
**Petroleum and related products —
Determination of the corrosion resistance
of water-containing fire-resistant fluids for
hydraulic systems**

*Pétrole et produits connexes — Détermination du pouvoir anticorrosif des
fluides difficilement inflammables contenant de l'eau, pour les systèmes
hydrauliques*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 4404:1998

<https://standards.iteh.ai/catalog/standards/sist/9bc730d6-1124-4e50-a883-c2cdc7282c97/iso-4404-1998>



Contents	Page
1 Scope	1
2 Normative references.....	1
3 Definitions.....	2
4 Principle.....	2
5 Reagents and materials.....	2
6 Apparatus	2
7 Producing the test fluid from an HFA type fluid concentrate.....	5
8 Procedure.....	5
8.1 Preparation for the test	5
8.2 Test.....	6
8.3 Assessment.....	6
9 Expression of results	7
10 Precision.....	7
11 Test report	7
Annex A (normative) Preparation of test waters	8
Annex B (informative) Equivalent specifications of standard test materials for test strips	10
Annex C (informative) Explanatory comments	11

ITeH STANDARD PREVIEW
(standards.iteh.ai)

ISO 4404:1998

<https://standards.iteh.ai/catalog/standards/sist/9bc750d6-1124-4e50-a883-c2cdc7282c97/iso-4404-1998>

© ISO 1998

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed 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.

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.

International Standard ISO 4404 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 4404:1998](https://standards.iteh.ai/catalog/standards/sist/9bc730d6-1124-4e50-a883-c2cdc7282c97/iso-4404-1998)

<https://standards.iteh.ai/catalog/standards/sist/9bc730d6-1124-4e50-a883-c2cdc7282c97/iso-4404-1998>

Introduction

Water-containing hydraulic fluids are used in hydraulic systems where fire-resistant fluids are required due to operating conditions. The corrosion resistance of such fluids has to be assessed in order to choose a suitable system design and prepare maintenance instructions. The method established by this International Standard is based on CETOP R 48H¹⁾ and the 7th edition of the Luxembourg report²⁾.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 4404:1998](https://standards.iteh.ai/catalog/standards/sist/9bc730d6-1124-4e50-a883-c2cdc7282c97/iso-4404-1998)

<https://standards.iteh.ai/catalog/standards/sist/9bc730d6-1124-4e50-a883-c2cdc7282c97/iso-4404-1998>

¹⁾ *Procedure for determining corrosion resistant characteristics of water based fire resistant fluids* (1984).

²⁾ Safety and Health Commission for the Mining and other Extractive Industries, Doc. No. 4746/10/91 EN (for English version, FR for French version), April 1994, *Requirements and tests applicable to fire-resistant hydraulic fluids used for power transmissions and control (hydrostatic and hydrokinetic)*, available from the Commission of the European Communities, Directorate-General V, Unit V.F.4 “Extractive, Iron and Steel Industries”, Bâtiment Jean Monnet, C4/65, L-2920 Luxembourg.

Petroleum and related products — Determination of the corrosion resistance of water-containing fire-resistant fluids for hydraulic systems

WARNING — The use of this International Standard may involve hazardous materials, operations and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies a test method to determine the influence on metals of fluids in categories HFA, HFB and HFC, as classified in ISO 6743-4. It evaluates the corrosion protection provided by these fluids towards metal components used in hydraulic systems and installations.

2 Normative references

The following standards contain provisions which, through reference in this text constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 209-1:1989, *Wrought aluminium and aluminium alloys – Chemical composition and forms of products – Part 1: Chemical composition*.
<https://standards.iso.org/standards/catalog/standards/siso/96c75000-1124-4c50-a865-c2cdc7282c97/iso-4404-1998>

ISO 426-1:1983, *Wrought copper-zinc alloys – Chemical composition and forms of wrought products – Part 1: Non-leaded and special copper-zinc alloys*.

ISO 648:1977, *Laboratory glassware – One-mark pipettes*.

ISO 752:1981, *Zinc ingots*.

ISO 1337:1980, *Wrought coppers (having minimum copper contents of 99,85 %) – Chemical composition and forms of wrought products*.

ISO 3696:1987, *Water for analytical laboratory use – Specification and test methods*.

ISO 3819:1985, *Laboratory glassware – Beakers*.

ISO 5598:1985, *Fluid power systems and components – Vocabulary*.

ISO 6344-1:—³⁾, *Coated abrasives – Grain size analysis – Part 1: Definitions designation and principle*.

ISO 6743-4:—⁴⁾, *Lubricants, industrial oils and related products (class L) – Classification – Part 4: Family H (Hydraulic systems)*.

EN 1179:1995, *Specification of zinc and zinc alloys – Primary zinc*.

EN 10083-2:1991, *Quenched and tempered steel – Part 2: Technical delivery conditions for unalloyed quality steel*.

DIN 12331:1988, *Laboratory glassware – Beakers*.

DIN 51346:1986, *Testing of fire resistant fluids – Determination of stability*.

³⁾ To be published.

⁴⁾ To be published. (Revision of ISO 6743-4:1982)

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5598 apply.

4 Principle

Test strips of various metals and metal pairs are partially submerged in the test fluid at a specific temperature for a specific period. The change in mass of each test strip, its surface appearance, and the change in the appearance of the fluid during the test are determined.

5 Reagents and materials

5.1 **Acetone**, analytical grade.

5.2 **Heptane**, analytical grade.

5.3 **Water**, conforming to at least grade 2 of ISO 3696.

5.4 **Metallic salts**, listed in table A.1, analytical grade⁵⁾.

6 Apparatus

Usual laboratory apparatus and glassware, together with the following:

6.1 **Glass beakers (ten required)**, of capacity 400 ml, height approximately 135 mm, without spout, conforming to ISO 3819 (see figure 1).

6.2 **Glass beaker**, type H 1000, conforming to DIN 12331 (of capacity 1 000 ml).

6.3 **Pipette**, complying with ISO 648, class A.

6.4 **Watch glasses (ten required)**, for covering the beakers (6.1), with a hole in the centre for suspending glass hooks (see figures 1 and 2).

6.5 **Glass hooks**, allowing free suspension of the test strips in the beaker and formed in such a way that the hole in the watch glass will be closed by the suspension device (see figures 1 and 2).

6.6 **Heating bath or oven**, thermostatically controlled and capable of maintaining the test fluids at $35\text{ °C} \pm 1\text{ °C}$. If a heating bath is used, it shall be equipped to give adequate stirring to ensure even temperature distribution.

6.7 **Analytical balance**, accurate to 0,000 2 g.

6.8 **Abrasive paper**, corundum/haematite/quartz (commercially known as "emery"), of various grades of fineness, including P 120, P 400 and P 600 grit designation according to ISO 6344-1.

6.9 **Cotton wool**.

6.10 **Tweezers**, suitable for handling the test strips.

6.11 **Grinding wheel (fine)**, rotating at approximately 1 400 r/min.

⁵⁾ For a specification of the reagents see for example, national pharmacopoeias.

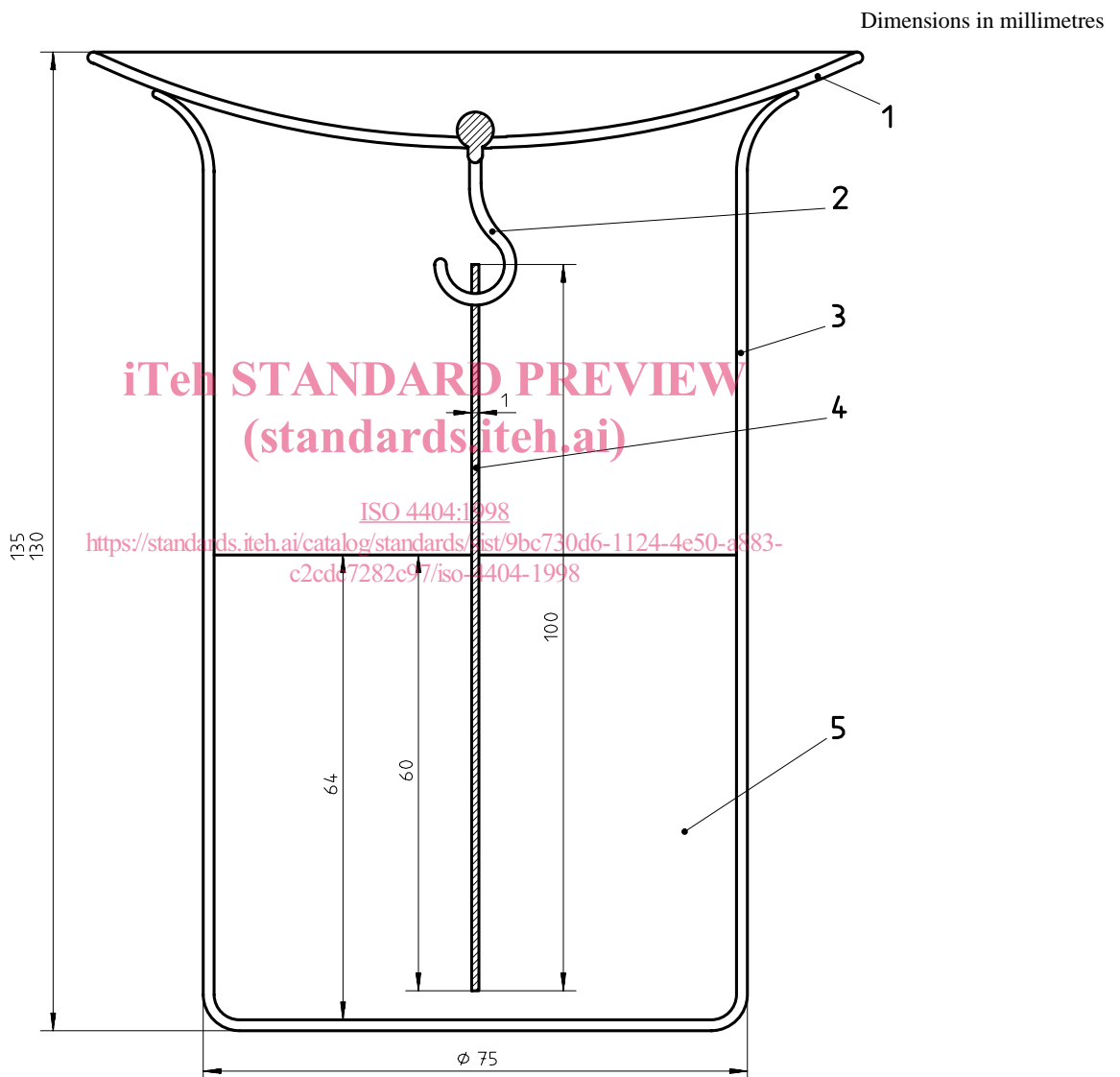
6.12 Test strips, of the materials listed in table 1, measuring 100 mm × 20 mm × 1 mm and having a hole of 4 mm diameter at one end for suspending on the glass hook (6.5).

NOTES

- 1 Test strips measuring 100 mm × 20 mm × 2 mm may also be used.
- 2 This test may be performed with any other material (metal and/or alloy) used in hydraulic systems, provided that the dimensions of the test strips are observed as specified in 6.12.

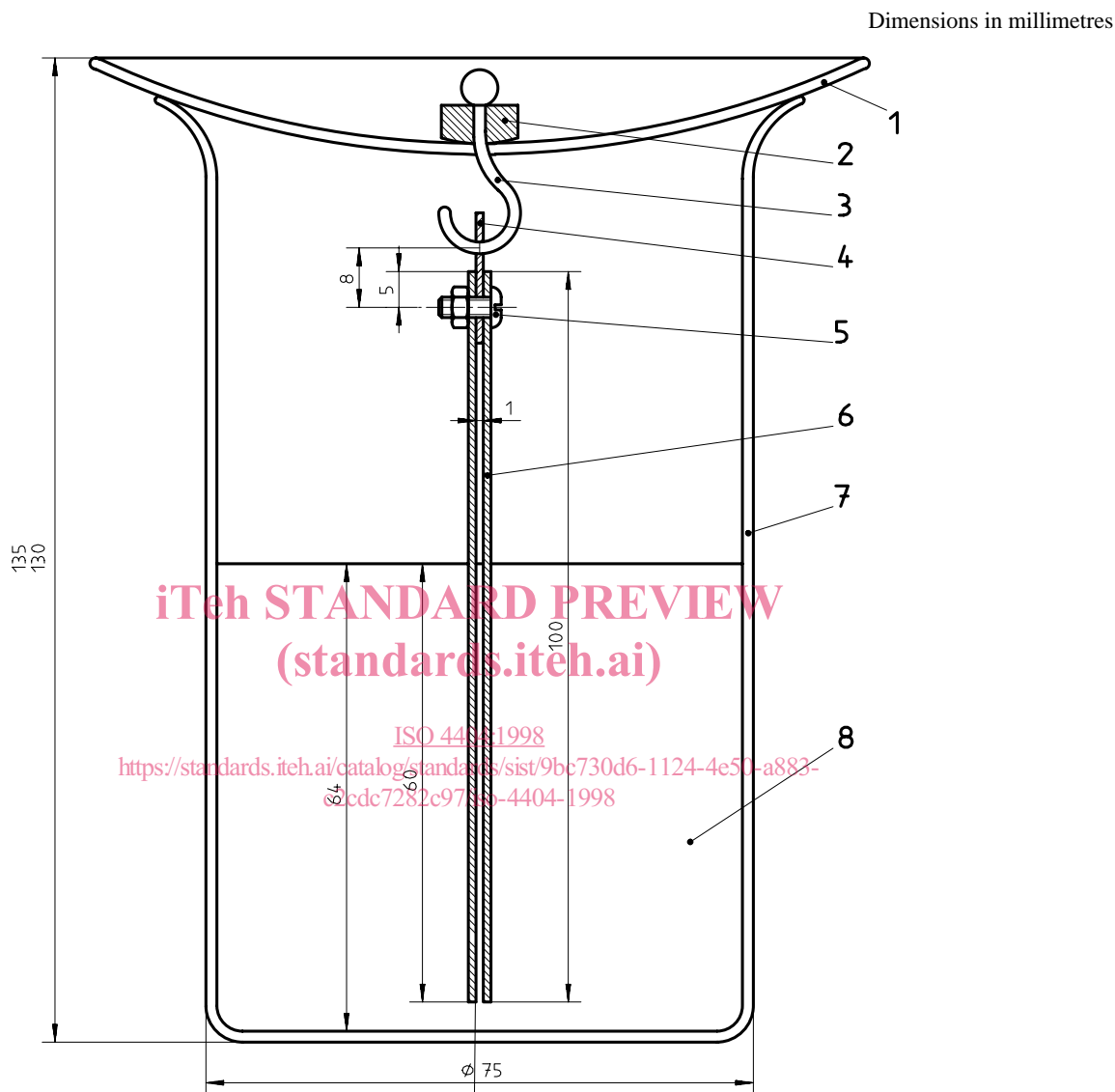
6.13 Spacer, of nylon, rectangular, 15 mm × 10 mm × 1 mm, with two holes of 5 mm diameter, for the glass hook (6.5) and bolt (6.14) (see figure 2).

6.14 Bolt and nut, of nylon, diameter 4 mm, 15 mm length (see figure 2).



Key

- | | |
|---|----------------------|
| 1 | Watch glass |
| 2 | Glass hook |
| 3 | Beaker without spout |
| 4 | Test strip |
| 5 | Test fluid |



Key

- | | | | |
|---|----------------------------|---|------------------------------------|
| 1 | Watch glass | 5 | Nylon bolt and nut $\varnothing 4$ |
| 2 | Shim | 6 | Pair of test strips |
| 3 | Glass hook | 7 | Beaker without spout |
| 4 | Nylon spacer (15 × 10 × 1) | 8 | Test fluid |

Figure 2 – Assembly for a pair of test strips

Table 1 — Specifications of standard test materials for test strips

Metal	Composition % (m/m)	References	
		ISO (grade)	EN (grade)
Steel	Fe 98,58 to 98,98 C 0,35 to 0,45 Mn 0,5 to 0,8 Si max. 0,10 S max. 0,035 P max. 0,035	—	10083-2 (C45)
Copper	Cu 99,9 (electrolyte copper)	1337 (Cu ETP or Cu-FRHC)	—
Brass	Cu 65 Zn 35	426-1 (Cu Zn 35)	—
Zinc	Zn 99,5 (pure zinc)	752 (99,5)	1179 (Z4)
Aluminium	Al 99,5 (pure aluminium)	209-1 (Al 99,5/1050A)	—

NOTE — For equivalent standards to those referenced in this table, see annex B.

iTeh STANDARD PREVIEW

7 Producing the test fluid from an HFA type fluid concentrate (standards.iteh.ai)

Mix the concentrate and the test water No. 1, No. 2 or No. 3, whose characteristics and preparation are described in annex A, in the proportion recommended by the supplier of the concentrate.

The type of test water used, chosen from annex A, shall be of the highest hardness still able to form a stable emulsion, i.e. an emulsion which satisfies the ratings 1A and 1R of DIN 51346.

Measure 600 ml of the test water into a glass beaker (6.2). With constant stirring, add the required amount of the concentrate in doses using the pipette (6.3) within 10 min. After the whole concentrate has been added, stirring shall continue for 5 min more, and then 250 ml of the test fluid shall be measured immediately into the prepared beakers (see 8.1.5).

Start the test on the day of mixing.

8 Procedure

8.1 Preparation for the test

8.1.1 Before polishing the test strips, carefully remove any burrs from the edges of the strips (6.12) using the grinding wheel (6.11).

8.1.2 Polish the test strips with suitable grades of emery paper (6.8), e.g. in the order of P 120, P 400 and finally P 600, until a smooth surface is achieved.

8.1.3 Subsequently, handle test strips exclusively with tweezers (6.10). Rub the test strips with dry cotton wool (6.9) and then with cotton wool soaked in heptane (5.2).

8.1.4 When all traces of solvent have evaporated, weigh the test strips and record their mass to the nearest 1 mg.

8.1.5 Fill each of ten beakers (6.1) with 250 ml of the homogenized test fluid.