



SLOVENSKI STANDARD SIST ISO 11500:1998

01-december-1998

Hydraulic fluid power -- Determination of particulate contamination by automatic counting using the light extinction principle

Hydraulic fluid power -- Determination of particulate contamination by automatic counting using the light extinction principle

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Transmissions hydrauliques -- Détermination de la pollution particulaire par comptage automatique à absorption de lumière

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Ta slovenski standard je istoveten z: **ISO 11500:1997**

ICS:

23.100.60 Filters, seals and contamination of fluids

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INTERNATIONAL STANDARD

ISO 11500

First edition
1997-09-01

Hydraulic fluid power — Determination of particulate contamination by automatic counting using the light extinction principle

*Transmissions hydrauliques — Détermination de la pollution particulaire
par comptage automatique à absorption de lumière*

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Reference number
ISO 11500:1997(E)

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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.

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.

International Standard ISO 11500 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 6, *Contamination control and hydraulic fluids*.

<https://standards.iteh.ai/catalog/standards/sist/4c2bf0a5-1f3-41b1-a35c-11500-1998>

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X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit. The liquid is both a lubricant and a power-transmitting medium.

The presence of solid contaminant particles in the liquid interferes with the ability of the hydraulic fluid to lubricate and causes wear to the components. The extent of contamination in the fluid has a direct bearing on the performance and reliability of the system, and needs to be controlled to levels which are considered appropriate for the system concerned.

Quantitative determination of particulate contamination requires precision in obtaining the sample and in determining the extent of contamination. The liquid automatic particle counter (APC) which works on the light extinction principle, has become an accepted means of determining the extent of contaminant. The accuracy of particle count data can be affected by the techniques used.

This International Standard details procedures for the analysis of contaminated liquid samples using an automatic particle counter. Use of an automatic particle counter will help to reduce errors and will enhance the accuracy of reproducibility in data.

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Hydraulic fluid power — Determination of particulate contamination by automatic counting using the light extinction principle

1 Scope

1.1 This International Standard specifies a liquid automatic particle counting procedure for determining the particle size distribution and number of particles present in hydraulic fluid bottle samples taken in accordance with an approved procedure. Measurements are generally made with the particles suspended in the original liquid.

1.2 In general, this method of quantitative analysis is suitable for monitoring

- the contamination level in hydraulic systems;
- the progress of a flushing operation;
- support equipment and test rigs;
- packaged stock.

1.3 The use of this technique is only applicable to clear, homogeneous single-phase liquids; the presence of a fluid interface will obstruct the light beam and give false signals.

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2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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

ISO 3938:1986, *Hydraulic fluid power — Contamination analysis — Method for reporting analysis data.*

ISO 4402:1991, *Hydraulic fluid power — Calibration of automatic-count instruments for particles suspended in liquids — Method using classified AC Fine Test Dust contaminant.*

ISO 4406:1987, *Hydraulic fluid power — Fluids — Code for defining the level of contamination by solid particles.*

ISO 4407:1991, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using a microscope.*

ISO 4572:—¹⁾, *Hydraulic fluid power — Filters — Multi-pass method for evaluating filtration performance of a filter element.*

1) To be published. (Revision of ISO 4572:1981)

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 agglomerates: Two or more particles which are in intimate contact and cannot be separated by gentle stirring and the small shear forces thus generated.

3.2 coincidence: Presence of more than one particle in the sensing volume at the same time.

NOTE — Coincidence causes an overcount of larger particles and an undercount of smaller particles. The coincidence limit of the counter (not to be confused with the saturation limit) is the maximum acceptable concentration of all particles larger than the size of the smallest particle detectable by the instrument. This concentration is normally given by the instrument manufacturer with a note indicating the probability of coincidence. Coincidence is reduced by dilution (see 6.7).

3.3 light extinction: Reduction in intensity of a light beam passing through the sensing volume caused by absorption and/or scattering of the light by single particles.

3.4 "noise" level (of the instrument): Minimum voltage setting of the detection circuit below which spurious signals of electrical noise become significant and are counted as particles.

3.5 saturation level: Saturation of the electronic circuitry when it ceases to function correctly due to an excessive particle concentration.

NOTE — Saturation may also arise when analysing samples containing a very large number of particles whose size is smaller than the minimum size detected by the instrument. Most particle distributions cause a coincidence problem before the instrument experiences saturation.

3.6 sensing volume: Illuminated volume through which particles pass and are detected.

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4 Apparatus

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4.1 Liquid automatic particle counter (APC), based on the light extinction principle, consisting of an instrument to size and record the electrical signals generated by the passage of single particles through a sensor suitable for counting within the specified range. The particle counter shall include an automatic bottle sampling apparatus or a similar means of allowing for the passage of liquid directly to the sensor and then into a measuring vessel, without altering the contaminant distribution.

If gas is used to force the liquid through the sensor, the gas shall be filtered through a 0,45 µm filter and shall be free from oil and water.

4.2 Electronic balance, calibrated, with a resolution of 0,1 mg.

4.3 Volumetric glassware, consisting of a range of graduated dosing pipettes and graduated cylinders conforming to an appropriate standard. All glassware used shall be cleaned and verified in accordance with ISO 3722.

4.4 Optical microscope, to check the suitability of the sample for particle counting using the automatic particle counter. A binocular microscope comprising:

- a magnification of up to × 200,
- a mechanical x — y stage,
- a calibrated eye-piece graticule,
- an internal incident or oblique lighting source,

is considered appropriate.

4.5 Sampling agitating device, suitable for redispersing the contaminant in the liquid sample. The device, such as a laboratory bottle roller or paint shaker, shall not alter the basic size distribution of the contaminant.

4.6 Ultrasonic bath, rated at 4 000 W/m² of the base area has been shown to be an acceptable means of both dispersing agglomerated particles within the liquid, and removing air introduced by manual agitation. However, experience has shown that particles can be liberated from the container, particularly if the period of immersion in the bath is prolonged (> 30 s). This can affect the validity of the results obtained from the analysis of clean samples, typically ISO 4406 code 16/14 and below.

4.7 Sample containers

The containers are normally cylindrical glass or polypropylene bottles, fitted with either a suitable non-shedding threaded cap forming a seal with the bottle without the use of an insert, or a cap with a suitable internal seal. The dimensions of the bottle will depend upon the type of sample bottle facility in use with the counter, but should normally be 250 ml capacity. The bottle should be flat-bottomed and wide-necked to facilitate cleaning.

The sample containers shall be cleaned and verified in accordance with ISO 3722.

4.8 Solvent dispensers, fitted with a 0,45 µm membrane filter directly at the outlet.

4.9 Vacuum filtration apparatus, suitable for filtering the various liquids used in the procedure. Filtering is generally through a 0,45 µm membrane filter, which shall be compatible with the liquids used.

5 Materials

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5.1 The following materials are required for cleaning glassware:

- a) a supply of distilled or deionised water; [SIST ISO 11500:1998](https://standards.itih.ai/catalog/standards/sist/4c2bf0a5-1fb3-41b1-a35c-e3ccbfa4fb5f/sist-iso-11500-1998)
- b) a liquid detergent which is water soluble, <https://standards.itih.ai/catalog/standards/sist/4c2bf0a5-1fb3-41b1-a35c-e3ccbfa4fb5f/sist-iso-11500-1998>
- c) propan-2-ol, reagent grade, 0,45 µm filtered;
- d) petroleum spirit (boiling point between 100°C and 120°C) or a suitable solvent with similar degreasing properties, 0,45 µm filtered.

5.2 Standardized test dust

Calibrated in accordance with ISO 4402.

5.3 Diluent liquid

A suitable liquid for diluting the sample shall be filtered through a 0,8 µm membrane filter or a suitable cartridge filter having an ISO 4572 multi-pass rating of $\beta_1 \geq 75$. The diluent liquid shall be compatible with both the sample liquid and the apparatus used.

It is recommended that the refractive index of the diluent liquid should not differ from that of the sample liquid by more than 10 %. An ISO VG5 base mineral oil, as defined in ISO 3448, is considered appropriate for oil samples.

The cleanliness level of the diluent liquid shall be checked before use. A level of less than 2 particles greater than 2 µm and less than 0,5 particles greater than 5 µm per millilitre of liquid is required.