
**Petroleum products — Determination of the
filterability of lubricating oils —**

Part 1:
Procedure for oils in the presence of water

*Produits pétroliers — Détermination de la filtrabilité des huiles
lubrifiantes —*

Partie 1: Méthode pour les huiles en présence d'eau



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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.ch
Web www.iso.ch

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 13357 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13357-1 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

ISO 13357 consists of the following parts, under the general title *Petroleum products — Determination of the filterability of lubricating oils*:

- *Part 1: Procedure for oils in the presence of water*
- *Part 2: Procedure for dry oils*

Annex A of this part of ISO 13357 is for information only.

Introduction

As the fluid in a hydraulic system acts as a lubricant to minimize wear of the components, it is important to reduce the concentrations of circulating hard contaminant particles. This is particularly necessary when the performance of the system depends on the maintenance of small clearances and orifices. Removal of these contaminants is effected by the use of filters. The ability of a hydraulic fluid to pass through fine filters, without plugging them, is called its filterability. This part of ISO 13357 describes a laboratory test procedure for assessing the filterability of mineral oils which have been heat-soaked in the presence of water. Filterability so determined is not a physical characteristic of the oil, but represents an estimation of its behaviour in service.

This part of ISO 13357 describes two measurements, referred to as "stages". The Stage I determination is based on a comparison of the mean flow rate of a fluid through a test membrane with its initial flow rate. Oils having good Stage I filterability, but only a poor Stage II performance (see below), would be unlikely to give performance problems in use, unless extremely fine system filters are utilized.

The Stage II determination is based on the ratio between the initial flow rate of fluid through the test membrane and the rate at the end of the test. It is considered that this part of the procedure is a more severe test, and is more sensitive to the presence of gels and fine silts in the oil. Silts and gels may be present in an oil when it is produced, or could be formed as an oil ages, especially when hot. An oil with good Stage II filterability would be unlikely to give filtration problems even in the most extreme conditions or with fine (less than 5 μm) filtration present. It would thus be suitable for use in more critical hydraulic and lubrication systems.

The procedure has been evaluated with mineral oils up to ISO viscosity grade 100. There would appear to be no reason why it should not be used with oils of higher viscosity grade (ISO viscosity grade 220 is a practical maximum), but the data could not be claimed to be completely in accordance with this method. Similarly, it should be possible to extend the test procedure to fluids other than mineral oils. However, some fluids, e.g. fire-resistant fluids, will not be compatible with the specified test membranes, and the test could only be used for comparison purposes even when suitable membranes, with similar pore size/pore density characteristics to those specified in this procedure, have been identified.

Petroleum products — Determination of the filterability of lubricating oils —

Part 1:

Procedure for oils in the presence of water

WARNING — The use of this part of ISO 13357 may involve hazardous materials, operations and equipment. This part of ISO 13357 does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this part of ISO 13357 to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This part of ISO 13357 specifies a procedure for the evaluation of the filterability of lubricating oils, particularly those designed for hydraulic applications, in the presence of water. The procedure only applies to mineral-based oils, since fluids manufactured from other materials (e.g. fire-resistant fluids) may not be compatible with the specified test membranes. The range of application has been evaluated with oils of viscosity up to ISO viscosity grade (VG) 100, as defined in ISO 3448. Within the range described, the filterability as defined is not dependent on the viscosity of the oil. The procedure is not suitable for some hydraulic oils on which specific properties have been conferred by the use of insoluble/partially soluble additives, or by particularly large molecular species.

NOTE Filterability is a prime requirement for lubricating oils used in hydraulic systems because of the fine filters used in this application.

This part of ISO 13357 defines a method for assessing the filterability of oils in the presence of contaminating water. It should be noted that some oils will exhibit poorer filterability characteristics in these conditions. ISO 13357-2 should be used to investigate the filterability of an oil which is to be used in applications where the presence of water in the oil is unlikely. An oil which has good filterability in the presence of contaminating water will not necessarily have equally good filterability in dry conditions. An oil having good filterability only when wet is unlikely to be generally acceptable.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13357. 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 ISO 13357 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 ISO and IEC maintain registers of currently valid International Standards.

ISO 1219-1:1991, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols*

ISO 3170:1988, *Petroleum liquids — Manual sampling*

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification*

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

ISO 4788:1980, *Laboratory glassware — Graduated measuring cylinders*

ISO 6614:1994, *Petroleum products — Determination of water separability of petroleum oils and synthetic fluids*

ISO 13357-2:1998, *Petroleum products — Determination of the filterability of lubricating oils — Part 2: Procedure for dry oils*

3 Terms and definitions

For the purposes of this part of ISO 13357, the following terms and definitions apply.

3.1

filterability

dimensionless number which is the ratio, expressed as a percentage, between volumes (Stage I) or flow rates (Stage II) at specified intervals in the test procedure

3.2

Stage I filterability

ratio, expressed as a percentage, between 240 ml and the volume of oil actually filtered in the time that 240 ml would have theoretically taken, assuming no plugging of the membrane

3.3

Stage II filterability

ratio, expressed as a percentage, between the flow rate near the start of the filtration, and the flow rate between 200 ml and 300 ml of filtered volume

4 Principle

The test fluid is treated with water at an elevated temperature, filtered under specified conditions through a membrane of 0,8 μm mean pore diameter, and the times for the specified filtrate volumes are recorded. Filterabilities are calculated from ratios of the filtration rate near the start of filtration to the filtration rate at specified higher filtered volumes. The result of the test is the average of three determined values.

Ideally, the filtration rate should remain constant.

5 Reagents and materials

5.1 Water, conforming to grade 3 of ISO 3696.

5.2 Propan-2-ol (isopropyl alcohol), filtered through a compatible 0,45 μm membrane filter.

NOTE A solvent-filtering dispenser, as shown in Figure 1, is a means of dispensing this solvent, and the wash solvent (5.3).

5.3 Wash solvent, of light aliphatic hydrocarbon, filtered through a compatible 0,45 μm membrane filter (see the note to 5.2). Heptane or 2,2,4-trimethylpentane is suitable.

5.4 Compressed gas, complete with regulator system capable of supplying gas at nominated pressures of between 50 kPa and 200 kPa. The gas (air or nitrogen) shall be dry and filtered.