
**Aerospace series — Hydraulic filter
elements — Test methods —**

**Part 6:
Initial cleanliness level**

*Série aéronautique — Éléments filtrants hydrauliques — Méthode
d'essais —*

Partie 6: Niveau de propreté

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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 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](http://www.iso.org/foreword)

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: Initial 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.

Hydraulic fluid circuits require high levels of cleanliness which are not to be degraded by the filter element itself when installed into the circuit. This procedure defined a test method to determine the initial cleanliness level of a new hydraulic filter element.

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Aerospace series — Hydraulic filter elements — Test methods —

Part 6: Initial cleanliness level

1 Scope

This part of ISO 14085 defines a reference method for determining the level of cleanliness of new filter elements for use in aircraft hydraulic systems, after production prior to shipment, or prior to installation in the circuit.

It applies to filter elements used on systems requiring fluid cleanliness conditions defined in the particular specification.

The tests data resulting from application of this part of ISO 14085 can be used to compare the cleanliness 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 3722, *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods*

ISO 4405, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the gravimetric method*

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

3 Terms and definitions

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

3.1

extraction liquid

test liquid extracted from the filter housing in which the filter element is installed during agitation

4 Summary of test method

The test consists of inserting the test filter element into a pre-cleaned filter housing and adding a solvent. The filter assembly shall then be agitated to flush and collect built-in contaminant from a new filter element. Multiple extraction liquid samples shall be used to achieve maximum contaminant removal. The collected contaminant shall then be analysed using particle counting or gravimetric techniques, and the amount of contamination shall be reported.

5 Materials and equipment

5.1 Test liquid: Use a suitable solvent with a viscosity less than 5 mm²/s at test temperature. The test liquid shall be compatible with all materials used in the filter, as well as with the functional liquid of the

system in which the filter will be applied. The test liquid should be compatible with all test apparatus, including seals and filters, and filtered to the agreed initial cleanliness level.

The supplier and purchaser should agree upon the test liquid to be used in the collection process, and its required initial cleanliness level, prior to the test. The contamination contained in the entire test liquid volume to be used shall be less than 1 % of the presumed or allowable contamination level of the filter element or class 1 per ISO 11218, so that it does not significantly influence the measured contamination level. If the expected contamination level is unknown, a maximum contamination level of three particles larger than or equal to 6 µm(c), or equivalent, per millilitre of container volume is considered appropriate.

WARNING — Exercise care when using test liquids with low flash points.

5.2 Test filter housing: Use a test filter housing (recommended by the filter manufacturer). Preferably the housing type to be used in service can be utilized for the cleanliness test. The test housing shall be pre-cleaned to achieve the required blank value. The plugs used to seal the housing shall also be pre-cleaned.

5.3 Collection tray and/or vessels: Clean all collection apparatus to achieve the required blank value. Any collection apparatus should be covered after cleaning and prior to use in order to limit contamination from the environment.

NOTE It is possible for contaminant remaining on the collection apparatus to be transferred to the sample and included as part of the contaminant attributed to the filter element.

5.4 Clean sample containers: Sample containers shall be sufficiently clean so as not to affect the results of contaminant analysis. If the expected contamination level is unknown, a maximum contamination level of three particles larger than or equal to 6 µm(c), or equivalent, per millilitre of container volume is considered appropriate. Qualify and control container cleanliness in accordance with ISO 3722.

5.5 Calibrated graduated cylinder: Use a calibrated graduate cylinder for fluid volume measurement that is sufficiently clean so as not to affect the results of contaminant analysis.

6 Procedure

6.1 Clean the test filter housing as required with clean test liquid by either pressure rinsing, flushing, or agitation.

6.2 After cleaning the housing, conduct a final agitation by filling the housing approximately 2/3 full with clean test liquid. Record the volume of the test fluid added (minimum accuracy ±5 %) on the report sheet of [Annex B](#). Put clean plugs into the inlet and outlet ports, conduct the agitation in accordance with a predetermined method, then pour the test fluid into a clean sample container. See ISO 18413 for guidance.

NOTE Insertion of the port plugs can generate contamination that will be included in the blank sample. Use clean plugs and caution not to over tighten the port plugs.

6.3 Measure the contamination contained in the entire housing sample (blank) per the procedures of [Clause 7](#), and record on the report sheet of [Annex B](#). If the total contamination in the housing blank sample is less than 10 % of the presumed or allowable contamination level of the filter element, then record the value on the report sheet in [Annex B](#) and proceed with the test. If the blank levels exceed the requirements, the housing and all of the equipment used shall be cleaned until the level is acceptable.

6.4 Insert the filter element to be tested into the cleaned filter housing.

6.5 Fill the filter assembly approximately 2/3 full of clean test liquid. Record the volume of fluid added (minimum accuracy ±5 %) on the report sheet of [Annex B](#). The volume of fluid added should be measured with a calibrated graduated cylinder that is sufficiently clean so as not to affect the results of contaminant analysis.

6.6 Insert clean plugs into the inlet and outlet ports.

NOTE Insertion of the port plugs can generate contamination that will be included in the sample. Use clean plugs and take care not to over tighten the port plugs.

6.7 Agitate in accordance with a predetermined method, reporting all relevant data (duration, frequency, amplitude, and direction).

6.8 Remove the port plugs and pour the extraction liquid from the outlet port into a clean sample container.

6.9 Measure the contamination level of the entire extraction liquid sample per the procedures of [Clause 7](#), and label the result as $C1$.

6.10 Repeat [6.5](#) to [6.9](#) twice and record these repetitions as $C2$ and $C3$. Determine whether $C3 \leq 0,1 \times (C1+C2+C3)$ and if so, the extraction is complete. If not repeat [6.5](#) to [6.9](#) until $Cn < 0,1 \times \sum(C1...Cn)$

6.11 If 6 extractions have been performed without $C6 < 0,1 \times \sum(C1...C6)$, then the extraction parameters are not suitable and shall be modified. Repeat operations [6.4](#) to [6.9](#) with new extraction parameters on a new filter element.

6.12 Record the results of the individual tests on the report sheet of [Annex B](#).

7 Contaminant analysis

7.1 Method of analysis

Analyse the liquid samples collected using one of the methods described in [Annex A](#). The method of contaminant analysis shall be agreed upon between all parties involved.

The whole extraction fluid volume should be analysed to quantify the total amount of contaminant. The amount of contaminant shall be expressed per 100 cm³ of wetted volume of the housing with filter element installed.

7.2 Reporting of results

Report the results of the contamination analyses on the report sheet in [Annex B](#).

8 Criterion for acceptance

Accept the cleanliness of the filter element if the reported cleanliness, as determined by the agreed contamination analysis method, is equal to or better than component cleanliness specified in the inspection document or specification.

9 Identification statement

Use the following statement in test reports, catalogues, and sales literature when electing to comply with this part of ISO 14085.

“Method for determining filtration performance data in accordance with ISO 14085-6, *Aerospace series — Hydraulic Filter elements — Test methods — Part 6: Cleanliness Level*.”