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Diesel fuel and petrol filters for internal combustion engines — Filtration efficiency using particle counting and contaminant retention capacity

Filtres à carburant, essence ou diesel, pour moteurs à combustion interne — Efficacité de filtration par comptage des particules et capacité de rétention

Reference number
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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 22, *Road vehicles*, Subcommittee SC 34, *Propulsion, powertrain and powertrain fluids*.

This second edition cancels and replaces the first edition (ISO 19438:2003), which has been technically revised.

The main changes are as follows:

— revised validation procedure;

— added requirement to measure final test system conductivity;

— revised test report to include initial and final test system conductivity;

— Replaced Annex D “Summary of the International interlaboratory trial (round robin) to validate ISO 19438 protocol” with “Effect of dust cake filtration on filter capacity”.

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.

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Introduction

This document establishes a standard test procedure for measuring the filtration efficiency, retention capacities and resistance to flow of fuel filters. This test is intended to differentiate filters according to their functional performance but is not intended to represent performance under actual field operating conditions. Test conditions are steady-state and the dynamic characteristics of the fuel systems are not represented. Other test protocols are in development to evaluate performance under cyclic flow and vibration.

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Diesel fuel and petrol filters for internal combustion engines — Filtration efficiency using particle counting and contaminant retention capacity

1 Scope

This document specifies a multi-pass filtration test, with continuous contaminant injection and using the on line particle counting method, to evaluate the performance of diesel fuel and petrol filters for internal combustion engines submitted to a constant flow rate of test liquid. The test procedure determines the contaminant capacity of a filter, its particulate removal characteristics and differential pressure. This document is applicable to filter elements having a rated flow between 50 l/h and 800 l/h; however, by agreement between the filter manufacturer and customer, and with some modifications, the procedure is permitted for application to fuel filters with higher flow rates.

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 2942, *Hydraulic fluid power — Filter elements — Verification of fabrication integrity and determination of the first bubble point*

ISO 3968, *Hydraulic fluid power — Filters — Evaluation of differential pressure versus flow*

ISO 4021, *Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system*

ISO 4405, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the gravimetric method*

ISO 11171, *Hydraulic fluid power — Calibration of automatic particle counters for liquids*

ISO 11841-1, *Road vehicles and internal combustion engines — Filter vocabulary — Part 1: Definitions of filters and filter components*

ISO 11841-2, *Road vehicles and internal combustion engines — Filter vocabulary — Part 2: Definitions of characteristics of filters and their components*

ISO 11943:2021, *Hydraulic fluid power — Online automatic particle-counting systems for liquids — Methods of calibration and validation*

ISO 12103-1, *Road vehicles — Test contaminants for filter evaluation — Part 1: Arizona test dust*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11841-1, ISO 11841-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1
multi-pass test
test which requires the recirculation of filtered fluid through the filter element

3.2
base upstream gravimetric level
upstream contaminant concentration if no contaminant is recirculated

3.3
filtration efficiency
ability of the filter to retain particles

Note 1 to entry: It is expressed as the percentage of particles of a given size retained by the filter under test.

3.4
overall efficiency
efficiency calculated from the average upstream and downstream particle counts obtained during the entire test

3.5
filter rating
particle size corresponding to an *initial efficiency* (3.7) or cumulative *overall efficiency* (3.4) of a given percentage

Note 1 to entry: It is expressed in micrometres(c) [µm(c)], which signifies throughout this document that a particle size measurement is carried out using an automatic particle counter calibrated in accordance with ISO 11171.

3.6
filter reference rating
filter rating (3.5) at 99 % efficiency

Note 1 to entry: It is expressed in micrometres(c) [µm(c)], which signifies throughout this document that a particle size measurement is carried out using an automatic particle counter calibrated in accordance with ISO 11171.

3.7
initial efficiency
efficiency at first data points calculated from 4 min, 5 min and 6 min particle counts

4 Symbols

Graphical symbols used in this document for fluid power system components are in accordance with ISO 1219-1.

5 Test apparatus and materials

5.1 Test apparatus

5.1.1 Test rig

The test rig, shown diagrammatically in Figure 1 (to which the numbers in parentheses throughout this document refer), shall comprise the following.

5.1.1.1 Filter test circuit, including the components specified in 5.1.1.1.1 to 5.1.1.1.7.

5.1.1.1.1 Reservoir (1), constructed with a conical bottom having an included angle of not more than 90° and where the oil entering is diffused below the fluid surface.

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