SLOVENSKI STANDARD
SIST ISO/TR 10949:2000

01-september-2000

Fluidna tehnika - Hidravlika - Metode za ļ iģļ enje in ocenjevanje stopnje snaģnosti sestavin

Hydraulic fluid power -- Methods for cleaning and for assessing the cleanliness level of components

Transmissions hydrauliques -- Méthodes de nettoyage et d'évaluation du niveau de propreté des composants

Ta slovenski standard je istoveten z: **ISO/TR 10949:1996**

ICS:

23.100.60	Filtri, tesnila in onesnaģevanje tekoļ in	Filters, seals and contamination of fluids

SIST ISO/TR 10949:2000 **en**

TECHNICAL REPORT

ISO TR 10949

First edition
1996-09-15

Hydraulic fluid power — Methods for cleaning and for assessing the cleanliness level of components

Transmissions hydrauliques — Méthodes de nettoyage et d'évaluation du niveau de propreté des composants

Reference number
ISO/TR 10949:1996(E)

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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 main task of technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 10949, which is a Technical Report of type 2, was prepared by Technical Committee ISO/TC 131, *Hydraulic fluid power,* Subcommittee SC 8, *Product testing and contamination control.*

On consideration of this document for circulation as a draft International Standard, it was concluded that standard practice had progressed beyond the recommendations presented herein. It was therefore decided to stop work and publish the document as a Technical Report of type 2, allowing interested bodies to refer to it, and as the basis for conversion into an International Standard.

Introduction

To ensure long life and satisfactory performance of hydraulic fluid power systems, the cleanliness of the system is of paramount importance. One factor affecting that cleanliness is the degree of contamination which is present in the system components after manufacture.

This Technical Report has been prepared to give guidance to manufacturers for producing clean components and to select the most appropriate of three alternative procedures for assessing the level of cleanliness as delivered to the user.

As it is not always clear what level and type of cleanliness would be beneficial for improved performance and life on a cost-effective basis, the actual quantitative levels can only be set in relation to other parameters and should be agreed between the manufacturer, supplier and user.

Hydraulic fluid power — Methods for cleaning and for assessing the cleanliness level of components

1 Scope

This Technical Report recommends methods of cleaning hydraulic fluid power components and describes alternative procedures for assessing the cleanliness of the components as delivered by the manufacturer to a system constructor or user.

It is not intended to cover complete systems or procedures for cleaning and assessing solid pipework.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3722:1976, *Hydraulic fluid power — Fluid sample containers — Qualifying and controlling cleaning methods.*

ISO 3938:1986, *Hydraulic fluid power — Contamination analysis — Method for reporting analysis data.*

ISO 4021:1992, *Hydraulic fluid power — Particulate contamination analysis — Extraction of fluid samples from lines of an operating system.*

ISO 4402:1991, *Hydraulic fluid power — Calibration of automatic-count instruments for particles suspended in liquids — Methods using classified AC Fine Test Dust contaminant.*

ISO 4405:1991, *Hydraulic fluid power — Fluid contamination — Determination of particle contamination by the gravimetric method.*

ISO 4406:—[1], *Hydraulic fluid power — Fluids — Code for defining the level of contamination by solid particles.*

ISO 4407:1991, *Hydraulic fluid power — Fluid contamination — Determination of particulate contamination by the counting method using a microscope.*

ISO 5598:1985, *Fluid power systems and components — Vocabulary.*

ISO 6072:1986, *Hydraulic fluid power — Compatibility between elastomeric materials and fluids.*

3 Definitions

For the purposes of this Technical Report, the definitions given in ISO 5598 apply.

4 Contamination control

Creating and maintaining a clean component is primarily a manufacturing responsibility but the customer or user must also accept responsibilities.

Care with cleanliness is needed by the manufacturer at all stages of production.

1) To be published. (Revision of ISO 4406:1987)

The manufacturer is responsible for:

— cleaning component parts prior to assembly;

— assembly in a clean area;

— flushing, if this operation is needed;

— cleanliness during testing;

— preparation for packing, corrosion prevention, port sealing etc.;

— adequate packaging.

On receipt of the component, the customer or user is responsible for:

— care in unpacking;

— keeping the component clean after removing protective plugs, etc.;

— installing the component in the system in a clean condition.

5 Cleaning and assembly of components and parts

5.1 Cleaning

To ensure that an adequate standard of cleanliness of finished units is achieved, it is essential that all parts which make up a component are thoroughly cleaned before assembly.

An appropriate procedure shall be implemented, for each component or component element, to remove such residues as chips, sand, filings, rust, weld spatter and slag, elastomers, sealants, water, aqueous products, chlorine, oil, acid, detergent, etc.

This cleaning procedure is essential to ensure that no damage to the finished component will occur during flushing or testing.

The cleaning procedure can be carried out as follows:

— shot blast or chemically clean castings to remove casting sand and scale prior to machining, and then carefully deburr and wash them before assembly;

— remove manufacturing residues, burrs, etc. by mechanical, ultrasonic, vibratory, chemical means, etc.;

— remove cleaning residues using chemical means, solvents, dry filtered compressed air, etc.;

— wipe with lint-free cloths;

— oven-dry or dry with dry filtered compressed air.

When cleaning components, special care should be taken to ensure that cored passages and deep holes are cleaned, and it should be remembered that items with designed sharp edges, such as grooved spools, can collect quantities of "finger dirt". Assembler's hands and benches should be kept clean and cleaning materials should be lint-free.

Ultrasonic cleaning of components can be very effective, providing the manufacturer's instructions for the ultrasonic cleaner are carefully followed. This process relies mainly on the effect of vapour bubbles imploding on the surface of components; it is important that the bath and component temperature are correct for this action to be fully effective. Adequate time shall, therefore, be allowed for components to reach working temperature after immersion. The design of containers and spacing of components is also critical and adequate flow paths shall be allowed for the sonic waves to reach all parts of all components. Baskets made of perforated sheet may tend to attenuate the sound waves, as will tightly packed parts. Open wire mesh baskets are normally satisfactory.

A further important point is that if the bath fluid is even slightly contaminated with oil or dissolved preserving agent (grease for example), traces of this grease may be left on the components. Components which require subsequent treatment, such as plating or the use of some sealants, should be cleaned in a vapour bath. It should be noted that some vapours, particularly some chlorinated hydrocarbons, can promote very rapid corrosion even if the components are subsequently coated with oil soon after cleaning.

5.2 Assembly

Components should, ideally, be assembled immediately after cleaning as even short storage periods can allow corrosion to start or airborne dust to settle on them. Components which are not required for immediate assembly should be adequately protected.

Assembly should be done in a clean area, well away from contaminant-generating operations such as grinding, welding and machining. Air jets used for cleaning in the vicinity of the assembly should be avoided as these jets can project contaminant many metres.

If adhesives or PTFE tape are used during assembly, care should be taken to avoid entrapment within the unit. If grease is used, it is important that it be kept clean and it should be used sparingly as it may not be soluble in the system fluid and may block filters.

After assembly, all joint surfaces and ports should be covered unless the unit is to be tested immediately. Cover plates and other closures, such as plastic plugs, should be as clean as the unit. Closures which have been used for this purpose will probably be oily and should be cleaned before re-use.

A list of some of the means of protecting a component is given in table 1. If further cleansing of an assembled component is required, the component should be flushed on a specifically designed flushing rig prior to testing.

WARNING — Test plant should not be used as a primary cleaning station.

Table 1

Nature of protection	Cleaned components[1)]
Pressed-on metallic plug or cap	T
Screwed cylindrical metallic plug with seal	R
Flanged plate with seal	R
Pressed-on plastic plug	T
Screwed male plastic plug	R
Self-cutting plastic plug	F
Anti-corrosive Kraft paper	F
Plastic packaging	R
Filling with clean compatible hydraulic fluid	R
Contact corrosion volatile inhibitor for spare parts	R By agreement
Vacuum-tight envelope[2)]	R
Pressure-tight envelope[2)]	R

1) R = recommended; T = tolerated; F = forbidden.
2) In addition to port plugs.

6 Flushing

6.1 Principle

The principle of flushing is to apply sufficient energy to the contaminants in order to dislodge them and to wash them away from the component for subsequent collection in a filter.

6.1.1 Fluid-conveying components

The preferred procedure involves circulating a fluid through the component under defined conditions of flow and temperature.

The fluid flow shall be turbulent ($Re > 4\,000$) and calculated from the nominal diameter of the component supply ports:

$$Re = \frac{Vd}{\nu} \times 10^3$$

where

Re is the Reynolds number;

d is the nominal diameter of the ports, in millimetres;

V is the linear velocity of the fluid, in metres per second;

ν is the kinematic viscosity of the fluid, in centistokes (cSt) [2)].

For the flowrate to achieve a Reynolds number of 4 000, the flowrate, in litres per minute, must be greater than 0,189 νd.

6.1.2 Non fluid-conveying components

Flushing may be carried out by filling the components with a suitable fluid, and by flushing them completely several times until the fluid cleanliness, as measured at regular intervals, reaches the required level.

6.2 Flushing installation

In order to achieve satisfactory conditions, it is recommended that an installation which meets the requirements given in 6.2.1 to 6.2.4 is used.

CAUTION — Special care shall be taken when mounting the component onto the flushing installation to check that the fluid sample taken for cleanliness determination is the same fluid as that conveyed by, or stored in, the component during the flushing operation.

2) 1 cSt = 1 mm^2/s