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Interested committees:

Title: Draft BS ISO 4407 Hydraulic fluid power - Fluid contamination - Determination of particulate contamination by the counting method using an optical microscope.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

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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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 4407

Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using an optical microscope

Transmissions hydrauliques — Pollution des fluides — Détermination de la pollution particulaire par comptage au microscope optique

ICS: 23.100.60

ISO/TC 131/SC 6

Secretariat: **BSI**

Voting begins on:
2024-05-31

Voting terminates on:
2024-08-23

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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).

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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/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 131, Fluid power systems and components, Subcommittee SC 6 Contamination Control.

This fourth edition cancels and replaces the third edition ISO 4407:2021 which has been technically revised.

The main changes are as follows:

- More detailed procedure for automatic particle counting by Image analysing software

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

Fluids are used for a multitude of reasons over an array of industries. Whether they are used for hydraulic power, lubricating or operational fluids, the presence of particulate contamination adversely affects the fluids properties. This reduces the fluids capabilities and performance that can lead to damage of components, equipment and eventual system failure.

The level of contamination in a fluid has a direct impact upon its performance and reliability.

Quantitative determination of particulate contamination requires precision in obtaining a representative sample of the fluid to accurately ascertain the level of contamination. The method of particle counting using an optical microscope is an accepted means of determining the extent of contamination. The accuracy of particle counting can be affected by the different techniques and methods used. The accuracy when using the automatic method described in ISO 4407 is typically in a range of +/- one ISO Code according to ISO 4406.

This document details procedures that are acceptable methods for each step of the process of removing particulate contamination from a fluid for analysis to achieve a uniform method, both manual and automatic, for particle counting. These steps include sample preparation, vacuum filtration, filter membrane preparation and, both manual and automatic counting methods.

Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using an optical microscope

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1 Scope

This document specifies acceptable methods for determining the level of particulate contamination in a known volume of fluid used in power systems by counting the number of particles captured on the surface of a filter membrane using an optical microscope. It includes accepted methods of particle counting utilising image analysis software or manual counting.

The aim of this document is to regulate a uniform, non-subjective filter membrane method of particle counting that will ensure that the classification standard result is achieved by analysing, where feasible, the entire effective filtration area (EFA) of the filter membrane.

The resolution and accuracy of the results will be dependent upon the optical system used, whether image capture analysis software is used, and when opting for the manual counting method, the capabilities of the operator.

All fluids that can be successfully vacuumed through the appropriate pore sized filter membrane will be able to use the following 2 methods of membrane filter analysis:

Automatic counting – Automatic detection, size classification and counting of particles on a membrane filter by using an optical microscope and image analysing software.

Manual counting – Manual detection, size classification and counting of particles on a membrane filter using an optical microscope..

A known volume of sample fluid is vacuum filtered through a membrane filter to capture the particulate contamination onto the surface of the membrane. The captured particles are analysed utilising an optical microscope and, where possible, image analysis software to size, count and tabulate the particles according to the particles longest chord.

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 3722:1976, *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods*

ISO 4406:2021, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 5598:2020, *Fluid power systems and components — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

3.1

blank count

counting resulting from contaminants introduced from other sources, such as reagents, cleaning of glassware and preparation of the membrane filter (See [6.1](#))

3.2

calculation factor

ratio of the EFA to the total area counted

3.3

effective filtration area (EFA)

circular area of the membrane filter open to flow during filtration of liquid

3.4

effective filtration diameter (EFD)

longest chord length of the membrane filter open to flow during filtration of liquid

Note 1 to entry: Both the EFA and the effective filtration diameter (EFD) are determined in [8.2](#).

3.5

measured filtration area (MFA).

The area that the software has analysed .

3.6

fibre

particle longer than 100 µm with a length-to-width ratio greater than or equal to 10:1

3.7

fixative fluid

fluid that, as a result of a heat curing process, causes a membrane filter to adhere to a glass base slide, can generate an opaque residue

3.8

grid square

square with side of nominally 3,1 mm printed on membrane filters

Note 1 to entry: Gridded membrane filters cannot be used in combination with automatic image analysis techniques.

3.9

image analyser

image analysis system with integrated software to automatically size, count and tabulate the particulate contamination captured on membrane filter

Note 1 to entry: A video image of the particle is digitally recreated based upon the difference in the grey scale contrast of the particle and background. The sizing is either automatically determined or manually on the video screen.

3.10

mountant fluid

fluid that when heated, causes a membrane filter, previously treated with fixative liquid, to become transparent and to adhere to the cover slip.

3.11

particle size

size of particle as defined by the particle's maximum feret diameter.