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Hydraulic fluid power – Monitoring the level of particulate contamination – Comparison membrane technique

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 October 2010. It was prepared by Technical Committee MCE/18, *Fluid power systems and components*. A list of organizations represented on this committee can be obtained on request to its secretary.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

0 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 power-transmitting medium. The presence of solid particulate contamination in the liquid interferes with its ability to lubricate and causes wear to the components. The extent of contamination in the liquid has a direct bearing on the performance and reliability of the system and has to be controlled to a level appropriate for the system concerned. The level of particulate contamination is usually determined by extracting a liquid sample from the hydraulic system and analyzing it for the number of particles at various sizes, often in a laboratory.

Particle count analysis requires precision to both obtain a representative sample of the liquid and to analyse the sample. ISO standards have been developed to limit the errors in the various processes. The result of particle count analysis is usually converted into broad contamination classes, such as the BS ISO 4406 system, to simplify the communication and reporting of this data. The interval between individual codes is usually a doubling or a halving of the numbers of particles. The user can then compare this broad level with that which is either usual for the system or is specified (required cleanliness level or RCL). The user of the data has an immediate and simple view of how clean or dirty the sample is and whether any corrective actions are necessary if it is dirtier than the RCL. Thus, for samples that are much dirtier or cleaner than the RCL, quantitative evaluation of the contaminant might not be required. For such samples an assessment of the general level of contamination might suffice, and this can offer significant savings in the period between taking the sample and obtaining the result.

1 Scope

This British Standard specifies methods to assess the level of particulate contamination in hydraulic liquids using an optical microscope. It includes assessment by two manual methods using either transmitted- or incident-lighting systems. It also includes procedures for evaluating and controlling the accuracy of the technique that ensure reproducible results.

This method is applicable to nearly all hydraulic liquids at a wide range of contamination levels, provided the samples can be filtered. However, the procedure requires modification for samples that are either heavily contaminated (e.g. > ISO -/20/17 according to BS ISO 4406) or lightly contaminated (< ISO -/12/10 according to BS ISO 4406), by decreasing or increasing the volume of sample filtered.

This procedure is not applicable to samples that have high concentrations of small (< 3 µm) particles (so called "silt"), gels or where overlapping particles are present on the membrane filter.

The method detailed is a qualitative assessment only, not a quantitative evaluation, and it is applicable to all samples where the data has to be expressed in terms of contaminant codes.

This procedure does not cover procedures for the extraction of fluid samples from systems or bulk containers.

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.

BS 5540-3, *Evaluating particulate contamination of hydraulic fluids – Part 3: Method of bottling fluid samples*

BS EN ISO 4788, *Laboratory glassware – Graduated measuring cylinders*

BS ISO 4406, *Hydraulic fluid power – Fluids – Method for coding the level of contamination by solid particles*

BS ISO 4407, *Hydraulic fluid power – Fluid contamination – Determination of particulate contamination by the counting method using an optical microscope*

BS ISO 5598, *Fluid power systems and components – Vocabulary*

BS ISO 11500, *Hydraulic fluid power – Determination of the particulate contamination level of a liquid sample by automatic particle counting using the light-extinction principle*

3 Terms and definitions

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

3.1 blank analysis

determination of the extent of contamination introduced during the analysis stage from other sources, such as reagents, incomplete cleaning of glassware and preparation of the membrane filter

NOTE For this determination, a membrane filter is prepared using filtered solvent and is either counted in accordance with BS ISO 4407, or assessed using this standard.

3.2 effective filtration area (EFA)

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

NOTE BS ISO 4407 describes a procedure for determining the effective filtration area.

3.3 fixative liquid

liquid that, as a result of a heat curing process, causes a membrane filter to adhere to the base glass slide, resulting in an opaque membrane filter. (See BS ISO 4407).

NOTE This is only used if a permanent slide is required.

3.4 field monitor

membrane filter pre-packed into a protective case for insertion into sampling equipment used to take samples from pressurized lines

3.5 gel

shapeless material that lacks definition and interferes with the measuring process by coating or by masking particles

NOTE A gel is usually formed by chemical reaction with the hydraulic or other liquids.