INTERNATIONAL STANDARD

ISO 14085-4

First edition
2015-03-01

Aerospace series — Hydraulic filter elements — Test methods —

Part 4: Verification of collapse/burst pressure rating

Série aérospatiale — Eléments filtrants hydrauliques — Méthode d'essais —

Partie 4: Vérification de la résistance à l'éclatement/écrasement

Reference number
ISO 14085-4:2015(E)

Contents

Page

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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

ISO 14085 consists of the following parts, under the general title *Aerospace series — Hydraulic filter elements — Test methods*:

— *Part 1: Test sequence*

— *Part 2: Conditioning*

— *Part 3: Filtration efficiency and retention capacity*

— *Part 4: Verification of collapse/burst pressure rating*

— *Part 5: Resistance to flow fatigue*

— *Part 6: Cleanliness level*

Introduction

In aerospace hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure. The liquid is both a lubricant and power-transmitting medium. The presence of solid contaminant particles in the liquid interferes with the ability of the hydraulic fluid to lubricate, and causes wear and malfunction of the components. The extent of contamination in the fluid has a direct bearing in the performance, reliability, and safety of the system, and needs to be controlled to levels that are considered appropriate for the system concerned.

Filters are used to control the contamination level of the fluid by removing solid contaminant particles, typically consisting of a filter element enclosed in a filter housing. The filter element is the porous device that performs the actual process of filtration. The complete assembly is designated as a filter.

As a filter element removes contaminant due to its efficiency, the filter element clogs and its differential pressure increases to values which can affect its structural integrity. The capability of the filter element to maintain a specified fluid cleanliness level depends on its performance and structural integrity, which can both be affected if the filter element differential pressure becomes too high.

A collapse/burst test quantifies the resistance of the filter element to high differential pressures that can occur both due to filter clogging, as well as that occurring in non-steady state operating conditions such as cold starts and decompression surges.

This part of ISO 14085 provides a procedure to verify that a filter element can withstand a designated high differential pressure without failure.

Aerospace series — Hydraulic filter elements — Test methods —

Part 4:
Verification of collapse/burst pressure rating

1 Scope

This part of ISO 14085 describes a method for verifying the collapse/burst pressure rating of an aerospace hydraulic fluid power filter element. This represents the capability of a filter element to withstand a designated differential pressure in the normal (intended) direction of flow, created by flowing contaminated fluid through the filter element until either collapse/burst occurs or the maximum expected differential pressure is reached without element failure.

The collapse/burst pressure test can be conducted in conjunction with an efficiency test performed according to the procedure defined in the ISO 14085-3 by continuing the contaminant injection until the designated filter element differential pressure is reached.

This part of ISO 14085 is not intended to qualify a filter element under replicate conditions of service; this can only be done by a specific test protocol developed for the purpose, including actual conditions of use, for example the operating fluid or contamination.

The tests data resulting from application of this part of ISO 14085 can be used to compare the performance of aerospace hydraulic filter elements.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 2942, *Hydraulic fluid power — Filter elements — Verification of fabrication integrity and determination of the first bubble point*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 11943, *Hydraulic fluid power — On-line automatic particle-counting systems for liquids — Methods of calibration and validation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5598 and the following apply.

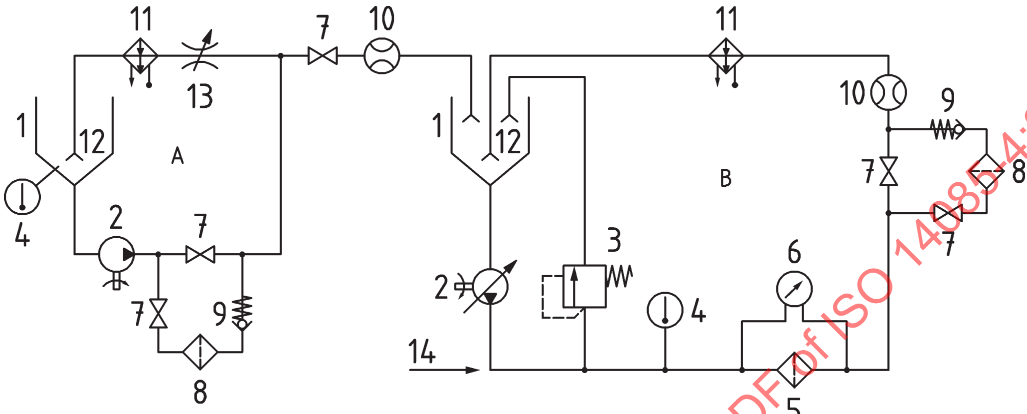
3.1
free-flow dummy element
duplicate test filter element with its media layers removed to replicate the flow pattern in the housing generated by the test filter element

4 Symbols and abbreviated terms

Graphic symbols used are in accordance with ISO 1219-1.

5 Test circuit and equipment

5.1 Test stand: Use a test stand and components similar to that depicted in Figure 1 to perform the collapse/burst test. Critical components of the test system are described below.



Key

A	contaminant injection system	7	shut-off valve
B	filter test system	8	clean-up filter
1	reservoir	9	check valve
2	pump	10	flow meter
3	relief valve	11	temperature controller
4	temperature gauge	12	diffuser
5	test filter	13	flow control valve
6	differential pressure (Δp) transducer	14	alternate contaminant injection point

Figure 1 — Typical circuit diagram for collapse/burst test

5.2 Test filter housing: Use a suitable test filter housing modified as necessary to ensure that fluid cannot by-pass the filter element.

5.3 Test system pump: Use a pump and motor capable of maintaining the flow of the fluid in the test circuit at a pressure greater than the differential pressure required. The pump and motor drive system shall maintain a constant uniform flow rate within a tolerance of ±5 % throughout the entire test.

NOTE Positive and/or negative fluctuations in flow rate causing excessive pressure ripple can lead to inaccurate results.

5.4 Reservoir: Use a reservoir of sufficient size to contain the fluid in the test circuit, designed to keep the contamination in suspension; dead legs and quiescent areas shall be avoided. A cylindrical reservoir with a conical bottom that has an included angle of not more than 90° has been shown to satisfy this requirement. The return line to the reservoir shall terminate with a diffuser that shall be below the fluid level to prevent aeration of the fluid.

5.5 Valves and connectors: Connectors and valves are necessary to control the flow of fluid through the filter. A pressure relief valve is optional.

5.6 Pressure gauge: Use a differential pressure transducer capable of recording the expected differential pressure, and an electronic strip chart-recording device with a response rate of 40 Hz to 100 Hz, or an equivalent recording device.

5.7 Test fluid: Unless otherwise agreed between parties involved, the test fluid shall be the fluid defined in ISO 14085-3, Annex A.

5.8 Test contaminant: The test contaminant shall be ISO 12103-1, A2 (ISO Fine Test Dust).

5.9 Online automatic particle counter: Optionally, an online automatic particle counter, calibrated in accordance with ISO 11943, can be installed in the system, downstream from the filter under test, and particle counts recorded throughout the test.

6 Accuracy of measurements and variations of test conditions

6.1 Utilize and maintain instrument accuracy and test conditions variations within the limits in Table 1.

6.2 Maintain specific test parameters within the limits in Table 1.

Table 1 — Instruments accuracy and test conditions variations

Test parameter	SI Unit	Instrument accuracy (±) of reading	Allowed test condition variation (±)
Differential pressure	Pa, kPa or bar	5 %	—
Flow			
Injection flow	ml/min	2 %	5 %
Test flow	l/min	2 %	5 %
Kinematic viscosity (2)	mm^2/s [a]	2 %	1 mm^2/s
Mass	g	0,1 mg	—
Temperature	°C	1 °C	2 °C
Time	s	1 s	—
Injection system volume	l	2 %	—
Filter test system volume	l	2 %	5 %

[a] 1 mm^2/s = 1 cSt (centistoke).

7 Test procedure

7.1 If the burst/collapse pressure test is to be performed after an efficiency test per ISO 14085-3, continue injecting test contaminant until the designated collapse/burst pressure is reached or until failure occurs.

7.2 If the collapse/burst pressure test is to be performed alone, subject the filter element to a fabrication integrity test per ISO 2942.

7.3 Disqualify from further testing any element that does not meet or exceed the manufacturer's specified minimum first bubble pressure. If the element meets or exceeds the manufacturer's rated minimum first bubble pressure, allow the fluid used in the fabrication integrity test to evaporate from the element, or rinse the element with the fluid to be used in the collapse/burst test procedure.

7.4 Install the filter housing and a free-flow dummy element in the collapse/burst test circuit at the location shown in Figure 1.

7.5 Determine the differential pressure across the filter housing with the free-flow dummy element installed at either the manufacturer's rated nominal flow rate or at a value between 50 % and 100 % of the nominal flow rate, and at either a selected test temperature between 15 °C and 40 °C or at a specified test temperature, and record.

7.6 Install the test filter element in the test filter housing.

7.7 Subject the element to the flow rate and temperature determined in 7.5. Maintain a uniform flow rate throughout the entire test. Record the viscosity of the fluid at test temperature and the overall differential pressure. The pressure relief valve cracking pressure, if one is installed in the system, should be set at not less than 150 % of the specified final collapse/burst pressure of the element being tested.

7.8 Inject the test contaminant into the system either continuously or intermittently (sometimes known as "batch loading"). For intermittent loading, a controlled amount of the test contaminant is introduced at a rate that is not greater than 5 % of the element's estimated contaminant capacity, at intervals of at least 2 min, while maintaining the specified test flow rate and test temperature. Record the lot number of contaminant used. The contaminant shall be injected in a uniform manner and at low enough concentration so that the pressure measurement equipment can detect any structural failure.

NOTE To reduce testing time, a preload of contaminant equal to 50 % of the element's estimated contaminant capacity can be added, if agreed by all parties involved.

7.9 Record the flow rate and differential pressure across the filter as a function of contaminant mass added (in grams) until the differential pressure (in kPa) across the element (filter assembly differential pressure minus housing differential pressure) meets or exceeds the specified collapse/burst pressure rating or until failure. If contaminant is added intermittently, wait 1 min after the addition of contaminant before recording the flow rate and differential pressure.

7.10 Record the downstream particle counts, if measured, throughout the test (see 5.9).

7.11 Stop the test, remove the filter element, and if physical collapse/burst has not occurred, subject it to a fabrication integrity test in accordance with ISO 2942, using the same fluid as in 7.2.

7.12 If the contaminant fills the filter housing before collapse/burst is achieved, the test shall not be valid.

7.13 Calculate the contaminant mass injection rate in grams per minute and multiply the test time (in minutes) by this factor to give the contaminant mass added.

7.14 Plot the relationship of differential pressure versus contaminant mass added in linear coordinate format (see Annex B).

8 Reporting

8.1 Record the following minimum data:

a) the test flow rate;

b) all differential pressure versus time and/or mass added data for plotting curve (see 7.14);

c) all particle count versus time data, if measured (see 7.10);

d) initial and final fabrication integrity data (first bubble points), if measured;

e) the fluid temperature;

f) the type of the fluid used and its viscosity at the test temperature;

g) the type of contaminant introduced, and the Lot Number of the contaminant;

h) direction of flow through the element;

i) the type of pump;

j) the maximum filter element differential pressure achieved.

8.2 The report form in Annex A can be used for this purpose.

8.3 The test report shall include all information related to the test conditions, results obtained, and plots made.

9 Acceptance criteria

9.1 The filter element collapse/burst pressure rating shall be verified if the following conditions are met.

9.2 There is no visual evidence of failure in the element's structure, filter medium and seals, when tested in accordance with ISO 2942.

9.3 There is no abrupt decrease in the slope of the differential pressure versus contaminant mass added curve plotted in 7.14 prior to the specified collapse/burst pressure rating (see Annex B for examples of abrupt decreases in slope).

Transients in differential pressure should not be included when evaluating the curve for an abrupt decrease in slope.

Annex A
(informative)

Test data report form

Laboratory:..Test date: .... Operator:..

Filter element:

Manufacturer: ....

Manufacturer's identification or part number: ....

Batch number/date code: ....

Used/unused: ....

Comment: ....

Test conditions and equipment:

Test flow rate: .... l/min Fluid temperature: .... °C

Type of contaminant: .... Lot number...

Direction of flow through the element: ....

Fluid used in the test circuit: Type: .... Viscosity: .... mm2/s at .... °C

Test results:

Fabrication integrity (first bubble point) values: Initial: .... Pa Final .... Pa

Maximum filter element differential pressure achieved prior to collapse: .... kPa

Minimum collapse/burst pressure rating verified: .... kPa

Method of collapse/burst verification:

..... Visual evidence (see 9.2): Describe ....

..... Abrupt decrease in slope of Δp curve (see 9.3): Attach curve with verified Δp marked