



**International
Standard**

ISO 12921

**Petroleum products and
lubricants — Determination of the
mechanical stability of greases in
presence of water**

*Produits pétroliers et lubrifiants — Détermination de la stabilité
mécanique des graisses en présence d'eau*

**First edition
2024-01**

STANDARDSISO.COM : Click to view the full PDF of ISO 12921:2024



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: 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 Principle.....	1
5 Significance of the test.....	1
6 Sampling.....	2
7 Materials.....	2
8 Reagents.....	2
9 Operating procedure.....	2
10 Calculation.....	3
11 Expression of the result.....	3
12 Test report.....	3
13 Precision.....	3
13.1 General.....	3
13.2 Repeatability, r	3
13.3 Reproducibility, R	4
Annex A (informative) Existing standards to evaluate the influence of water on grease properties.....	5
Bibliography.....	6

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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/iso/foreword.html.

This document was prepared by Technical Committee 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*.

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.

Introduction

Numerous standards exist to evaluate the influence of water on grease properties. These standards are described in [Annex A](#).

The purpose of this document is to describe a method for the evaluation of the effect of water on the working stability of a grease, by comparing the penetrations of the grease worked without water and the grease worked in presence of water. This allows to predict the mechanical behaviour of the grease, the risk of leakages due to excessive softening, the risk of lubricating properties losses by excessive hardening or complete solubilization.

STANDARDSISO.COM : Click to view the full PDF of ISO 12921:2024

STANDARDSISO.COM : Click to view the full PDF of ISO 12921:2024

Petroleum products and lubricants — Determination of the mechanical stability of greases in presence of water

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel prior to the application of this document, and to determine the applicability of any other restrictions for this purpose.

1 Scope

This document specifies a method for evaluating the change of consistency of a grease when it is submitted to working and prolonged working in presence of 10 % of water.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2137:2020, *Petroleum products and lubricants — Determination of cone penetration of lubricating greases and petrolatum*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 7120, *Petroleum products and lubricants — Petroleum oils and other fluids — Determination of rust-preventing characteristics in the presence of water*

ISO 23572, *Petroleum products — Lubricating greases — Sampling of greases*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminology 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 Principle

A specified mass of grease is blended with a specified quantity of water, then worked, either 60 strokes or 100 000 strokes in a grease worker. The penetration measured after this working is compared to the penetration measured after working 60 strokes or 100 000 strokes in absence of water. The difference of the penetrations recorded with and without water yields the water resistance of the grease.

5 Significance of the test

This test method estimates the softening or hardening tendency of a grease when submitted to prolonged working in presence of water. No formal correlation with field service has been established.

6 Sampling

Sampling of the bearing greases shall be carried out in accordance with ISO 23572. The sample shall be evaluated on a representative portion. Any drum, barrel, tanker compartment or any type of container delivered to the end user may be sampled and analysed at the discretion of the purchaser.

7 Materials

Only materials of recognized analytical grade shall be used.

7.1 Equipment to perform penetrability measurement, as specified in ISO 2137. Use only the full-scale cone (or the optional cone) and the full-scale worker.

7.2 Cup, flat bottom with a diameter of approximately 200 mm, with handles.

7.3 Spatula, made from non-abrasive material (wood, plastic).

7.4 Balance, which can be read to the nearest 0,1 g.

7.5 Mechanical stirrer, low speed, (electric kitchen) with a suitable mixing bowl.

8 Reagents

Only reagents of recognized analytical grade shall be used.

8.1 Water, conforming to grade 2 of ISO 3696.

8.2 Synthetic sea water, in accordance with ISO 7120.

9 Operating procedure

9.1 Determine the $P_{60 \text{ dry}}$ (penetration after 60 strokes without water) in accordance with ISO 2137:2020, 8.2 after working 60 strokes.

9.2 Determine the penetration, $P_{60 \text{ wet}}$ (penetration after 60 strokes in presence of water).

9.2.1 Weigh in the cup (7.2) 450 g of grease and 50 g of water (8.1 or 8.2).

9.2.2 Using the spatula (7.3), blend the grease and the water until completely homogenized.

When the water is incorporated to the grease, fill the worker and proceed as in 9.1 to determine the penetration after working 60 strokes.

NOTE In the case where the blend is not homogeneous, or the water is difficult to incorporate, it is possible to perform the blend using a mechanical stirrer (7.5) the rotating speed of which being chosen so as to avoid water splashing on the walls of the cup and not to provoke too important agitation.

9.3 Determine the penetration $P_{100\,000 \text{ dry}}$ (penetration after 100 000 strokes without water) as specified in ISO 2137:2020, 8.3, after working 100 000 strokes.

9.4 Determine the penetration $P_{100\,000 \text{ wet}}$ (penetration after 100 000 strokes in presence of water) on the sample from penetrability $P_{60 \text{ wet}}$ as specified in ISO 2137:2020, 8.3, after working 100 000 strokes.

10 Calculation

Calculate:

$P_{60 \text{ wet}} - P_{60 \text{ dry}}$ which indicates how grease consistency is affected by water ingress (when >0 , the grease softens, when <0 , the grease hardens).

$P_{100\,000 \text{ wet}} - P_{100\,000 \text{ dry}}$ which indicates how the grease can continue to operate after water ingress.

$P_{100\,000 \text{ wet}} - P_{60 \text{ dry}}$ which gives information about the effect of prolonged working in presence of water.

$P_{100\,000 \text{ wet}} - P_{60 \text{ wet}}$ which gives information of the effect of water ingress on the mechanical stability.

11 Expression of the result

Report the results in 1/10 of millimetres:

$P_{60 \text{ dry}}, P_{60 \text{ wet}}, P_{100\,000 \text{ dry}}, P_{100\,000 \text{ wet}}$

$P_{60 \text{ wet}} - P_{60 \text{ dry}}, P_{100\,000 \text{ wet}} - P_{100\,000 \text{ dry}}, P_{100\,000 \text{ wet}} - P_{60 \text{ dry}}, P_{100\,000 \text{ wet}} - P_{60 \text{ wet}}$

12 Test report

The test report shall contain at least the following information:

- a reference to this document, i.e. ISO 12921:2024;
- the type and complete identification of the product tested;
- the nature of the water used (distilled or synthetic sea water);
- the result (see [Clause 11](#));
- any deviations from the procedure;
- any unusual features observed;
- the date of the test.

13 Precision

13.1 General

The precision has been evaluated for $P_{100\,000 \text{ wet}} - P_{100\,000 \text{ dry}}$ and for $P_{100\,000 \text{ wet}} - P_{60 \text{ dry}}$ by examining interlaboratory test results according to ISO 4259-1^[16]. The precision for $P_{100\,000 \text{ wet}} - P_{100\,000 \text{ dry}}$, distilled and salt water, for $P_{100\,000 \text{ wet}} - P_{60 \text{ dry}}$ as determined by statistical examination of interlaboratory test results according to ISO 4259-1, is given in [13.2](#) and [13.3](#).

13.2 Repeatability, r

The difference between two independent results obtained using this method for test material considered to be the same in the same laboratory, by the same operator using the same equipment within short intervals of time, in the normal and correct operation of the method that is expected to be exceeded with a probability of 5 % due to random variation, is shown in [Table 1](#).

13.3 Reproducibility, R

The difference between two independent results obtained using this method for test material considered to be the same in different laboratories, where different laboratory means a different operator, different equipment, different geographic location, and under different supervisory control, in the normal and correct operation of the test that is expected to be exceeded with a probability of 5 % due to random variation, is shown in [Table 1](#).

Table 1 — Precision of the test

Penetration	r	R
$P_{100\,000\text{ wet}} - P_{60\text{ dry}}$ distilled water	12	40
$P_{100\,000\text{ wet}} - P_{60\text{ dry}}$ synthetic sea water	22	53
$P_{100\,000\text{ wet}} - P_{60\text{ dry}}$	20	26

STANDARDSISO.COM : Click to view the full PDF of ISO 12921:2024

Annex A

(informative)

Existing standards to evaluate the influence of water on grease properties

[Table A.1](#) shows the various methods currently used to determine the effect of water on the properties of grease.

Table A.1 — Behaviour of grease in presence of water

Behaviour of grease in presence of water		
Property evaluated	ISO standard	Other standard
Resistance to wash out	ISO 11009 ^[1]	IP 215 ^[4] , ASTM D1264 ^[5] , ASTM D4049 ^[6] , DIN 51807-1 ^[7] , DIN 51807-2 ^[8]
Corrosion protection	ISO 11007-1 ^[2]	ASTM D1743 ^[10] , IP 220 ^[11] , DIN 51802 ^[9] , ASTM D6138 ^[12]
	ISO/TS 11007-2 ^[3]	
Resistance to prolonged working in presence of water	ISO 12921	ASTM D7342 ^[13] , NF T60-626 ^[14]
Rolling stability in presence water		ASTM D8022 ^[15]

ISO 11009^[1] describes a method to evaluate the resistance of grease to washout from a bearing in laboratory conditions. ASTM D1264^[5], DIN 51807-2^[8] and IP 215^[4] use a similar procedure.

DIN 51807-1^[7] is a static test.

ASTM D4049^[6] indicates the ability of a grease to adhere to a metallic surface when subjected to a water spray.

ISO 11007-1^[2] and ISO/TS 11007-2^[3] evaluate the ability of a grease to protect bearings against corrosion in dynamic conditions and in presence of wash out respectively. DIN 51802^[9] is equivalent to ISO 11007-1.

ASTM D6138^[12] and IP 220^[11] are similar to ISO 11007-1.

ASTM D1743^[10] covers the corrosion preventive properties of lubricating grease using grease lubricating tapered roller bearings stored under wet conditions. This test is, contrarily to ISO 11007-1 and ISO/TS 11007-2, a static test.

This document (similar to ASTM D7342^[13], NF T60-626^[14] and ASTM D8022^[15]) includes tests which evaluate the behaviour of greases when submitted to working in presence of water. The action of water on greases can also be shown by a more or less important absorption of water, by more or less important hardening or softening, or by a loss of adhesiveness on metallic surfaces.