INTERNATIONAL STANDARD

ISO 4548-5

Third edition
2020-03

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

Part 5: Test for hydraulic pulse durability

Méthodes d'essai des filtres à huile de lubrification à passage intégral pour moteurs à combustion interne —
Partie 5: Méthode d'essai de résistance aux impulsions hydrauliques

Reference number
ISO 4548-5:2020(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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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).

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).

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.

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

This third edition cancels and replaces the second edition (ISO 4548-5:2013), which has been technically revised.

The main changes compared to the previous edition are as follows:

— The test system schematic has been revised to include updated instrumentation.

— The cold start simulation test and hydraulic pulse durability procedures have been combined into Clause 8.

— The names of the tests have been revised to the “extreme” and “normal” pressure surge tests.

— The test system setup has been defined in more detail.

— A round robin test has been added to be performed to validate the changes. The results have been summarized in a new informative annex (see Annex B).

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.

Introduction

ISO 4548 (all parts) establishes standard test procedures for measuring the performance of full-flow lubricating oil filters for internal combustion engines. The 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.

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

Part 5: Test for hydraulic pulse durability

1 Scope

This document specifies a method of testing the ability of full-flow lubricating oil filters manufactured with metal pressure vessel materials for internal combustion engines to withstand an internal pressure surge. Normally surges occur when an engine is started from cold, and cyclic internal pressure variations experienced during operation.

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

The tests can be applied to other filters, if thought applicable, by agreement between the filter manufacturer and the purchaser.

NOTE This test is not intended to replace simulated environmental testing (e.g. at very low temperatures). If such testing is required, it will be the subject of negotiation between the supplier and customer.

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 apply.

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

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

— IEC Electropedia: available at http://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 in service to pressure fluctuations caused by either engine cold starting conditions or hydraulic pulse events during normal operation. The test specified in Clause 8 can be performed at a range of pressures on separate filters to simulate in-service conditions and verify the capability of the filter canister and seal to withstand these pressures.

5 Test rig

See Figure 1 as an example of a typical test circuit. An alternative test rig, which produces the pressure pulse waveforms shown in Figure 2, may be used.

6 Test fluid

The test fluid shall be oil with a viscosity class ISO VG 22. The temperature shall be 60 °C ± 10 °C, unless otherwise specified.

NOTE The kinematic viscosity of ISO VG22 is 10 mm^2/s ± 5 mm^2/s at 63 °C.

7 Accuracy

7.1 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	±5 %	—
Time	s	±0,002 s	—
Temperature	°C	±1 °C	±2 °C

7.2 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 dB.

7.3 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.

7.4 Instruments and procedures should conform to ISO 9110-1 and ISO 9110-2.

8 Hydraulic pulse durability test (see Figure 1)

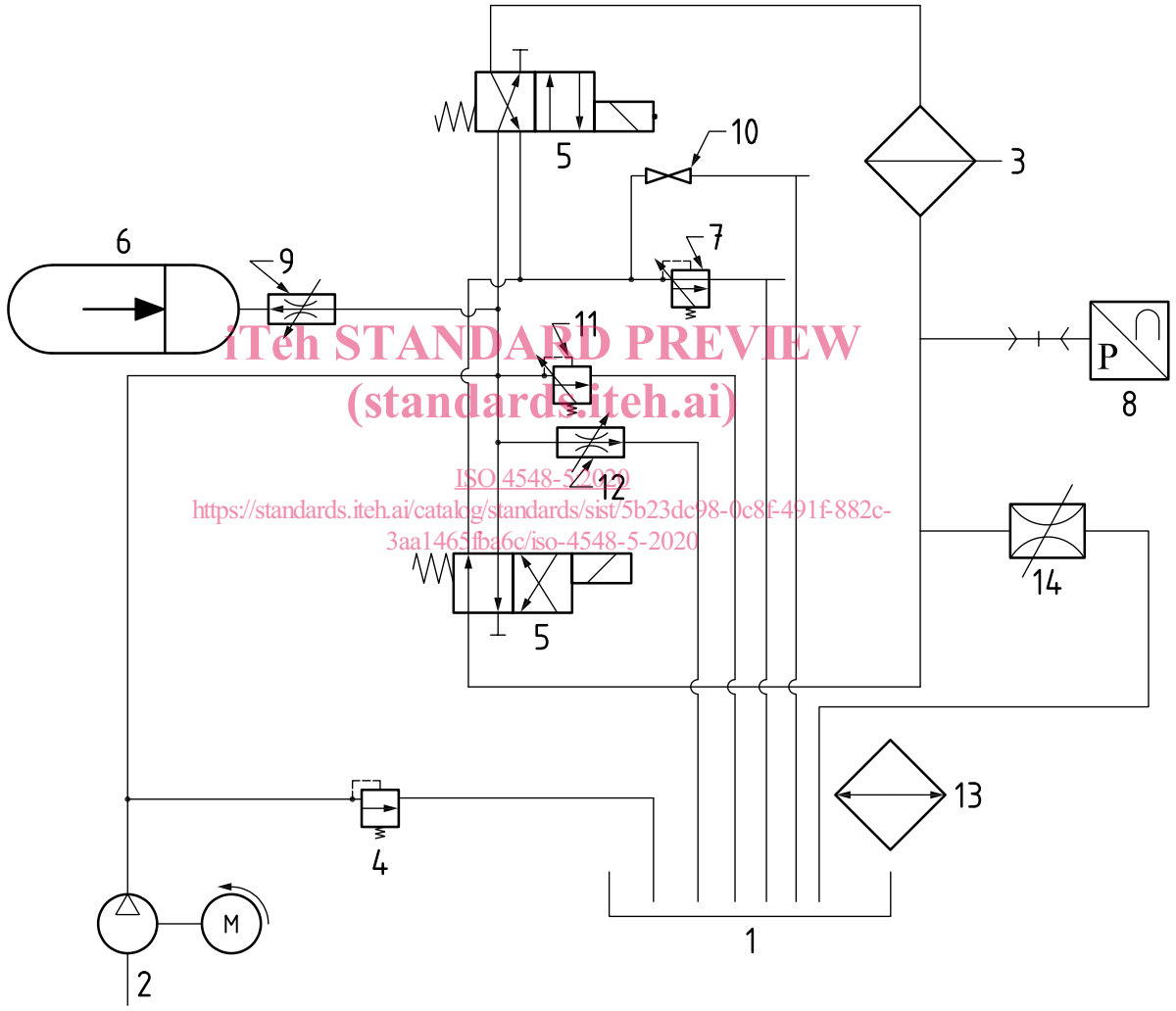
8.1 Fit a filter on an appropriate adaptor and install the test filter to the filter manufacturer's recommended tightening torque or angle of rotation for the filter to be tested. When multiple samples are to be tested for getting the statistically meaningful data, the mean and standard deviation should 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 (see Annex B) and the B10 value are described in ISO 19973-1.

8.2 Connect the test adaptor to the pipework system of the test rig.

NOTE Figure 1 has been shown to produce an acceptable waveform. Other hydraulic configurations will work as well.

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



Key

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

Figure 1 — Test rig for the hydraulic pulse durability test