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BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Environmental testing –
Part 2-74: Tests – Test Xc: Fluid contamination

Essais d'environnement –
Partie 2-74: Essais – Essai Xc: Contamination par des fluides

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ENVIRONMENTAL TESTING –

Part 2: Tests – Test Xc: Fluid contamination

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IEC 60068-2-74 edition 1.1 contains the first edition (1999-06) [documents 104/124/FDIS and 104/129/RVD] and its amendment 1 (2018-04) [documents 104/739/CDV and 104/791/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60068-2-74 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test*.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

It has the status of a basic safety publication in accordance with IEC Guide 104.

Annex A is for information only.

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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* IEC technical committee 50: Environmental testing, has been transformed into IEC technical committee 104.

ENVIRONMENTAL TESTING –

Part 2: Tests – Test Xc: Fluid contamination

1 Scope

This part of IEC 60068 gives a method of test which provides a standard procedure to determine the ability of components, equipments or their constituent materials, hereinafter referred to as specimen, to withstand accidental contact with fluids, without being unacceptably affected.

The fluids listed in this part of IEC 60068 are representative of those commonly encountered in operational applications. It is not intended that a specimen should be exposed to all, or even any of them. Nor is the list intended to be complete; fluids not listed and for which a test is appropriate should be included in the relevant specification. Guidance is given in annex A on the choice of test fluids, specimens and severities.

These tests are not intended to demonstrate the suitability of components or equipments to perform in continuous contact with a fluid, e.g. an immersed fuel pump. Nor are they a test to demonstrate immunity from electrolytic corrosion.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60068. 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 IEC 60068 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 IEC and ISO maintain registers of currently valid International Standards.

ISO 1817:~~1985~~ 2015, *Rubber, vulcanized or thermoplastic – Determination of the effect of liquids*

3 Test fluid

3.1 Specification of test fluid

The relevant specification (see Clause 12) shall specify the required test fluids which shall wherever possible be selected from the list given in Table 1. Each fluid has been specified as being representative of a group of fluids. (See Clause A.2.) **The actual composition of some of the fluids specified in Table 1 are provided for information in Table 2 and Table 3.**

The relevant specification shall also specify any additional fluids not listed in Table 1 for which a test is required.

3.2 Precaution

Since many fluids may have flash points within the test temperature range, care should be taken to ensure that adequate safety measures are taken to limit the possibility of fire or explosion.

Some fluids may themselves, or in combination with other fluids or the specimen, be toxic. Due consideration should be given to this possibility before commencing the tests. Consultation of a health and safety expert is strongly advised.

Table 1 – Major contaminant fluid groups and test fluids

Contaminant fluid group (See Annex A for description of contamination fluids including environmental and toxicological aspects.)		Test fluid reference	Test fluid ^{d e}	Test temperature (± 2 °C) ^c
Fuels	Kerosene (turbine) fuel	(a)	ISO 1817:2015, Test liquid F (see Table 2)	70 ^a
	Diesel fuel			
	Gasoline (piston engine) fuel	(b)	ISO 1817:2015, Test liquid B (see Table 2)	40 ^a
Hydraulic fluids	Mineral oil based	(c)	NATO H-520 (OM18) ⁴ (ON-18) (or as an alternative NATO H-515)	70
	Phosphate ester based (synthetic)	(d)	ISO 1817:2015, Test liquid 103 (see Table 3)	70
	Silicone based	(e)	Dimethyl silicone fluid grade 10 (10 mm ² /s (cSt) at 25 °C) NATO S-1714 (Joint Service designation ZX-42)	70
Lubricating oils	Mineral based	(f)	SAE 10W/30 NATO O-1176 (Joint Service designation OMD- 80 90)	70
	Ester based (synthetic)	(g)	ISO 1817:2015, Test liquid 101 (see Table 3)	150
Solvents and cleaning fluids		(h)	Propan-2-ol (isopropyl alcohol); CAS No 67-63-0, (BS 1595-1, ASTM D770 and DIN 53245)	50 ^a
		(i)	Denatured alcohol (methylated spirits)	23
		(j)	Detergent	23
De-icing and antifreeze fluids		(k)	Inhibited ethanediol (ethylene glycol) CAS No 107-21-1 with a volume fraction of 80 % in water	23
		(l)	Inhibited ethanediol (ethylene glycol) CAS No 107-21-1 with a volume fraction of 50 % in water	23
Runway de-icers		(m)	Ethylene glycol CAS No 107-21-1 (25 % urea / 25 % ethanediol (ethylene glycol) in water) ⁴⁾	23
		(n)	Potassium acetate CAS No 127-822-2 50 % inhibited potassium acetate in water ⁴⁾	23
Insecticides		(o)	Dichlorvos (DDVP) pyrethrum based, CAS No 62-73-7 (2 % solution in kerosene CAS No 8008-20-6)	23
		(p)	D – phenothrin CAS No 26002-80-2 2% solution in kerosene CAS No 8008-20-6	23
Coolant dielectric fluids (see A.2.9)		(q)	Silicate ester dielectric heat transfer fluid (commercial product “Coolanol 25R TM ” b)	70

Fire extinguishants	(r)	Fluorochemical foam (rapid intervention) Fluoroprotein foam (NATO Stock #4210 99 224 6854)	23
	(s)	Fluoroprotein foam Aqueous film forming foam (AFFF) containing fluorochemical surfactants	23
<p>^a The indicated temperature exceeds the critical flash point temperature. Expert advice should be taken on the conduct of the test.</p> <p>^b Coolanol 25R™ is the tradename of a product supplied by ExxonMobil. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.</p> <p>^c See Clauses 8, 9, 10 and A.7.</p> <p>^d Wherever possible the fluid given is specified in an international standard or is described by its constituent chemicals. In some cases a NATO identification has been used in preference to a commercial identification. Reference to the relevant commercial literature can correlate to the NATO number with commercially available fluids.</p> <p>^e CAS No. refers to Chemical Abstracts Service Number (www.cas.org).</p> <p>⁴ NATO H-515 may be used as an alternative if desired.</p>			

Table 2 – Standard simulated fuels

ISO 1817:2015 Test fluid	Liquid constituents	Content % (by volume)	CAS Registry Number	Application
B	2,2,4-trimethylpentane	70	540-84-1	Liquid B is intended to simulate petroleum-derived fuels without oxygen compounds.
	toluene	30	108-88-3	
F	straight-chain paraffins (C12 to C18)	80	68476-34-6	Liquid F is intended to simulate diesel fuel, domestic heating oils and similar light furnace oils.
	1-methylnaphthalene	20	90-12-0	

Table 3 – Simulated service liquids

ISO 1817:2015, Test fluid	Liquid constituents	Content % (by mass)	CAS Registry Number	Application
101	di-2-ethylhexyl sebacate	99,5	122-62-3	Intended to simulate synthetic diester-type lubricating oils.
	phenothiazine	0,5	92-84-2	
103	tri- <i>n</i> -butyl phosphate	100	126-73-8	Intended to simulate phosphate-ester hydraulic oils used in aircraft.

4 Specimen

4.1 The specimen shall be either:

- a) an equipment; or
- b) a component

NOTE 1 – Where size or availability of an equipment does not permit a full test, a specially selected representation of materials, finishes and components used in an equipment may be used as a specimen.

NOTE 2 – Specimens for materials or finishes should have a minimum surface area where possible of 20 cm².

4.2 The relevant specification shall specify the number and type of specimens to be tested. (See clause A.4.)

5 Cleaning

5.1 Initial cleaning

Unless otherwise specified in the relevant specification the specimen shall be thoroughly cleaned to remove unrepresentative coatings, for example preservatives, grease or contaminants. (See clause A.5.)

5.2 Intermediate cleaning

If sequential testing is required, the relevant specification shall specify any necessary cleaning method.

NOTE – It is essential that cleaning methods and cleaning fluids are chosen such that they do not affect the specimen.

5.3 Final cleaning

The relevant specification shall specify any necessary cleaning method prior to final examination. (See clause A.5.)

6 Initial examination

6.1 The specimen shall be visually examined following initial cleaning, if required, and its condition recorded.

6.2 The relevant specification shall specify any measurements or tests required. (See clause A.6.)

7 Testing

7.1 Three test procedures are given in clauses 8 to 10. The relevant specification shall specify the test or tests to be used and the order of application of the test fluids if sequential testing is required. (See clause A.7.)

NOTE – If sequential testing is specified care should be taken that there are no synergistic effects.

7.2 The relevant specification shall specify whether the specimen is to be connected electrically or mechanically and, if it is required to operate before, during or after the procedure, the operating parameters shall also be defined. If an initial operating test is specified, it shall be carried out following the initial examination.

8 Occasional contamination (class A)

8.1 Mount the specimen in its normal operating configuration and maintain at room temperature, or as specified in the relevant specification.

8.2 Dip, brush or spray the relevant specimen with the specified fluid which shall be maintained at the test temperature given in table 1, or as specified in the relevant specification. Ensure that the entire surface of the specimen is thoroughly wetted. Allow the sample to drain naturally for 5 min to 10 min, shaking or wiping is not permitted.

8.3 Transfer the specimen into a suitable test chamber, mounted in its normal operating configuration if important, and maintain at the test temperature for the time specified in the relevant specification. If not specified, the parameters shall be

$70\text{ °C} \pm 2\text{ °C}$ for $93\text{ h} \pm 3\text{ h}$.

8.4 At the end of the period allow the specimen to cool to room temperature before being subjected to final examination.

8.5 Repeat this procedure, if and as required by the relevant specification.

9 Intermittent contamination (class B)

9.1 Mount the specimen in its normal operating configuration and maintain it at room temperature, or as specified in the relevant specification.

9.2 Dip, spray or brush the relevant specimen with the specified fluid which shall be maintained at the test temperature given in table 1, or as specified in the relevant specification. Ensure that the entire surface of the specimen is wetted. Repeat this procedure one or more times as necessary to maintain all the specimen surfaces in a wetted condition for the period prescribed in the relevant specification.

If the period is not specified it shall be three cycles each of $24\text{ h} \pm 1\text{ h}$. Each cycle shall consist of $8\text{ h} \pm 0,5\text{ h}$ in the fully wetted condition followed by a drain period of $16\text{ h} \pm 0,5\text{ h}$ at ambient temperature during which no additional wetting shall occur.

9.3 Transfer the specimen into a suitable test chamber and maintain it at the test temperature and for the time specified in the relevant specification. If not specified, the parameters shall be

$70\text{ °C} \pm 2\text{ °C}$ for $93\text{ h} \pm 3\text{ h}$.

9.4 At the end of the period allow the specimen to cool to room temperature before being subjected to final examination.

10 Extended contamination (class C)

NOTE – This procedure is not intended to demonstrate the operation of an equipment which is normally immersed in a fluid.

10.1 Immerse the specimen fully in the specified test fluid which shall be maintained at the temperature and for the time stated in the relevant specification. If the temperature and/or duration are not specified, the temperature shall be as given in table 1, and the duration shall be $24\text{ h} \pm 1\text{ h}$.

10.2 Transfer the specimen into a suitable test chamber and maintain it at the test temperature and for the time specified in the relevant specification. If not specified, the