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Aerospace series — Test methods for hydraulic filter elements —

Part 3: Filtration efficiency and retention capacity

Série aérospatiale — Méthodes d'essais pour les éléments filtrants hydrauliques —

Partie 3: Efficacité de filtration et capacité de rétention

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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 document 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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 10, *Aerospace fluid systems and components*.

This second edition cancels and replaces the first edition (ISO 14085-3:2015), which has been technically revised.

The main changes are as follows:

— Table 3 has been revised;

— 10.3.2 has been revised;

— Figure 4 has been converted to Table 4 and Table 5.

A list of all parts in the ISO 14085 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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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 on the performance, reliability, and safety of the system, and should be controlled to levels that are considered appropriate for the system concerned.

Different principles are used to control the contamination level of the fluid by removing solid contaminant particles; one of them uses 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.

The performance characteristics of a filter are a function of the filter element (its medium and geometry) and the housing (its general configuration and seal design). For a given filter, the actual performance is a function of the characteristics of the liquid (viscosity, temperature, conductivity, etc.), the particles in suspension (size, shape, hardness, etc.), and the flow conditions.

A standard multi-pass method for evaluating the performance of hydraulic fluid filter elements under steady state conditions has been developed and used for several years, and is referred to in several aircraft hydraulic systems specifications.

Most aircraft hydraulic systems are subjected to unsteady flow with flow cycles caused by such conditions as actuator movement. Such flow variations can have a significant impact on filter performance. The relative performance of hydraulic filters is compared in order to select the most appropriate filter. To ensure the reliability of such comparisons, it is necessary to perform testing with the same standard operating conditions.

This document describes two test methods and the equipment required to measure hydraulic filter element performance with multi-pass flow in both steady and cyclic conditions.

The influence of other stressful operating conditions, such as heat, cold, and vibration, are not measured with this procedure alone. The influence of such conditions is determined with pre-conditioning performed on the test filter element prior to efficiency testing (refer to ISO 14085-1 for descriptions of such tests and when they are applied).

The stabilized contamination level measured while testing with cyclic flow gives an indication of the average contamination level maintained by the filter in a dynamic operating system. The average system contamination level is important in establishing wear rates and reliability levels.

The measurements are made with precise control over the operating conditions, in particular the test fluid and test contaminant, to ensure repeatability and reproducibility. However, because the test parameters and test contaminant do not exactly replicate actual operating conditions which significantly differ from one system to another, the measurements cannot be expected to duplicate the actual performance in an operating system.

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Aerospace series — Test methods for hydraulic filter elements —

Part 3: Filtration efficiency and retention capacity

1 Scope

This document describes two methods to measure in repeatable conditions the filtration efficiency of filter elements used in aviation and aerospace hydraulic fluid systems. It can be applied when evaluating the overall characteristics of a filter element according to ISO 14085-1, or separately.

Since the filtration efficiency of a filter element can change during its service life as it is clogging, this test method specifies its continuous measurement by using on-line particle counters with continuous injection of test contaminant and recirculation of particles not retained by the test filter element until the differential pressure across the element reaches a given final or "terminal" value.

This document allows the efficiency to be measured under both steady or cyclic flow conditions. It is also applicable to measuring the stabilized contamination levels that are produced by the filter element while testing with cyclic flow.

This document is not applicable to qualifying 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, e.g. the operating fluid or contamination.

The test data resulting from application of this document can be used to compare the performance of aerospace hydraulic filter elements.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 2942, *Hydraulic fluid power — Filter elements — Verification of fabrication integrity and determination of the first bubble point*

ISO 3968, *Hydraulic fluid power — Filters — Evaluation of differential pressure versus flow*

ISO 4021, *Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system*

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

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

ISO 11171, *Hydraulic fluid power — Calibration of automatic particle counters for liquids*

ISO 11218, *Aerospace — Cleanliness classification for hydraulic fluids*

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

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ISO 12103-1:2024, *Road vehicles — Test contaminants for filter evaluation — Part 1: Arizona test dust*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

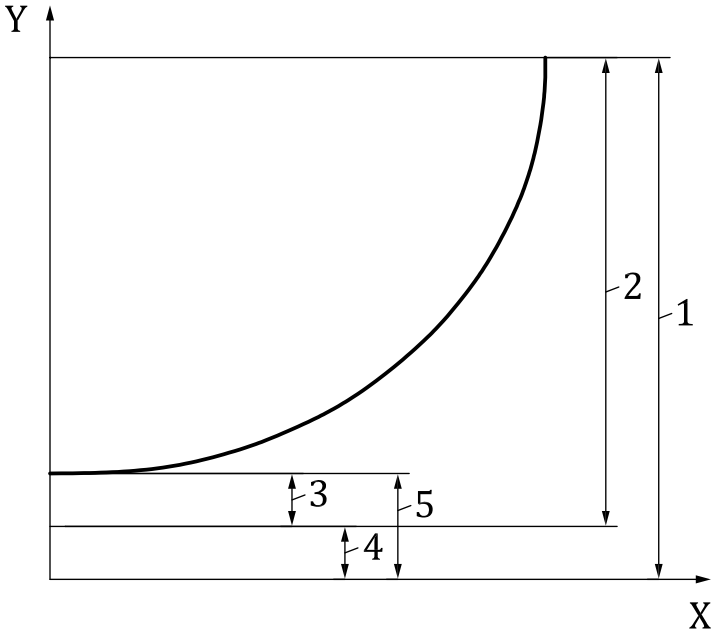
— IEC Electropedia: available at https://www.electropedia.org/

3.1
contaminant mass injected
mass of a specific particulate contaminant injected into the test circuit to obtain the terminal differential pressure

3.2
cyclic flow
change of flow from the specified rated flow rate to 25 % of the rated flow rate at a specified frequency and waveform

3.3
differential pressure
Δp
difference between the inlet and outlet pressures of the component under test, as measured under specified conditions

Note 1 to entry: See Figure 1 and Figure 2 for graphical depiction of *differential pressure* (3.3) terms.



Key

X	test time or mass injected	3	clean element differential pressure
Y	differential pressure	4	housing differential pressure
1	final assembly (end of test) differential pressure	5	clean assembly differential pressure
2	terminal element differential pressure		

Figure 1 — Differential pressure conventions for multi-pass test with steady flow

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