

INTERNATIONAL STANDARD

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

Part 5:

**Cold start simulation and hydraulic pulse
durability test**

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

*Partie 5: Essais de simulation de démarrage à froid et de résistance aux
impulsions hydrauliques*



Reference number
ISO 4548-5:1990(E)

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 4548-5 was prepared by Technical Committee ISO/TC 70, *Internal combustion engines*.

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: Pressure drop/flow characteristics
- Part 2: Element by-pass component characteristics
- Part 3: Resistance to high pressure drop 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 8: Inlet anti-drain valve test
- Part 9: Outlet anti-drain valve tests
- Part 10: Presence of water in oil

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- *Part 11: Filters with self cleaning*
- *Part 12: Particle retention ability and contaminant holding capacity using particle counting*

Annex A forms an integral part of this part of ISO 4548. Annex B is for information only.

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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.

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

Part 5:

Cold start simulation and hydraulic pulse durability test

1 Scope

This part of ISO 4548 specifies a method of testing the ability of full-flow lubricating oil filters for internal combustion engines to withstand an internal pressure surge such as occurs 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 with a maximum flow rate of 100 l/min. The tests may be applied to other filters if thought applicable by agreement between the filter manufacturer and the purchaser.

NOTE 1 This test is not intended to replace simulated environmental testing (e.g. at very low temperatures). If such testing is required, it should be the subject of negotiation between the supplier and customer.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 4548. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4548-1:1982, *Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 1: Pressure drop/flow characteristics*.

3 Definitions and graphical symbols

3.1 Definitions

For the purposes of this part of ISO 4548, the definitions given in ISO 4548-1 apply.

3.2 Graphical symbols

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

4 Operational characteristics to be tested

Filters are subjected in service to pressure fluctuations caused by engine cold starting conditions. The test specified in clause 7 verifies the ability of the filter canister and seal to withstand these high pressure fluctuations for a given number of start conditions.

Filters are also subjected to cyclic pressure variations during normal operation. The test given in clause 8 verifies the ability of the filter canister and seal to withstand these pressures for a given number of cycles.

5 Test rig

The test rig shall comprise the following components, together with the necessary tubing, connectors and supports (see figure 1):

- oil reservoir;
- pump assembly;
- filter to be tested;

- d) inlet pressure control valve;
- e) solenoid valves;
- f) outlet pressure control valve;
- g) pressure gauge;
- h) solenoid sequence timer and counter;
- i) cooling coils (heat exchanger);
- j) thermostat (to operate the cut-out switch).

NOTE 2 An alternative test rig which produces the pressure pulse waveforms shown in figure 2 may be used.

6 Test liquid

The test liquid shall be oil with a kinematic viscosity of $10 \text{ mm}^2/\text{s} \pm 5 \text{ mm}^2/\text{s}$ ($10 \text{ cSt} \pm 5 \text{ cSt}$) throughout the test [viscosity class ISO VG22 at 63°C or SAE 5W at 68°C (see [2] and [3])].

7 Cold start simulation test (see figure 1)

7.1 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.

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

7.3 Start the pump, ensuring that regulating valves ④ and ⑦ and solenoid valves ⑤ and ⑥ are fully open.

7.4 Allow the rig to run until all air has been purged from the system. Close solenoid valves ⑤ and ⑥ and adjust valve ④ 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.

Switch on solenoid valves ⑤ and ⑥ to obtain a pressure waveform as indicated in figure 2. Valve ⑦ shall be adjusted to give a pressure differential of 0,1 bar to 0,2 bar to avoid negative pulses of outlet pressure. Any further adjustments during the test should be made as necessary during periods when solenoid valves ⑤ and ⑥ are closed. An oscilloscope or an alternative device shall be provided to monitor the pressure waveform and cycle times.

7.5 Set the counter to zero.

7.6 Open the inlet and return valves of the water cooling system and adjust the water flow to regulate the reservoir oil temperature to maintain the required viscosity (see clause 6).

7.7 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.

7.8 To stop the test, fully open valve ④ and switch off the pump and the solenoid valve control switch.

7.9 Check and record the tightening torque (i.e. turn in the tightening direction).

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

8 Hydraulic pulse durability test (see figure 1)

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

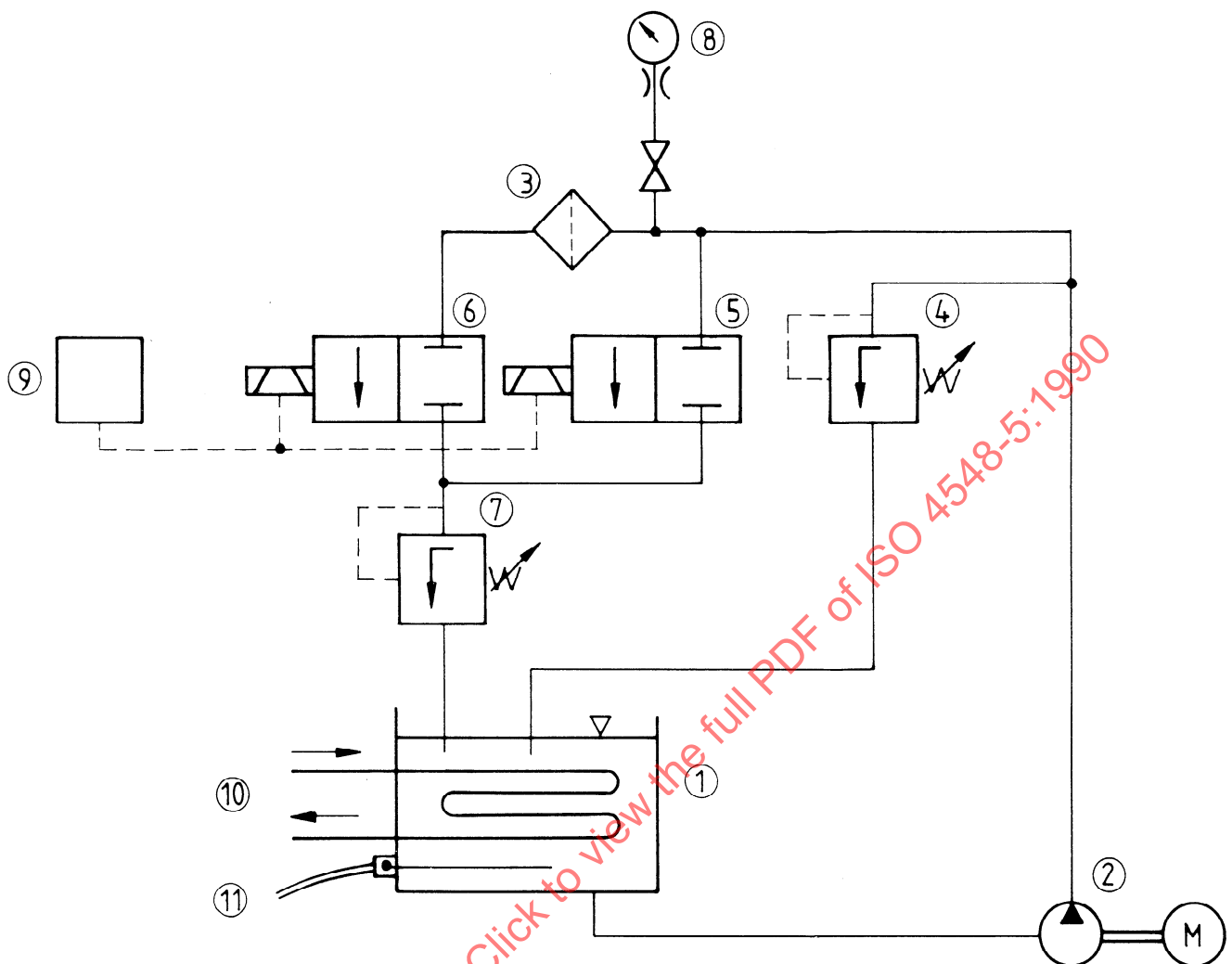
8.2 Connect the test adaptor to the pipework system of the pulse test rig.

8.3 Start the pump, ensuring that regulating valves ④ and ⑦ and solenoid valves ⑤ and ⑥ are fully open.

8.4 Allow the rig to run until all air has been purged from the system. Close solenoid valves ⑤ and ⑥ and adjust valve ④ until the pressure agreed with the engine manufacturer is obtained. In the absence of such an agreement, the value given in annex A for the appropriate category shall be used.

Switch on solenoid valves ⑤ and ⑥ to obtain a pressure waveform as indicated in figure 2. Valve ⑦ shall be adjusted to give a pressure differential of 0,1 bar to 0,2 bar to avoid negative pulses of outlet pressure. Any further adjustments during the test should be made as necessary during periods when solenoid valves ⑤ and ⑥ are open or closed. An oscilloscope or an alternative device shall be provided to monitor the pressure waveform and cycle times.

8.5 Set the counter to zero.

**Key**

- ① Oil reservoir
- ② Pump assembly
- ③ Filter to be tested
- ④ Inlet pressure control valve
- ⑤ Solenoid valve
- ⑥ Solenoid valve
- ⑦ Outlet pressure control valve
- ⑧ Pressure gauge
- ⑨ Solenoid sequence timer and counter to operate valves ⑤ and ⑥
- ⑩ Cooling coils (heat exchanger)
- ⑪ Thermostat (to operate the cut-out switch)

Figure 1 — Test rig for cold start simulation and hydraulic pulse test

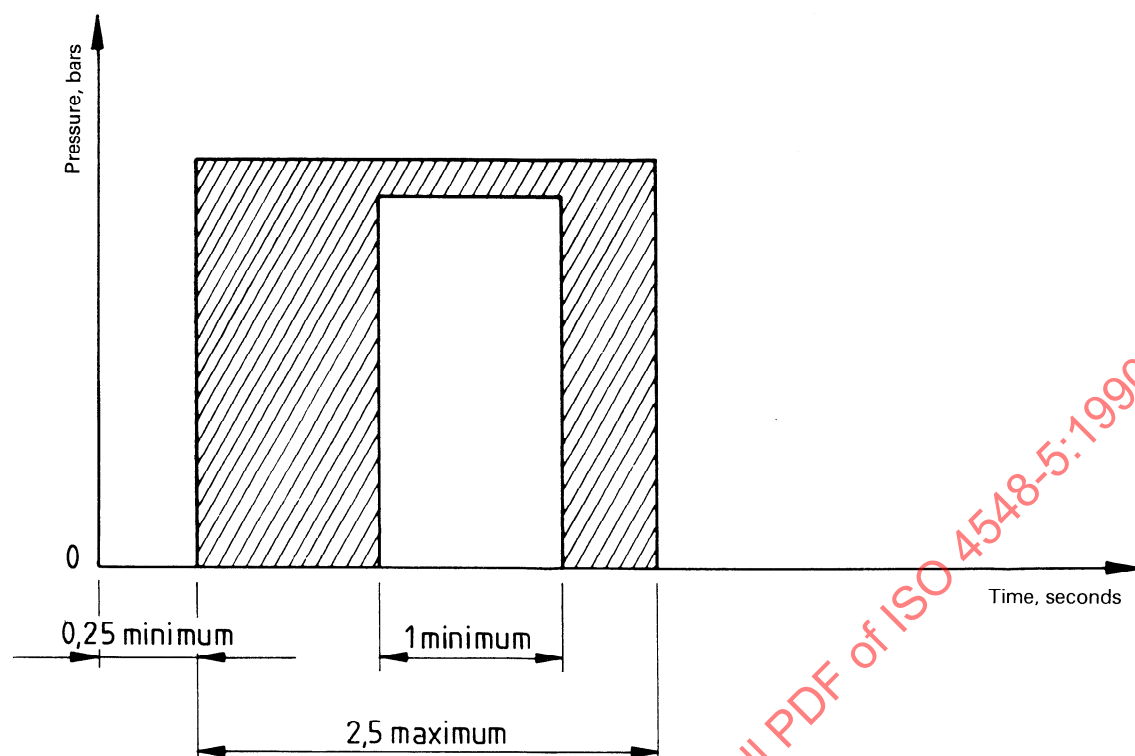


Figure 2 — Diagrammatic pressure pulse waveform for the cold start simulation test and for the hydraulic pulse durability test

8.6 Open the inlet and return valves of the water cooling system and adjust the water flow to regulate the reservoir oil temperature to maintain the required viscosity (see clause 6).

8.7 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 appropriate category shall be used.

8.8 To stop the test, fully open valves ④ and ⑦ and switch off the pump and the solenoid valve control switch.

8.9 Check and record the tightening torque (i.e. turn in the tightening direction).

8.10 Remove the filter, allow to drain, and visually examine the unit, after dismantling if necessary, to determine the failure point and type of failure, if any.

9 Test report

The test report shall include at least the following:

- the name of the test establishment;
- the filter type (manufacturer, model number and batch number);
- the date of the test;
- a description of the filter and whether it is new or used; if it is used, the approximate period of service;
- the category of filter (see annex A);
- the rated flow, in litres per minute;
- the test pressure, in bars (see 7.4 and 8.4);
- the mode of failure and its location;
- the torque applied initially and at the end of the test, in newton metres (see 7.1 and 7.9, 8.1 and 8.9);
- the number of cycles to failure or the number of cycles completed (see 7.7 and 8.7).

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

Filter type	Category	Cold start simulation test		Hydraulic pulse durability test	
		Pressure	Number of cycles	Pressure	Number of cycles
		bar		bar	
Spin-on	A	$10 \pm 0,3$	1 000	$5 \pm 0,2$	25 000
Spin-on	B	$13 \pm 0,3$	3 000	$7 \pm 0,2$	50 000
Detachable with disposable element	C	$16 \pm 0,5$	5 000	$9 \pm 0,3$	75 000