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

Part 14:  
**Hydraulic pulse durability for  
composite filter housings**

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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/iso/foreword.html).

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

This second edition cancels and replaces the first edition (ISO 4548-14:2016), which has been technically revised.

The main changes are as follows:

- the title of this document has been updated, removing "cold start simulation";
- the test system schematic has been added;
- the test system setup has been defined in more detail;
- the statistical evaluation in testing with multiple samples has been added.

A list of all parts in the ISO 4548 series can be found on the ISO website.

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](http://www.iso.org/members.html).

## Introduction

This document establishes standard test procedures for measuring the performance of full-flow lubricating oil filter modules made of composite or temperature-sensitive materials for internal combustion engines. The ISO 4548 series 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 can be conducted separately.

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

## Part 14: Hydraulic pulse durability for composite filter housings

### 1 Scope

This document specifies the hydraulic pulse durability test for composite filter housings. This method tests 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 or temperature-sensitive materials.

### 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 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 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/>

#### 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 caused by either cold starting conditions or hydraulic pulse events during normal operation. The test specified in [Clause 9](#) can be performed at a range of temperatures and pressures on separate filters to simulate in-service conditions and verify the capability of the filter canister and seal to withstand these conditions.

## 5 Test equipment

[Figure 1](#) shows an example of a typical test circuit. An alternative test rig, which produces the pressure pulse waveforms shown in [Figure 2](#), may also be used.

## 6 Test liquid

The test oil shall be functional between  $-20\text{ °C}$  and  $130\text{ °C}$  (or the temperature range agreed upon by the manufacturer and the purchaser) to avoid inflammation or gelling. The viscosity of the oil shall be between  $5\text{ mm}^2/\text{sec}$  and  $10,000\text{ mm}^2/\text{sec}$  in the temperature range.

## 7 Test temperature

In the absence of an engine manufacturer's specification or customer-supplier agreement, test temperatures shall be between  $-20\text{ °C}$  and  $130\text{ °C}$ .

## 8 Accuracy

**8.1** The measuring instruments shall be capable of measuring to the levels of accuracy given in [Table 1](#). The last column in the table gives the limits within which the test conditions shall be maintained.

**Table 1 — Instrument accuracy and test condition variation**

Test condition	Unit	Measurement accuracy	Permissible test condition variation
Pressure	kPa	$\pm 5\%$	—
Time	s	$\pm 0,002\text{ s}$	—
Temperature	$^{\circ}\text{C}$	$\pm 1\text{ }^{\circ}\text{C}$	$\pm 2\text{ }^{\circ}\text{C}$

**8.2** 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  $-3\text{ dB}$ .

**8.3** 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.

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

## 9 Hydraulic pulse durability test

**9.1** 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. When multiple samples are tested to obtain statistically meaningful data, the mean and standard deviation should be calculated and reported. Additionally, the B10 value by Weibull analysis can be calculated and reported when tested with more than seven samples.

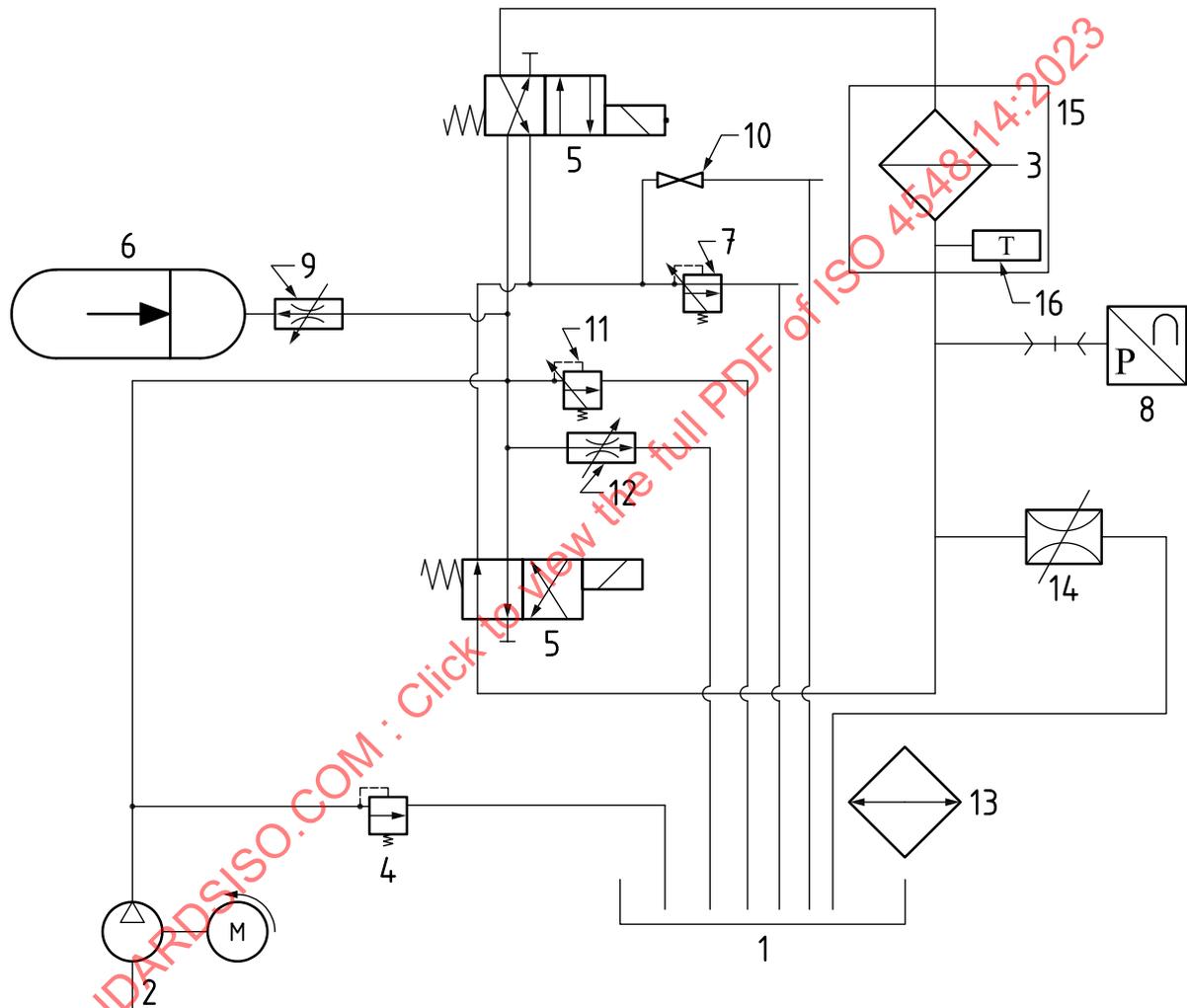
NOTE Weibull analysis and the B10 value are described in ISO 19973-1.

Precondition test assembly at test temperature for a minimum of 4 hours.

Shorter preconditioning time may be used if shown not to affect test results.

**9.2** Referring to [Figure 1](#), adjust the charge in the accumulator (key reference 6) to approximately 50 % of the maximum test pressure agreed with the customer. In the absence of such an agreement, one

of the values given in [Annex A](#) may be used. Set the system pressure relief valve (key reference 4) to at least 110 % of the test pressure. Open the inlet pressure valve (key reference 11) to reduce test pressure to minimum. Start the pump (key reference 2). Allow the rig to run until all air has been purged from the system. Bleed the filter to be tested (key reference 3) by opening the bleed valve (key reference 14). The directional control valves (key reference 5) shall be open to pass oil through the filter and bleed air out of the system. The adjust valve (key reference 12) should be open 10 % to 20 % to allow pressure adjustment during the test. Open the flow restrict valve (key reference 9) approximately 50 %. Close the bleed valve (key reference 14). Adjust the inlet pressure valve (key reference 11) to the specified pressure. Precision modulation of pressure can be attained by using the adjust valve (key reference 12). Start the test.



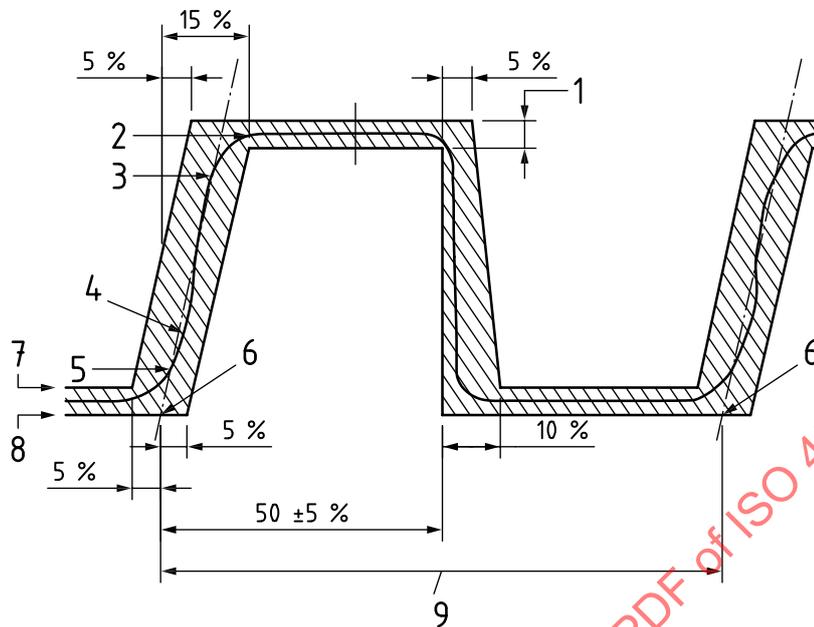
**Key**

- |   |                       |    |                             |
|---|-----------------------|----|-----------------------------|
| 1 | oil reservoir         | 9  | flow restrict valve         |
| 2 | pump assembly         | 10 | shunt valve                 |
| 3 | filter to be tested   | 11 | inlet pressure valve        |
| 4 | system pressure valve | 12 | adjust valve                |
| 5 | directional valve     | 13 | heat exchanger in reservoir |
| 6 | accumulator           | 14 | bleed valve                 |
| 7 | outlet pressure valve | 15 | climatic chamber            |
| 8 | pressure sensor       | 16 | temperature sensor          |

Refer to ISO 1219-1 for definitions of the graphical symbols used in this figure.

**Figure 1 — Test rig for the hydraulic pulse durability test**

Initiate the cyclic test at system pressure meeting the waveform specified in [Figure 2](#). Valves 14, 9 and 10 can be adjusted to remove pressure spikes. Without a specific pulse frequency requirement transmitted by the customer, the cycle rate shall be in the range of 0,5 cycles to 2 cycles per second.



**Key**

- 1 test pressure  $\pm 5\%$
- 2 cyclic test pressure
- 3 85 % cyclic test pressure
- 4 secant pressure rise
- 5 15 % cyclic test pressure
- 6 point "0": the intersection of the secant pressure rise with zero pressure (0 kPa)
- 7 5 % cyclic test pressure
- 8 0 kPa (0 psi)
- 9 time for one impulse cycle

NOTE 1 The above waveform is shown as an example.

NOTE 2 The hatched area shows the tolerances of the test pressure.

**Figure 2 — Diagrammatic pressure pulse waveform for the hydraulic pulse durability test**

An oscilloscope or an alternative device shall be provided to monitor the pressure waveform and cycle times.

9.3 Set the counter to zero.

9.4 Regulate the reservoir oil temperature to maintain the required viscosity (see [Clause 6](#)).

9.5 Allow the test to continue, monitoring 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 may be used.

9.6 Upon test completion, check the angle of rotation and/or tightening torque (i.e. turn in the tightening direction).

9.7 Remove the filter, allow it 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](#) for description of options);
- 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 angles or torques (in Newton metres) required for installation and removal;
- l) the number of cycles to failure or the number of cycles completed;
- m) the test cycle rate;
- n) the international standard used (including its year of publication);
- o) any deviation from the procedure;
- p) any unusual features observed.