

Full-flow lubricating oil filters for internal combustion engines —

Part 11: Methods of test for self-cleaning filters

ICS 21.260

National foreword

This British Standard reproduces verbatim ISO 4548-11:1997 and implements it as the UK national standard.

The UK participation in its preparation was entrusted by Technical Committee MCE/21, Filters for gases and liquids, to Subcommittee MCE/21/5, Filters for lubricating oil, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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, the ISO title page, page ii, pages 1 to 16, 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.

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 February 1998

© BSI 04-1999

ISBN 0 580 29469 2

Amendments issued since publication

Amd. No.	Date	Comments

Contents

	Page
National Foreword	Inside front cover
Foreword	ii
1 Scope	1
2 Normative references	1
3 Definitions	1
4 Graphical symbols	2
5 Test method for absolute rating (maximum particle diameter transmitted)	2
5.1 Principle	2
5.2 Test equipment and materials	2
5.3 Test procedure	4
5.4 Test results	4
6 Test method for pressure differential/flow characteristics	4
6.1 Principle	4
6.2 Test equipment and materials	4
6.3 Test procedure	6
6.4 Test results	6
7 Test methods for evaluation of gravimetric efficiency and self-cleaning ability of the complete filter	6
7.1 Principle	6
7.2 Test equipment and materials	6
7.3 Test procedure for continuous self-cleaning filters	6
7.4 Test procedure for intermittent self-cleaning filters	9
7.5 Test results	9
8 Test for resistance of the filtering element to high differential pressure	10
8.1 Principle	10
8.2 Test equipment and materials	10
8.3 Test procedure	10
8.4 Test results	10
9 Test for resistance of the filtering element to elevated temperature	10
9.1 Principle	10
9.2 Test equipment and materials	10
9.3 Test procedure	10
9.4 Test results	10
10 Test for the effects of the presence of water	10
10.1 Principle	10
10.2 Test equipment and materials	12
10.3 Test procedure	12
10.4 Test results	12
11 Test for mechanical stability to alternating direction of flow	12
11.1 Principle	12
11.2 Test equipment and materials	12
11.3 Test procedure	12
11.4 Test results	14
11.5 Acceptance criteria	14

	Page
Annex A (informative) Examples of graphs of differential pressure versus time	15
Annex B (informative) Bibliography	Inside back cover
Figure 1 — Test rig for measurement of maximum particle diameter transmitted	3
Figure 2 — Test rig for evaluation of differential pressure as a function of fluid flow rate and viscosity	5
Figure 3 — Test rig for evaluation of gravimetric efficiency and cleaning ability	7
Figure 4 — Test rig for evaluation of filtering element resistance to elevated temperature	11
Figure 5 — Test rig for mechanical stability to alternating direction of flow	13
Figure 6 — Cycles for endurance test	14
Figure A.1 — Main test	15
Figure A.2 — Additional tests (5 blocking and cleaning cycles)	15
Figure A.3 — Filtration and cleaning tests	16
Table 1 — Particle size distribution of glass microspheres	2
Table 2 — Accuracy of measuring instruments	2

Descriptors: Internal combustion engines, lubrication systems, oil filters, tests, performance tests, test equipment.

INTERNATIONAL STANDARD

ISO
4548-11

First edition
1997-09-15

Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 11: Self-cleaning filters

*Méthodes d'essai des filtres à huile de lubrification à passage intégral pour
moteurs à combustion interne —*

Partie 11: Filtres à nettoyage automatique



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 4548-11 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*, Subcommittee SC 7, *Tests for lubricating oil filters*.

ISO 4548 consists of the following parts, under the general title *Methods of test for full-flow lubricating oil filters for internal combustion engines*:

- *Part 1: Differential pressure/flow characteristics;*
- *Part 2: Element by-pass valve characteristics;*
- *Part 3: Resistance to high differential pressure and to elevated temperature;*
- *Part 4: Initial particle retention efficiency, life and cumulative efficiency (gravimetric method);*
- *Part 5: Cold start simulation and hydraulic pulse durability test;*
- *Part 6: Static burst pressure test;*
- *Part 7: Vibration fatigue test;*
- *Part 9: Inlet and outlet anti-drain valve tests;*
- *Part 10: Life and cumulative efficiency in the presence of water in oil;*
- *Part 11: Self-cleaning filters;*
- *Part 12: Particle retention ability and contaminant holding capacity using particle counting.*

Annex A and Annex B of this part of ISO 4548 are for information only.

Introduction

ISO 4548 establishes standard test procedures for measuring the performance of full-flow lubricating oil filters for internal combustion engines. It has been prepared in separate parts, each part relating to a particular performance characteristic.

Together the tests provide the information necessary to assess the characteristics of a filter, but if agreed between the purchaser and the manufacturer, the tests may be conducted separately.

1 Scope

This part of ISO 4548 specifies test methods for evaluating the characteristics of self-cleaning oil filters for internal combustion engines. It is applicable to filters in which self-cleaning is continuous or intermittent.

The removal of retained particles from the filter is achieved by periodic reversal of the direction of the fluid flow through the elements. However, this also applies mechanical stresses to the filter media. The tests specified in this standard are designed to check the filtration performance of the elements under simulated operating conditions and to confirm their ability to withstand, without damage, variations in oil pressure, temperature, direction of flow and the presence of water.

The equipment and procedures specified in this part of ISO 4548 are recommended for filters having a nominal flow rate of up to 1 600 l/min.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 4548. At the time of publication, the editions indicated were valid. All standards, are subject to revision, and parties to agreements based on this part of ISO 4548 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 1219-1:1991, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols.*

ISO 2942:1994, *Hydraulic fluid power — Filter elements — Determination of fabrication integrity and determination of the first bubble point.*

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

ISO 4405:1991, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the gravimetric method.*

ISO 4548-1:—¹⁾, *Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 1: Pressure drop/flow characteristics.*

ISO 11841-1:—²⁾, *Road vehicles and internal combustion engines — Filter vocabulary — Part 1: Definitions of filters and filter components.*

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

ISO 12103-1:—²⁾, *Road vehicles — Test dust for filter evaluation — Part 1: Arizona test dust.*

3 Definitions

For the purposes of this part of ISO 4548, the definitions given in ISO 11841-1 and ISO 11841-2, together with the following definitions apply.

3.1 continuous self-cleaning filter

filter in which the process of cleaning the filtering elements operates permanently, irrespective of the operating conditions of the filter and the degree of blockage of the filtering medium

3.2 intermittent self-cleaning filter

filter in which the process of cleaning the filtering elements operates only when one of the characteristic operating parameters of the filter (time, pressure drop) reaches a predetermined value

3.3 retention capacity

mass of specific contaminant that the filtering element can retain at its nominal flow rate before its differential pressure reaches a specified value, such as the value that initiates self-cleaning

3.4 filtration efficiency

ability of the filter to retain particles contained in the fluid to be filtered

¹⁾ To be published. (Revision of ISO 4548-1:1982)

²⁾ To be published.

3.5 absolute rating

diameter, expressed in micrometres, of the largest non-deformable spherical particle capable of passing through the filtering element under predetermined test conditions

3.6 pressure

gauge pressure

4 Graphical symbols

The graphical symbols used in this part of ISO 4548 are in accordance with ISO 1219-1.

5 Test method for absolute rating (maximum particle diameter transmitted)

5.1 Principle

The test on the filtering element consists of filtering a suspension of calibrated glass microspheres at the nominal flow rate of the filtering element to be tested. A microscopic observation of all the spheres that have passed through the filtering element then allows measurement of the diameter of the largest sphere passing through.

The test gives an indication of the size of the largest pore of the filtering medium employed.

NOTE The test applies only to the filtering element and not to the complete filter. However a test on the complete filter may be carried out by mutual agreement between the purchaser and the supplier.

5.2 Test equipment and materials

5.2.1 Test fluid

In the absence of any contrary agreement between the supplier and the purchaser of the filter, the oil for the test is to be a pure mineral oil with a kinematic viscosity as ISO VG 15 (see [1]), used at ambient temperature.

5.2.2 Contaminant

The measurement of the maximum size of particle transmitted shall be carried out with glass microspheres with the particle size distribution given in Table 1.

Table 1 — Particle size distribution of glass microspheres

Diameter μm	Mass %
< 20	5 ± 3
≥ 20 to < 40	10 ± 3
≥ 40 to < 60	20 ± 3
≥ 60 to < 100	30 ± 5
≥ 100 to < 200	35 ± 5

5.2.3 Measuring instruments

The measuring instruments shall be capable of measuring to the levels of accuracy given in Table 2.

Table 2 — Accuracy of measuring instruments

Measurement	Accuracy %
Test flow rate	± 5
Relative pressure	± 2
Differential pressure	± 4
Temperature	± 1

5.2.4 Test rig

The test rig is shown diagrammatically in Figure 1. It shall include the components described in 5.2.4.1 to 5.2.4.3.

5.2.4.1 Pressure regulator 1: capable of regulating the pressure maintained in the tank **6** to guarantee a flow of the fluid in the filter under test **10** at its nominal flow rate. Tests shall be conducted to determine the oil flow rate/air pressure curve.

5.2.4.2 Centrifugal pump 13: capable of providing a turbulent flow of $Re \geq 3\,000$ in the pipelines.

5.2.4.3 Purification filter 15: capable of maintaining a level of particulate contamination of the circuit less than or equal to 2 mg/l, in accordance to ISO 4405.