INTERNATIONAL STANDARD

ISO 4548-7

First edition
1990-11-15

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

Part 7:
Vibration fatigue test

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

Partie 7: Essai de fatigue aux vibrations

Reference number
ISO 4548-7:1990(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 4548-7 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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Printed in Switzerland

— *Part 11: Filters with self cleaning*

— *Part 12: Particle retention ability and contaminant holding capacity using particle counting*

Annex A of this part of ISO 4548 is 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.

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

Part 7:
Vibration fatigue test

1 Scope

This part of ISO 4548 specifies a method of testing the constructional integrity of full-flow lubricating oil filters to withstand engine or installation vibration.

This test is intended for application to spin-on type filters and detachable filters with disposable elements with a maximum flow rate of 100 l/min. The test may also be applied to other filters if thought applicable by agreement between the filter manufacturer and the purchaser.

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

Integrally mounted oil filter assemblies, including filter heads, adaptors, mounting brackets, etc., are subjected to forcing frequencies due to engine or installation vibration. The test establishes the ability of the filter assembly to withstand vibration under pressure, for a predetermined 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):

a) electro-mechanical vibrator, together with sinusoidal oscillator and frequency controller, amplifier and display unit to indicate displacement, velocity and acceleration;

b) oil pressure source, which may be manually or mechanically operated;

c) oil pressure gauge 0 to 7 bar (0 to 700 kPa);

d) two accelerometers, featuring linear calibration over a minimum range of -100 m/s^2 to $+100$ m/s^2;

e) filter to be tested, together with filter head or adaptor.

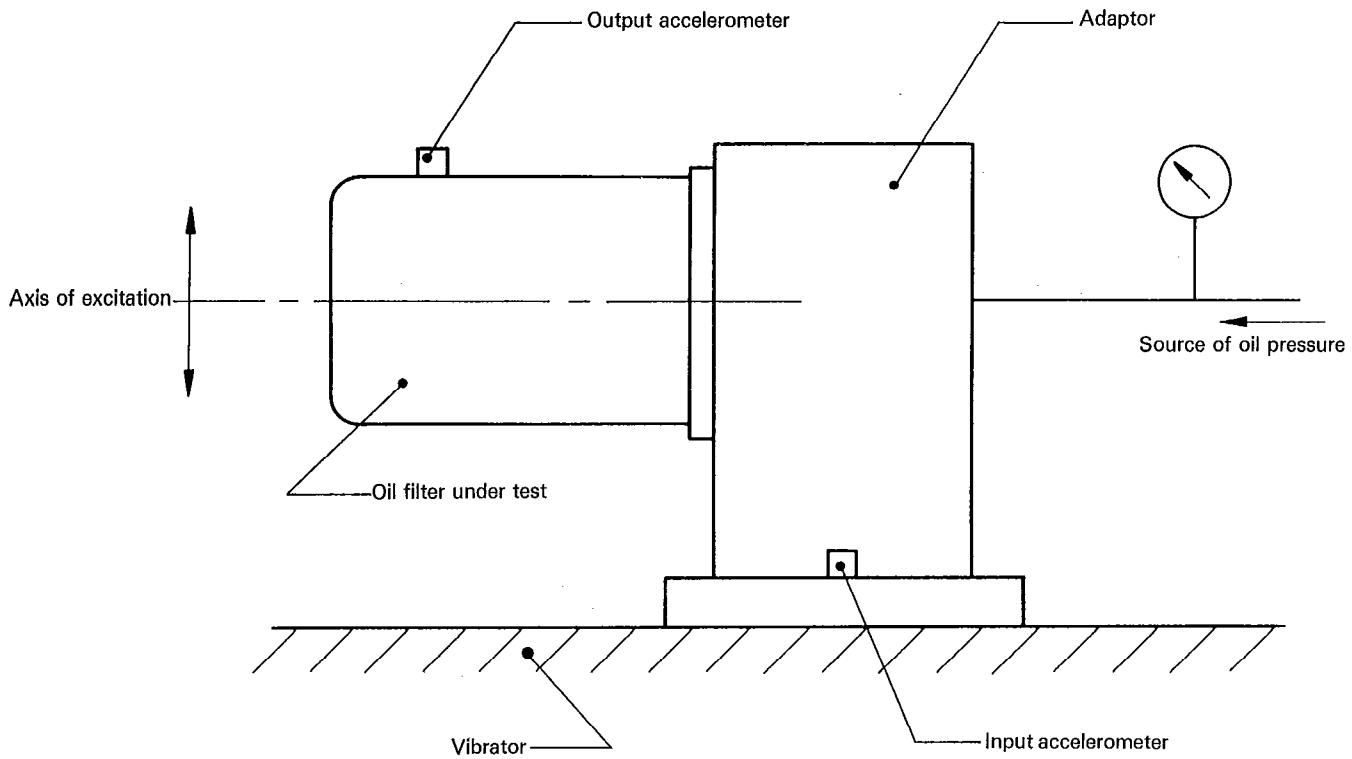

Figure 1 — Test rig — First arrangement

6 Test liquid

The test liquid shall be an oil with a kinematic viscosity less than 10 mm^2/s (10 cSt) at ambient temperature [ISO VG22 or SAE 5W (see [2] and [3])].

7 Vibration fatigue test (see figure 1)

7.1 Install the filter on the filter head or adaptor, applying the recommended torque or angle of rotation for the filter to be tested.

7.2 Mount the filter and head assembly on a rigid bracket or adaptor plate with high deformation resistance, using suitable jointing or sealant to ensure leak-proof mating surfaces.

7.3 Rigidly mount the bracket or adaptor plate/filter assembly on the vibrating table, ensuring that the filter polar axis is a right angles to the axis of excitation.

7.4 Connect the filter to a pressure gauge and to a source of oil pressure at normal ambient temperature, using flexible tubing in such a way as to ensure that it does not interfere with the vibration of the filter unit.

7.5 Attach the input accelerometer to the filter head/adaptor and the output accelerometer to the filter, positioned approximately 100 mm from the top face of the sealing ring, or at a distance equivalent to 0,85 of the filter length if the filter is shorter than 120 mm. The polar axis of both accelerometers shall be parallel to the axis of excitation (see figure 1).

Make the appropriate electrical connections between the accelerometer, vibration control and monitoring equipment.

7.6 Ensure that the filter under test is filled with the test liquid and that all entrapped air has been expelled from the assembly. Pressurize to 5 bar (500 kPa). This pressure should be maintained throughout the duration of the tests.

7.7 Start the vibrator and conduct a resonant search up to a frequency of 400 Hz, maintaining peak input acceleration at a constant value within the range 10 m/s^2 to 60 m/s^2.

If resonance occurs at one frequency, carry out the following test at that frequency. If resonance occurs at more than one frequency, carry out the following test at the frequency which exhibits the maximum amplitude. If resonance does not occur, carry out the following test at a frequency of 150 Hz.

Adjust the power of the vibrator to give a peak input acceleration as agreed between the filter manufac-

turer and engine manufacturer or, in the absence of such an agreement, an acceleration of 60 m/s^2, and determine the total amplitude (peak-to-peak displacement) of vibration.

NOTE 1 The total amplitude (peak-to-peak) of vibration, S, in metres, may be calculated as follows:

$$S = \frac{a}{2\pi^2 f^2}$$

where

a is the peak acceleration, in metres per second squared;

f is the frequency of vibration, in hertz.

7.8 Test the assembly to a total of 10^7 cycles unless prior failure occurs. Commence testing at the frequency and either acceleration or amplitude values as determined in 7.7. Since the resonant frequency of the assembly under test may vary throughout the test, repeat the procedure described in 7.7 and correct the values after each 5×10^5 cycles and continue with the test, unless the test rig is equipped with a means of automatic resonant frequency control and correction.

7.9 At the end of the test, determine the tightening torque or angle of rotation for comparison with the initial setting.

7.10 If 10^7 cycles can be completed without apparent failure, remove the test filter, allow to drain, and carefully dismantle the filter to reveal any visual signs of internal damage.

7.11 Repeat the procedures given in 7.1 to 7.10 but with a new filter of the same type and with the accelerometer polar axis normal to the axis of excitation. Position the accelerometers as shown in figure 2.

8 Test report

The test report shall include at least the following:

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 rated flow, in litres per minute;

f) the test pressure, in bars;

g) the amplitude and frequency of vibration;

h) the mode of failure and its location;

i) the torque applied initially and at the end of the test (in newton metres);

j) the number of cycles to failure or number of cycles completed.

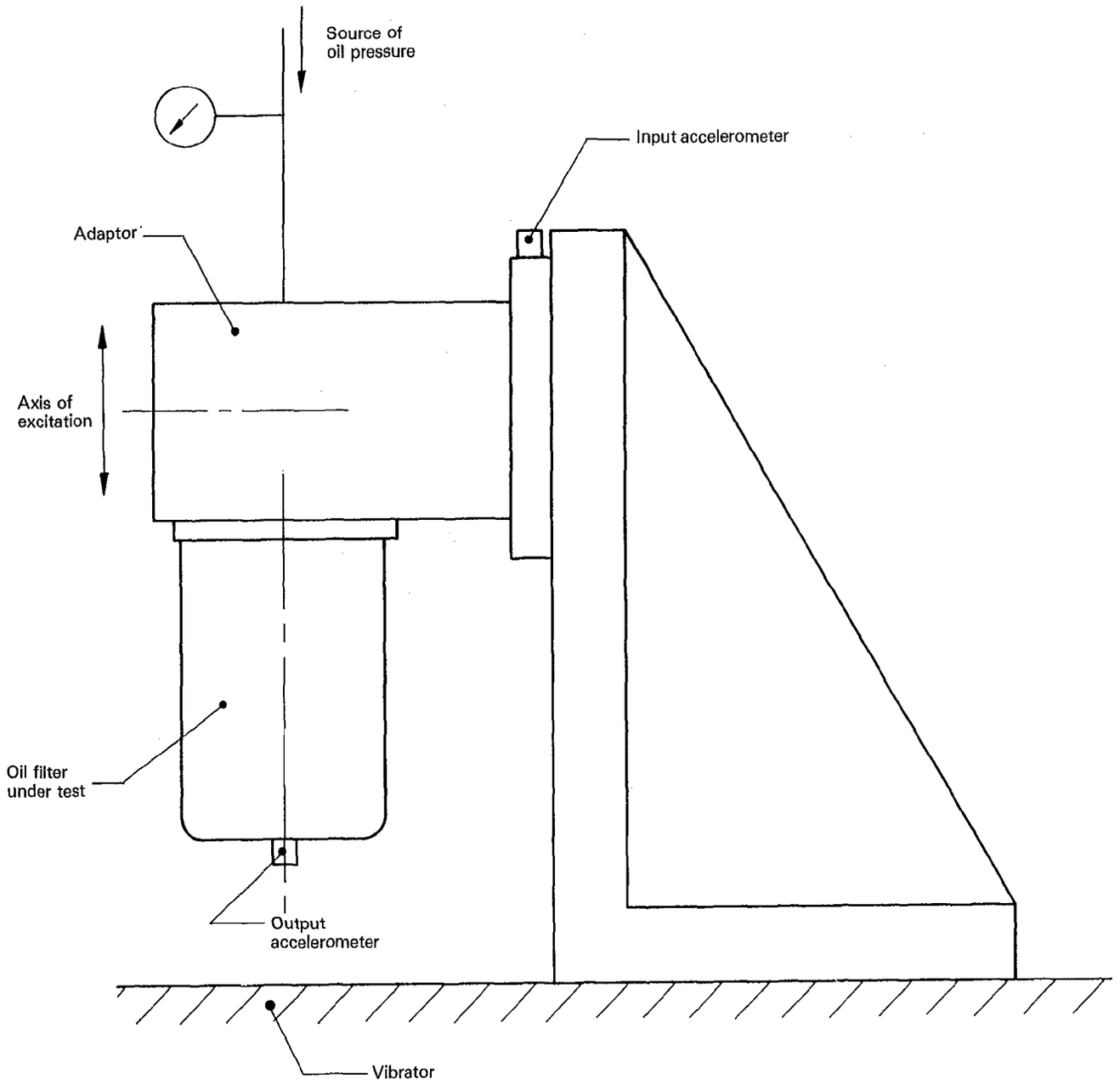

Figure 2 — Test rig — Second arrangement

Annex A
(informative)

Bibliography

[1] ISO 1219:1976, *Fluid power systems and components — Graphic symbols.*

[2] ISO 3448:1975, *Industrial liquid lubricants — ISO viscosity classification.*

[3] SAE J300c, *Engine oil viscosity classification.*

UDC 621.43-729.3:620.178.3

Descriptors: internal combustion engines, lubrification systems, oil filters, tests, vibration tests, fatigue tests.

Price based on 5 pages