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BSI Standards Publication

Methods of test for full-flow lubricating oil filters for internal combustion engines

Part 14: Cold start simulation and hydraulic pulse durability for composite filter housings

National foreword

This British Standard is the UK implementation of ISO 4548-14:2016.

The UK participation in its preparation was entrusted to Technical Committee MCE/21/6, Filters for volatile liquid fuels and lubricating oils.

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

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Methods of test for full-flow lubricating oil filters for internal combustion engines —

Part 14: Cold start simulation and hydraulic pulse durability for composite filter housings

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

Partie 14: Essais de simulation de démarrage à froid et de résistance aux impulsions hydrauliques pour les corps de filtre pressurisés à base de matériaux composites

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Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
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Foreword

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The committee responsible for this document is 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: Test for cold start simulation and hydraulic pulse durability*

— *Part 6: Static burst pressure test*

— *Part 7: Vibration fatigue test*

— *Part 9: Inlet and outlet anti-drain valve tests*

— *Part 12: Filtration efficiency using particle counting, and contaminant retention capacity*

— *Part 13: Static burst pressure test for composite filter housings*

— *Part 14: Cold start simulation and hydraulic pulse durability for composite filter housings*

— *Part 15: Vibration fatigue test for composite filter housings*

Introduction

This part of ISO 4548 establishes standard test procedures for measuring the performance of full-flow lubricating oil filter modules made of composite materials for internal combustion engines in tests of cold start simulation and hydraulic pulse durability.

INTERNATIONAL STANDARD ISO 4548-14:2016(E)

Methods of test for full-flow lubricating oil filters for internal combustion engines —

Part 14:
Cold start simulation and hydraulic pulse durability for composite filter housings

1 Scope

This part of ISO 4548 specifies a method of testing the ability of full-flow lubricating oil filters manufactured with composite pressure vessel materials for internal combustion engines to withstand an internal pressure surge and cyclic internal pressure variations experienced in the application at specified operating temperatures.

These tests are intended for application to spin-on type filters and detachable filters with disposable elements constructed of composite materials.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1219-1, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 1: Graphical symbols for conventional use and data-processing applications*

ISO 4548-1, *Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 1: Differential pressure/flow characteristics*

3 Terms, definitions, and graphical symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4548-1 apply.

3.2 Graphical symbols

For the purposes of this document, the graphical symbols given in ISO 1219-1 apply.

4 Operational characteristics to be tested

Filters are subjected to a wide range of temperature and pressure fluctuations in service. The tests specified in Clause 9 verify the ability of the filter canister and seal to withstand these high pressure fluctuations for a given number of start conditions or cyclic pressure variations. These tests can be performed over a range of test temperatures.

5 Test equipment

The test equipment and circuit shall be able to generate and repeat the pressure cycle (see Figure 1) at the specified test temperature.

6 Test liquid

The test liquid shall be either the same as the system operating fluid or another compatible fluid agreed between the supplier and purchaser. The liquid shall be able to operate in test temperature specified in Clause 7.

7 Test temperature

In the absence of an engine manufacturer's specification or customer/supplier agreement; test temperature extremes of -20 °C and 130 °C.

8 Accuracy

Instrumentation shall be accurate to within the following limits:

— pressure: ±1,0 % of the upper cyclic test pressure;

— time: ±0,002 s resolution;

— temperature: ±2°C.

Use pressure transducers, amplifiers, and recording devices with a combined system frequency response, such that in the frequency range 0 kHz to 2 kHz, the amplitude ratio is within 0 dB to -3 dB.

Pressure transducer(s) shall be mounted directly into the test component, or as nearly as possible, so as to record the internal conditions applied to the component. Any restrictions between the transducers and the pressure-containing envelope being tested should be avoided.

Instruments and procedure should conform to ISO 9110-1 and ISO 9110-2.

9 Cold start simulation and hydraulic pulse durability test

Fit the filter on an appropriate adaptor and apply the filter manufacturer's recommended tightening torque or angle of rotation for the filter to be tested.

Connect the test adapter to the pipe work system of the test rig.

Start the test system, and allow the rig to run until all air has been purged from the system.

Precondition test assembly at the specified test temperature for 4 h.

Increase system pressure until the pressure agreed with the engine manufacturer is obtained. In the absence of such an agreement, one of the values given in Annex A shall be used.

Initiate cyclic test at system pressure meeting waveform specified in Figure 1. Without specific requirement transmitted by the customer, the cycle rate shall be in the range of 0,5 cycles to 2 cycles per second.

Allow the test to continue, making visual checks for signs of failure at frequent intervals, until failure occurs or until the number of cycles agreed with the engine manufacturer has been applied. In the absence of such an agreement, the value given in Annex A for the test pressure chosen shall be used.

Stop the test. Check and record the tightening torque.

Remove the filter. Allow to drain and visually examine the unit to determine the failure point and type of failure, if any.

10 Test report

The test report shall include at least the following information:

a) the name of the test establishment;

b) the filter type (manufacturer, model number, and batch number);

c) the date of the test;

d) a description of the filter and whether it is new or used; if it is used, the approximate period of service;

e) the category of filter (see Annex A);

f) the rated flow, in litres per minute;

g) the test pressure in kPa;

h) the test fluid;

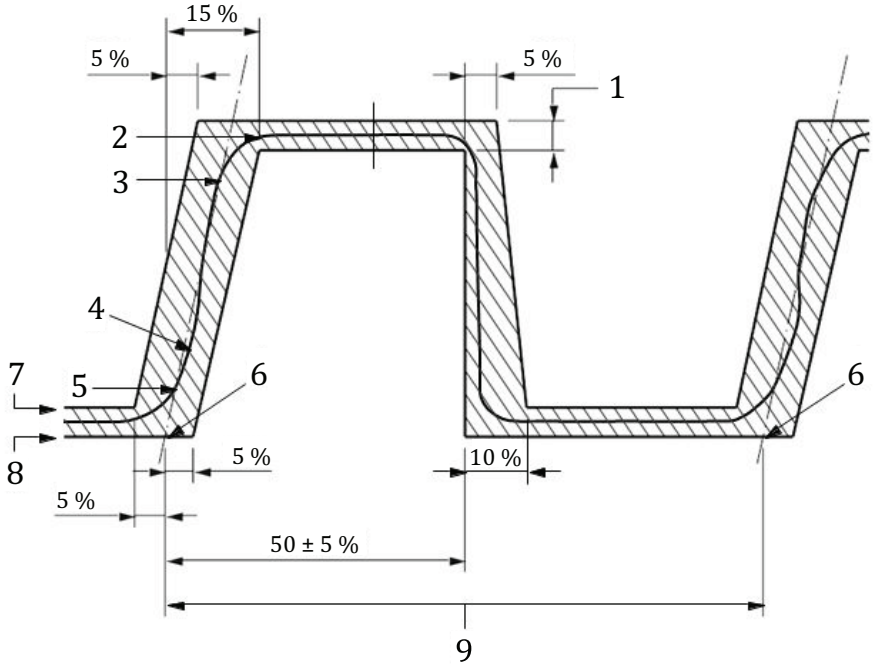
i) the test temperature;

j) the mode of failure and its location;

k) the torque applied initially and at the end of the test, in Newton metres;

l) the number of cycles to failure or the number of cycles completed;

m) the test cycle rate.



Key

1 test pressure ±5 %
2 cyclic test pressure
3 85 % test pressure
4 secant pressure rise
5 15 % cyclic test pressure
6 point “0” — the intersection of the secant pressure rise with zero pressure
7 5 % (CTP)
8 0 kPa (0 psi)
9 one impulse cycle

Figure 1 — Diagrammatic pressure pulse waveform for the cold start simulation test and for the hydraulic pulse durability test

Annex A
(normative)

Values to be used for tests if no agreement is reached with the manufacturer

Table A.1 gives the pressure and number of cycles to be used in the cold start simulation test and the hydraulic pulse durability test for the chosen category of filter.

Table A.1 — Pressure and number of cycles to be used for tests

Filter type	Category	Cold start simulation test		Hydraulic pulse durability test	
		Pressure kPa	Number of cycles	Pressure kPa	Number of cycles
Spin-on (light duty)	A	1 000 ± 30	1 000	500 ± 20	25 000
Spin-on (heavy duty)	B	1 300 ± 30	3 000	700 ± 20	50 000
Detachable with disposable element	C	1 600 ± 50	5 000	900 ± 30	75 000

Bibliography

[1] ISO 3448, *Industrial liquid lubricants — ISO viscosity classification*

[2] ISO 4548-5, *Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 5: Test for cold start simulation and hydraulic pulse durability*

[3] ISO 9110-1, *Hydraulic fluid power — Measurement techniques — Part 1: General measurement principles*

[4] ISO 9110-2, *Hydraulic fluid power — Measurement techniques — Part 2: Measurement of average steady-state pressure in a closed conduit*

[5] ISO 10771-1, *Hydraulic fluid power — Fatigue pressure testing of metal pressure-containing envelopes — Part 1: Test method*

[6] SAE J300c, *Engine oil viscosity classification*

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