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Hydraulic fluid power — Assembled systems — Verification of cleanliness

Transmissions hydrauliques — Systèmes assemblés — Vérification de la 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

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An ISO/PAS or ISO/TS is reviewed after three years with a view to deciding whether it should be confirmed for a further three years, revised to become an International Standard, or withdrawn. In the case of a confirmed ISO/PAS or ISO/TS, it is reviewed again after six years at which time it has to be either transposed into an International Standard or withdrawn.

Attention is drawn to the possibility that some of the elements of this Technical Specification may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TS 16431 was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 6, *Contamination control*.

Annexes A and B of this Technical Specification are for information only.

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Introduction

In hydraulic fluid power systems, power is transmitted and controlled through a liquid under pressure within an enclosed circuit.

The initial cleanliness level of a hydraulic system can affect its performance and useful life. Unless removed, contaminants present after manufacture and assembly of a system may circulate through the system, causing damage. To limit such damage, the fluid and internal surfaces of the hydraulic fluid power system must be cleaned to an acceptable level.

While this Technical Specification describes a clean-up procedure that uses filters after final assembly of the system, this practice is not a substitute for the use of good practices to achieve and maintain cleanliness prior to final assembly.

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Hydraulic fluid power — Assembled systems — Verification of cleanliness

1 Scope

This Technical Specification defines a procedure for measuring and verifying a desired cleanliness level in an assembled hydraulic fluid power system upon its release from the production area.

NOTE It is recommended that components and parts used in such systems be clean prior to assembly; see ISO 18413 for guidance.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Technical Specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this Technical Specification are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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ISO 3722, *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods*

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

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ISO 4407[1)], *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using an optical microscope*

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

ISO 11500, *Hydraulic fluid power — Determination of particulate contamination by automatic counting using the light extinction principle*

3 Terms and definitions

For the purposes of this Technical Specification, the definitions given in ISO 5598 and the following apply:

3.1
clean-up filter
high efficiency filter capable of providing the required cleanliness

3.2
off-line loop filter
filter or other filtration device that is externally mounted and connected to the assembled fluid power system for the purpose of providing fluid filtration then is removed from the system after verification of the system's cleanliness

1) To be published. (Revision of ISO 4407:1991)

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3.3
particle count analysis
process using automatic particle counters or other such approved methods to measure the size distribution of particles in a given sample volume of fluid at a given time

3.4
on-line analysis
analysis performed on fluid supplied directly to the instrument by a continuous line from the hydraulic system

3.5
off-line analysis
analysis performed on a fluid sample by an instrument that is not directly connected to the hydraulic system

3.6
purchaser
party that stipulates the requirements of a machine, equipment, system or component and judges whether the product satisfies those requirements

3.7
supplier
party that contracts to provide the product(s) to satisfy the purchaser's requirements

NOTE The manufacturer and supplier may be the same person or company.

4 Test equipment

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4.1 Fluid line sampler that conforms to ISO 4021. In the absence of such samplers, a **pressure measuring port** may be used, as long as the sample is taken from the main flow.

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4.2 Fluid sample containers, qualified in accordance with ISO 3722. If on-line analysis is used, such sample containers are not required.

4.3 Automatic particle counter, in accordance with ISO 11500 or optical microscope or **image analysis equipment,** in accordance with ISO 4407.

4.4 Clean-up filter or **off-line loop filter** and a **means** of circulating the system fluid through the filter.

5 Sampling

CAUTION Sampling from high pressure lines can be dangerous. A means of dissipating the pressure shall be provided.

Samples shall not be taken from the system's reservoir unless there are no alternative sampling points available.

It is important to adequately purge the sampling supply line to ensure that a representative fluid sample can be obtained.

6 Test procedure

6.1 The procedures contained in this clause should be considered as the minimum required and may not give the cleanliness required for all systems, especially those with large pipe runs and complex circuitry. For such systems, it may be necessary to use more specific flushing procedures.

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See Figure 1 for a flowchart (block diagram) that illustrates the procedure for verifying the cleanliness of an assembled hydraulic system. Figure 1 also provides the numbers of subclauses corresponding to each step in the procedure.

6.2 Install the fluid line sampler and record its location.

6.3 Circulate the system fluid through all circuits of the system for a minimum of 10 min or until the manufacturer's operating conditions are achieved and all components of the system have been exercised.

6.4 Obtain a representative fluid sample and perform a particle count analysis in accordance with ISO 11500 or ISO 4407. Record the data. Evaluate the results of the analysis in accordance with the requirements of clause 7.

6.5 If the requirements of clause 7 are not met and additional cleaning operations are required, proceed to 6.6. If the requirements of clause 7 are met, proceed to 6.16.

6.6 Select a clean-up or off-line loop filter and install it in an appropriate location in the system in accordance with the system manufacturer's recommended procedures (e.g., at the outlet of the main system pump; in the existing filter housing; at an external connection to the reservoir).

6.7 Determine if any components should be temporarily bypassed, e.g.:

— components that are highly sensitive to contamination;

— cylinders that are supplied by lines with a static volume greater than 50 % of the cylinder's volume.

If no components are bypassed, proceed to 6.13.

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6.8 Bypass any component as required by interconnecting supply and return lines at the component.

NOTE Addition or removal of a line or component, addition of fluid or other disruption of the system may add contamination to the system.

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6.9 Circulate the system fluid through all circuits of the system by operating the system for a time considered sufficient to clean the system fluid to a cleanliness level that meets the requirements of clause 7.

6.10 Obtain a representative fluid sample and perform a particle count analysis in accordance with ISO 11500 or ISO 4407. Evaluate the results of the analysis in accordance with the requirements of clause 7.

6.11 If the requirements of clause 7 are not met and additional cleaning operations are required, repeat the procedures specified in 6.9 and 6.10. If the requirements of clause 7 are met, proceed to 6.12.

NOTE If the agreed-upon system cleanliness level cannot be achieved in an acceptable period of time, contamination control practices used in the production of system parts and components should be reviewed.

6.12 Reconnect the supply and return lines of any bypassed components.

6.13 Circulate the system fluid through all circuits of the system by operating the system for a time considered sufficient to clean the system fluid to a cleanliness level that meets the requirements of clause 7.

6.14 Obtain a representative fluid sample and perform a particle count analysis in accordance with ISO 11500 or ISO 4407. Evaluate the results of the analysis in accordance with the requirements of clause 7.

6.15 If the requirements of clause 7 are met, proceed to 6.16. If the requirements of clause 7 are not met and further cleaning operations are required, repeat the procedures specified in 6.13 and 6.14.

6.16 Remove the fluid line sampler and any externally attached clean-up system.

6.17 Report final data as required in clause 8.

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