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

Part 9: Inlet and outlet anti-drain valve tests

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

Partie 9: Essais des clapets antiretours aval et amont

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 4548-9 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 4548-9:1995), of which it constitutes a minor revision.

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: Cold start simulation and hydraulic pulse durability test*

— *Part 6: Static burst pressure test*

— *Part 7: Vibration fatigue test*

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

— *Part 11: Self-cleaning filters*

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

Introduction

The ISO 4548 series establishes standard test procedures for measuring and 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 can be conducted separately.

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

Part 9:
Inlet and outlet anti-drain valve tests

1 Scope

This part of ISO 4548 specifies methods of measuring the effectiveness of either inlet or outlet anti-drain valves if fitted to a full-flow lubricating oil filter of the “spin-on” or “easy change” type, for internal combustion engines.

2 Normative references

The following referenced documents are indispensable for the application 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 4548-1, *Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 1: Differential pressure/flow characteristics*

3 Terms and definitions

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

4 Principle

4.1 Inlet and anti-drain valve

Assessment of the capability of the inlet anti-drain valve to prevent oil contained in the filter from draining out of the inlet when the engine is stopped.

4.2 Outlet anti-drain valve

Assessment of the capability of the outlet anti-drain valve to prevent oil contained in the filter from draining out the outlet when the engine is stopped.

5 Test rigs

Suggested test rigs are shown diagrammatically in Figures 1 to 3. Figures 1 and 2 are simplified rigs for basic tests. Figure 3 is a more complicated rig involving the means to raise and lower the header tank at a fixed speed of 0,5 m/min between a 0 mm and a 1 500 mm head from the test block. This shall be used only if opening pressures and flow/pressure drop data are required.

NOTE Graphical symbols used in Figures 1 to 3 are in accordance with ISO 1219-1[1].

The test rig shall comprise the following components together with necessary tubing, connectors and supports:

a) oil reservoir;

b) pump (vane type recommended);

c) screen filter;

d) stopcocks (see Figures 1 to 3);

e) 3-way valves (see Figures 1 to 3);

f) test mounting block;

g) header tank (e.g. a separating funnel);

h) measuring cylinders;

i) stopwatch or clock (not shown).

If it is required to carry out all tests specified in this part of ISO 4548, then a single test rig incorporating the features of Figures 1 to 3 may be used.

6 Test liquid

The test liquid shall be mineral oil that has a kinematic viscosity[1)] of 8 $mm^2/s \pm 2$ mm^2/s at 20 °C (viscosity class ISO VG 5[2]).

7 Test liquid

7.1 General

Two test procedures for both inlet and outlet anti-drain valves are described. Test A covers the essential basic performance of the valve in terms of its function as an anti-drain feature. Test B covers the basic performance test and additional procedures suggested to ascertain supplementary performance data which may be required.

7.2 Inlet anti-drain valve — Test A: Basic performance test

7.2.1 An example of the apparatus required for this test is shown in Figure 1. The individual elements of Figure 1, where referenced in 7.2.2 to 7.2.13 by number, are given in bold typeface inside parentheses.

7.2.2 If the filter incorporates an outlet anti-drain valve then, prior to testing, this valve should be locked open by a suitable means, to permit entry of oil on the outlet side of the filter.

7.2.3 Carry out the test at an ambient temperature of 25 °C ± 5 °C.

7.2.4 Fit the test mounting block (**6**) into the test right in an inverted position (i.e. 180° from the position shown in Figure 1).

1) 1 $mm^2/s = 1$ cSt.

7.2.5 Assemble the filter to be tested on the mounting block using a suitable gasket to prevent leakage through the thread.

If the object of this test is to assess the performance of the valve only and not the integrity of the filter assembly as a whole, the potential leak path between the threaded mounting plate and the gasket retainer should also be sealed off.

7.2.6 Open the inlet cock (**4**) to the filter and the outlet cock (**8**) in the base of the header tank (**9**).

7.2.7 Pump test liquid into the system until all air is expelled and a 600 mm ± 10 mm head is obtained above the base of the filter, then close the inlet cock (**4**) and the outlet cock (**8**) in the base of the header tank (**9**).

NOTE The filter is installed in the position described in order to achieve a more complete expulsion of air.

7.2.8 Disconnect the inlet pipe at the base of the filter and turn the filter through 180°, into the position shown in Figure 1.

7.2.9 Open the outlet cock (**8**) at the base of the header tank (**9**) and remove the bleed screw (**5**) from the test mounting block. Leave for 5 min to drain surplus test liquid from the test mounting block.

7.2.10 Replace the bleed screw and place a suitable measuring cylinder (**10**) beneath the outlet pipe (**11**), and start the stopwatch.

7.2.11 Leave for a test time of 1 h, then measure the amount of test liquid that leaked from the filter during this period.

7.2.12 Maintain the level of test liquid contained in the header tank (**9**) at 600 mm ± 10 mm.

7.2.13 Record the results (see Clause 8).

7.3 Inlet anti-drain valve — Test B: Basic and supplementary performance test

7.3.1 An example of the apparatus required for Test B is shown in Figure 3. The individual elements of Figure 3, where referenced in 7.3.2 to 7.3.20 by number, are given in bold typeface inside parentheses.

7.3.2 This test may be used if flow/pressure drop and opening pressure are required.

If necessary, repeat the test for the following conditions:

a) with the filter in a position other than vertical (at an angle agreed between the purchaser and the manufacturer);

b) after submitting the filter to an ageing test in accordance with ISO 4548-3[3] in vertical and inclined positions.

7.3.3 Carry out the test at a temperature of 25 °C ± 5 °C.

7.3.4 Fit the test mounting block (**8**) into the test rig in an inverted position i.e. 180° from the test position shown in Figure 3.

7.3.5 Assemble the filter to be tested on the mounting block using a suitable gasket to prevent leakage through the thread.

7.3.6 Open the inlet cock (**4**) and the outlet cock (**11**). Set 3-way valves (**5**), (**6**) and (**10**) to permit oil flow through the filter and return via the header tank (**12**).

7.3.7 Start the pump (**2**) and adjust the inlet cock (**4**) to allow oil through the filter at sufficient flow rate to open the anti-drain valve and flow until oil is free from air bubbles.

If the object of this test is to assess the performance of the valve only and not the integrity of the filter assembly as a whole, the potential leak path between the threaded mounting plate and the gasket retainer should also be sealed off.

7.3.8 Stop the pump (**2**) and close cocks (**4**) and (**11**) and adjust valve (**6**) such that the inlet to the mounting block is closed.

7.3.9 Adjust the position of the header tank (**12**) to obtain a 600 mm ± 10 mm head, or such head as may be otherwise specified. Turn the filter through 180°, into the position shown in Figure 3.

Adjust valve (**5**) to supply oil to the header tank only, open the inlet cock (**4**) and start the pump to maintain the oil level in the header tank.

7.3.10 Open cocks (**11**) and (**13**). Drain the oil down-stream of the inlet anti-drain valve into a suitable container [not (**15**)] and leave for 5 min to drain surplus test liquid from the mounting block.

7.3.11 Place the measuring cylinder (**15**) under the line from drain cock (**13**) and simultaneously start the stopwatch.

7.3.12 Allow to drain for 1 h into the measuring cylinder (**15**) then measure the quantity of oil leaked through the inlet anti-drain valve during this period.

7.3.13 Close drain cock (**13**) and record the results (see Clause 8).

7.3.14 Lower the header tank (**12**) to reduce the head to approximately zero.

7.3.15 Adjust valves (**10**) and (**6**) such that flow from the header tank is diverted to the inlet of the mounting block.

7.3.16 Open drain cock (**14**) and allow to drain for 5 min into a suitable container [not (**16**)].

7.3.17 Progressively raise the header tank until flow is seen at the drain cock (**14**) indicating that the inlet anti-drain valve is opening. Note the head at that point. Reduce the head again to valve closure. Place a clean measuring cylinder (**16**) in position.

7.3.18 Raise the header tank at a rate of 0,5 m/min, increasing the head until the observed valve opening pressure is reached, indicated by flow commencing through the drain cock (**14**). Record the head at that point.

7.3.19 Raise the header tank to the next 100 mm point at a rate of 0,5 m/min. Allow the flow to stabilize for 2 min. Place a clean measuring cylinder (**16**) under drain cock (**14**) and simultaneously start the stopwatch and measure the flow rate. Repeat the procedure after each 100 mm increase in head up to 1 500 mm.

7.3.20 Plot a curve of flow rate versus head. Derive the valve opening pressure from this curve at the flow rate of 0,05 l/min.

7.4 Outlet anti-drain valve — Test A: Basic performance test

7.4.1 An example of the apparatus required for this test is shown in Figure 2. The individual elements of Figure 2, where referenced in 7.4.2 to 7.4.11 by number, are given in bold typeface inside parentheses.

If the filter incorporates an inlet anti-drain valve then, prior to testing, this valve should be locked open by a suitable means, to permit entry of oil on the inlet side of the filter.

7.4.2 Carry out the procedures described in 7.2.3 to 7.2.5.

7.4.3 Close the outlet cock (**7**), open the inlet cock (**4**) and the drain cock (**10**), and start the pump (**2**). Let oil flow through the filter until all air is expelled.

If the object of this test is to assess the performance of the valve only and not the integrity of the filter assembly as a whole, the potential leak path between the threaded mounting plate and the gasket retainer should also be sealed off.

7.4.4 Close the drain cock (**10**) and turn the filter through 180°, into the position shown in Figure 2.

7.4.5 Open the outlet cock (**7**) to fill the header tank (**8**) to a head of 150 mm ± 10 mm, or such head as may be otherwise specified.

7.4.6 Close the inlet cock (**4**) and stop the pump.

7.4.7 Open the drain cock (**10**) and allow the mounting block to drain for 5 min.

7.4.8 Place a measuring cylinder (**11**) under the drain cock (**10**) and simultaneously start the stopwatch.

7.4.9 Leave for a test time of 1 h and measure the amount of test liquid that leaked from the filter during this period.

7.4.10 Maintain the level of test liquid contained in the header tank at 150 mm ± 10 mm, or such head as otherwise specified (see 7.4.5).

7.4.11 Record the results (see Clause 8).

7.5 Outlet anti-drain valve — Test B: Basic and supplementary performance test

7.5.1 An example of the apparatus required for this test is shown in Figure 3. The individual elements of Figure 3, where referenced in 7.5.2 to 7.5.13 by number, are given in bold typeface inside parentheses.

7.5.2 Carry out the procedures described in 7.3.3 to 7.3.8.

7.5.3 Adjust the position of the header tank to obtain 1 500 mm ± 10 mm head, or such head as may be otherwise specified. Turn the filter through 180° into the position shown in Figure 3.

7.5.4 Adjust valves (**6**) and (**10**) and open the outlet cock (**11**) to direct the oil flow from the header tank (**12**) to the filter inlet. Open the drain cock (**14**).

7.5.5 Drain the oil downstream of the outlet anti-drain valve into a suitable container [not (**16**)] and leave for 5 min to drain surplus test liquid from the mounting block.

7.5.6 Place a measuring cylinder (**16**) under the line from the drain cock (**14**) and simultaneously start the stopwatch.

7.5.7 Allow to drain for 1 h into the measuring cylinder (**16**) then measure the quantity of oil leaked through the outlet and anti-drain valve during this period.

7.5.8 Close the drain cock (**14**) and record the results (see Clause 8).

7.5.9 Lower the header tank (**12**) to reduce the head to approximately zero. Open the drain cock (**14**).

7.5.10 Progressively raise the header tank until flow is seen at the drain cock (**14**) indicating the outlet anti-drain valve is opening. Reduce the head again until the valve closes. Place a clean measuring cylinder (**16**) in position.

7.5.11 Raise the header tank at a rate of 0,5 m/min, increasing the head until the observed outlet anti-drain valve opening pressure is reached, indicated by flow commencing through the drain cock (**14**). Record the head at that point.

7.5.12 Raise the header tank to the next 100 mm point at a rate of 0,5 m/min. Allow flow to stabilize for 2 min. Place a clean measuring cylinder (**16**) under the drain cock (**14**) and simultaneously start the stopwatch and measure the flow rate. Repeat the procedure after each 100 mm increase in head up to 1 500 mm.

7.5.13 Plot a curve of flow rate versus head. Derive the valve opening pressure from this curve at the flow rate of 0,05 l/min.

8 Test report

The test report shall include the following:

a) a reference to this part of ISO 4548 (i.e. ISO 4589-9);

b) the name of the test establishment;

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

d) the date of test;

e) the test temperature;

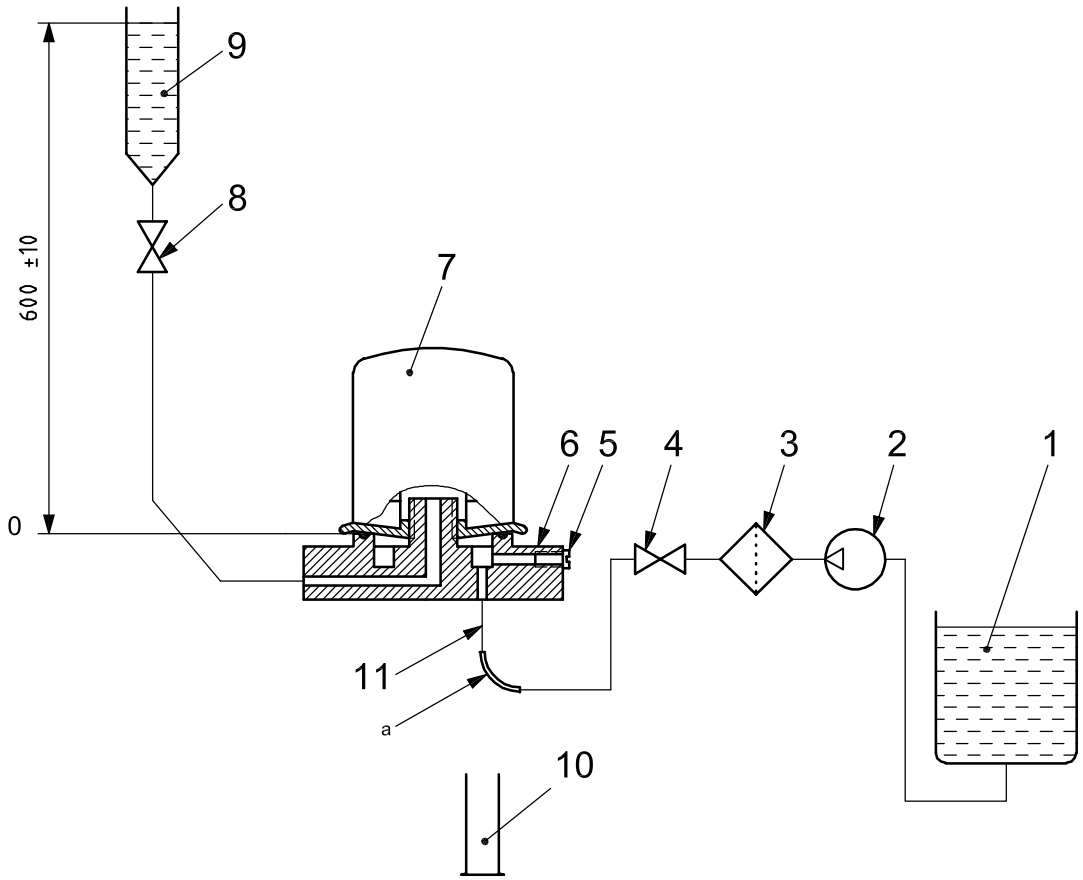
f) the amount of test liquid leaked from the filter, in litres and the corresponding head (see 7.2.11 and 7.3.10);

g) the derived valve opening pressure, if applicable, in megapascals[2)] (MPa) (see 7.3.20 and 7.5.13);

h) the curves of flow rate versus head, if applicable.

2) 1 MPa = $1 \times 10^6 N/m^2$ = 10 bar

Dimensions in millimetres



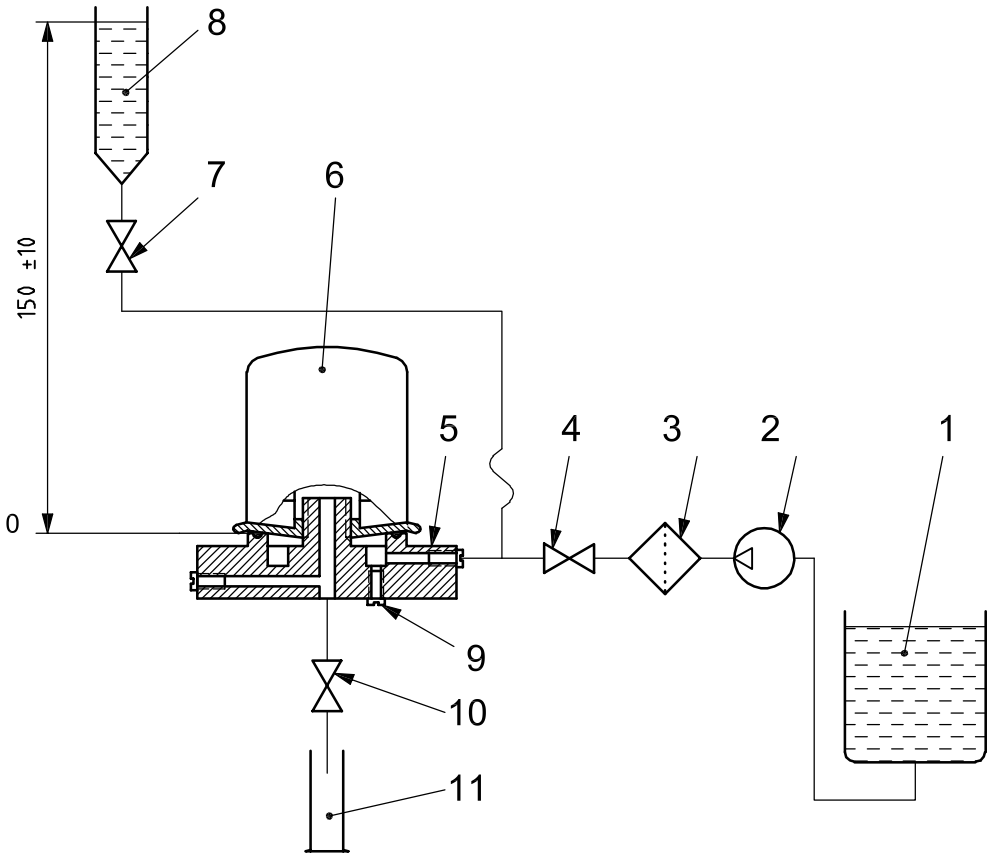
Key

1 oil reservoir
2 pump
3 screen filter
4 inlet cock
5 bleed screw
6 test mounting block
7 filter to be tested
8 outlet cock
9 header tank
10 measuring cylinder
11 outlet pipe

[a] Disconnect here.

Figure 1 — Test rig for inlet anti-drain valve

Dimensions in millimetres

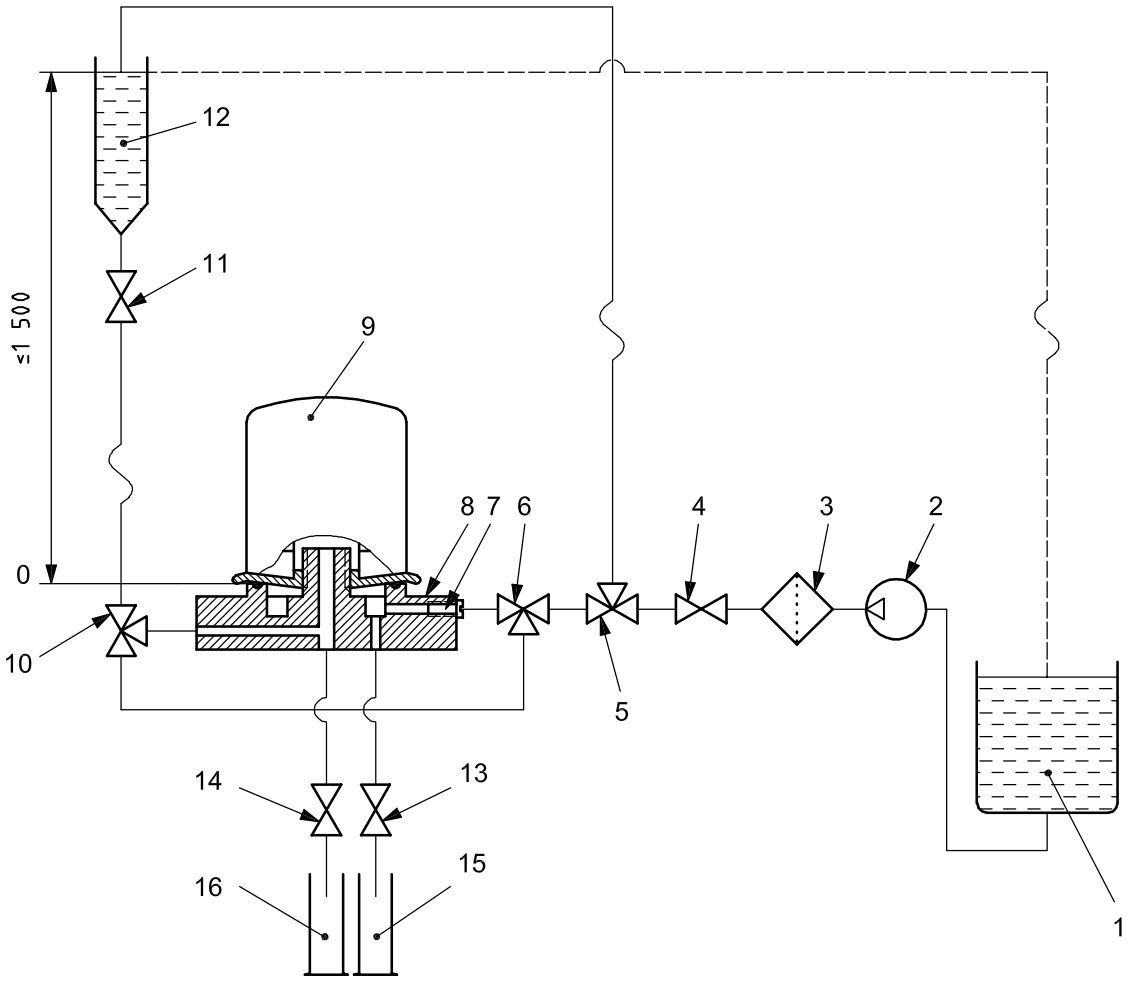


Key

1 oil reservoir
2 pump
3 screen filter
4 inlet cock
5 test mounting block
6 filter to be tested
7 outlet cock
8 header tank
9 bleed screw
10 drain cock
11 measuring cylinder

Figure 2 — Test rig for outlet anti-drain valve

Dimensions in millimetres



Key

1 oil reservoir
2 pump
3 screen filter
4 inlet cock
5 3-way valve
6 3-way valve
7 inlet
8 test mounting block
9 filter to be tested
10 3-way valve
11 outlet cock
12 header tank
13 drain cock
14 drain cock
15 measuring cylinder
16 measuring cylinder

Figure 3 — Test rig for inlet and outlet anti-drain valves

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

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[3] ISO 4548-3, *Methods of test for full-flow lubricating oil filters for internal combustion engines — Part 3: Resistance to high differential pressure and to elevated temperature*

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