water for 60 s. Rinsing shall be performed in accordance with the environmental regulations governing disposal of the test fluid.

i) Allow the test sample to dry under flowing air or nitrogen for 24 h prior to final evaluation.