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Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 7148-2

Plain bearings — Testing of the tribological behaviour of bearing materials —

Part 2: Testing of polymer-based bearing materials

*Paliers lisses — Essai du comportement tribologique des
matériaux antifriction —*

Partie 2: Essai des matériaux pour paliers à base de polymère

ICS: 21.100.10

ISO/TC 123/SC 2

Secretariat: **DIN**

Voting begins on:
2024-08-16

Voting terminates on:
2024-11-08

This document is circulated as received from the committee secretariat.

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/foreword.html.

This document was prepared by Technical Committee ISO/TC 123, Plain bearings, Subcommittee SC 2, *Materials and lubricants, their properties, characteristics, test methods and testing conditions*.

This third edition cancels and replaces the second edition (ISO 7148-2:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

- “This part of ISO 7148” has been replaced with “This document”;
- [Clause 2](#) “Normative references” has been updated;
- [Clause 3](#) “Terms and definitions” has been implemented;
- [Table 1](#) and [Table A.1](#) has been updated, and [Table 2](#) has been added;
- [Clause 6](#), [Clause 7](#), [Clause 8](#) and [Clause 11](#) and [Clause 13](#) has been updated;

A list of all parts in the ISO 7148 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Plain bearings — Testing of the tribological behaviour of bearing materials —

Part 2: Testing of polymer-based bearing materials

1 Scope

This document specifies tribological tests of polymer-based plain bearing materials under specified working conditions, i.e. load, sliding velocity and temperature, with and without lubrication. From the test results, data are obtained which indicate the relative tribological behaviour of metal-polymer and polymer-polymer rubbing parts.

The purpose of this document is to obtain, for polymer material combinations used in plain bearings, reproducible measured values for friction and wear under specified and exactly-defined test conditions without lubrication (dry surfaces) and with lubrication (boundary lubrication).

The test results give useful information for practical application only if all parameters of influence are identical. The more the test conditions deviate from the actual application, the greater the uncertainty of the applicability of the results.

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 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 4378-2, *Plain bearings — Terms, definitions, classification and symbols — Part 2: Friction and wear*

ISO 4378-3, *Plain bearings — Terms, definitions, classification and symbols — Part 3: Lubrication*

ISO 4385, *Plain bearings — Compression testing of metallic bearing materials*

ISO 6691, *Thermoplastic polymers for plain bearings — Classification and designation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4378-2 and ISO 4378-3 apply.

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Symbols, units and abbreviated terms

See [Table 1](#).

Table 1 — Symbols, units and abbreviated terms

Symbol	Term	Unit
A, B, C, D, E, F	Test method	-
a	Sliding distance	km
b_1	Machined plate length	mm
b_2	Machined plate width	mm
dr	Dry	-
f	Coefficient of friction; ratio between friction force and normal force, i.e.: $f = \frac{F_f}{F_n}$	-
F_f	Friction force	N
F_n	Normal force	N
gr	Grease	-
h	Machined plate thickness	mm
K_w	Coefficient of wear, volumetric wear rate related to the normal force, i.e.: $K_w = \frac{V_w}{F_n \times a} = \frac{w_v}{F_n}$	mm ³ /N·m
l_w	Linear wear as measured by change in distance	mm
M_f	Friction moment	N·m
oi	Oil	-
$\bar{p}$	Specific force per unit area (force/projected contact area)	N/mm ²
Q	Thermal constant of the test equipment. $Q = (T_{lim} - T_{amb}) / (f \times \bar{p} \times U \times 10^6)$	°C · m · s/N
Ra	Arithmetic mean height	µm
Rk	Core height	µm
Rpk	Reduced peak height	µm
Rvk	Reduced pit depth	µm
$R_{d,B}$	Compression strength	N/mm ²
$R_{d0,2}$	0,2 % Compression limit	N/mm ²
so	Solid lubricant	-
T	Specimen's temperature near the sliding surface during testing under steady-state conditions	°C
T_{amb}	Ambient temperature	°C
T_g	Glass transition temperature	°C
T_{lim}	Maximum permissible temperature	°C
t	Plate thickness	mm
t_{Ch}	Test duration	h
U	Sliding velocity	m/s
V_w	Material removed by wear as measured by change in volume	mm ³

Table 1 (continued)

Symbol	Term	Unit
w_l	Linear wear rate, i.e.: $w_l = \frac{l_w}{a}$	mm/km
w_v	Volumetric wear rate, i.e.: $w_v = \frac{V_w}{a}$	mm ³ /km
η	Lubricant viscosity	mPa·s

5 Special features for the tribological testing of polymer-based materials

Polymers have a low thermal conductivity and a low melting temperature, so that heat resulting from contact friction can lead to partial melting and hence feign wear. Due to the high thermal expansion of polymers (up to 10 times higher than that of steel) results obtained can be misleading because the test specimens have expanded under frictional heat. Hence allowance shall be made for the effects of thermal expansion (change of clearance) and thermal conductivity (melting) when assessing the results. Where possible the temperature of both test specimens should be controlled.

Polymers have a glass transition temperature, T_g , which depends on their chemical structure. At this temperature, their physical properties and their tribological behaviour can change.

Injection-moulded polymer surfaces have different properties from machined surfaces. The test specimens shall be tested with the same surface conditions as they have in practical application.

Reinforcements and fillers, i.e. fibres, can lead to very strong anisotropy of the material and influence its wear behaviour depending on fibre orientation. The test specimens should have the same fibre orientation as in practical application.

In order to avoid stick-slip, the test rig shall be very stiff and shall not be susceptible to vibrations.

The tribological behaviour of polymers depends very strongly on the material combination, which part moves and which part remains stationary. The test system shall be similar to practical application.

Polymers show wear processes that are different from that of metals. There are not only abrasive wear processes with powder-like wear debris, but also adhesive wear processes with the creation of transfer layers which can be smooth or rough. Also ploughing wear, plastic deformation or even thermal destruction is possible. Therefore, wear cannot be gravimetrically measured in all cases and the wear status shall be judged after the tests (whether the surfaces are fine- or coarse- grained, scored or plucked out, scaled, melted or plastically deformed).

Some polymers can show poor repeatability of the results and require repeated testing (i.e. six or more repetitions).

The preparation and preparatory treatment (e.g. conditioning, storage, cleaning) of the test specimens can have a high influence on performance.

In some thermoplastics, e.g. polyamides, moisture absorption effects a gradual change in linear dimensions and modifies their mechanical properties. Environmental parameters should, therefore, be controlled in the test array. Moisture absorption prohibits gravimetric measurement of wear.

6 Test methods

6.1 General

The more the test conditions deviate from the actual application, the greater is the uncertainty of the applicability of the results. Different test methods are provided for tests in accordance with this document so that the following contact geometries are available, an overview on these test methods is given in [Table 2](#). The test methods should correspond to the practical application as closely as possible.