

Evaluating particulate contamination of hydraulic fluids —

Part 6: Method of calibrating liquid automatic particle-count instruments (using mono-sized latex spheres)

Confirmed
February 2011

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Machinery and Components Standards Policy Committee (MCE/-) to Technical Committee MCE/18, upon which the following bodies were represented:

- Advanced Manufacturing Technology Research Institute
- Association of British Mining Equipment Companies
- Bath University Library
- British Compressed Air Society
- British Fluid Power Association
- British Steel Industry
- Department of Trade and Industry (National Engineering Laboratory)
- Institution of Mechanical Engineers
- Ministry of Defence

The following bodies were also represented in the drafting of the standard, through subcommittees and panels:

- British Hydromechanics Research Association
- British Railways Board
- Society of Motor Manufacturers and Traders Ltd.

This British Standard, having been prepared under the direction of the Machinery and Components Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 December 1990

© BSI 07-1999

The following BSI references relate to the work on this standard:
Committee reference MCE/18
Draft for comment 88/72515 DC

ISBN 0 580 19178 8

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
0 Introduction	1
1 Scope	1
2 Definitions	1
3 Apparatus	2
4 Materials	2
5 Preliminary procedures	3
6 Calibration procedures	4
Figure 1 — Typical example of percentage distribution curve for 38.8 μm spheres	7
Publication(s) referred to	Inside back cover

Foreword

This Part of BS 5540 has been prepared under the direction of the Machinery and Components Standards Policy Committee and is one of a series relating to the evaluation of particulate contamination in hydraulic fluids.

This Part of BS 5540 describes a method of calibrating liquid automatic particle counters working on the light obscuration principle, using mono-sized latex spheres.

Other Parts in the series are as follows.

- *Part 1: Qualifying and controlling of cleaning methods for sample containers;*
- *Part 2: Method of calibrating liquid automatic particle-count instruments (using AC Fine Test Dust contaminant);*
- *Part 3: Methods of bottling fluid samples;*
- *Part 4: Method of defining levels of contamination (solid contamination code);*
- *Part 5: Method of reporting contamination analysis data.*

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

0 Introduction

In hydraulic fluid power applications 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 contamination particles in the liquid interferes with the ability of the fluid to lubricate and causes wear to the hydraulic 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 levels that are considered appropriate for the system.

Quantitative determination of particulate contamination requires precision in obtaining the sample and determining the extent of contamination. The liquid automatic particle counter working on the light obscuration principle has become an accepted means of determining the extent of contamination.

The accuracy of repeatability and reproducibility of particle count data is affected by both the procedures used and the method of calibration.

1 Scope

This Part of BS 5540 describes a method for the calibration of liquid automatic particle counters (APCs) working on the light obscuration principle. It establishes a uniform and precise method of calibrating these instruments which will enhance the degree of reproducibility of particle count data between laboratories.

The calibration material used is mono-sized latex spheres whose size can be verified by a number of different methods. The particle size parameter reported is the equivalent optical diameter based upon the projected area of a spherical particle.

The method described first confirms the maximum concentration limits of the instrument being calibrated, verifies the particle size distribution of the latex spheres and, finally, enables the instrument to be calibrated in an accurate and precise manner.

The calibration curve of an APC is the reference that relates the particle size to the electrical threshold settings of the instrument. The development of the calibration curve is of primary importance in establishing the accurate sizing of particles being counted. A procedure is described that enables the voltage threshold value for any particle size within the sizing range of the sensor to be obtained.

This method is intended for application to any APC working on the light obscuration principle in which particles interrupt the passage of light from a source to a detector. It assumes that the counter is equipped with at least two channels with adjustable voltage thresholds.

Although this Part of BS 5540 is intended for fluid power applications, it may also be applicable to other fields where this method of calibration is considered appropriate.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 5540 the following definitions apply.

2.1

agglomerate

two or more particles that are in intimate contact and can not be separated by the small shear forces generated by gentle stirring

2.2

channel

a particle size range as set into the liquid automatic particle counter

2.3

coincidence

the presence of more than one particle within the sensing volume at the same time

2.4

dynamic sizing range

the diameter of the smallest particle detected compared to the diameter of the largest particle passing through the sensor

NOTE This is usually quoted by the instrument manufacturer.

2.5

equivalent optical diameter

the diameter reported by the counting/sizing device in use. It is the diameter of a sphere giving the same optical response as the particle

2.6

light obscuration

the reduction of intensity of a light beam through the sensing volume caused by adsorption and/or scattering of the light by a single particle

2.7

minimum particle size

the diameter of the smallest latex sphere used in the calibration procedure that is also within the size range that can be resolved by the counter