
**Hydraulic fluid power systems —
Assembled systems — Methods of
cleaning lines by flushing**

*Transmissions hydrauliques — Systèmes assemblés — Méthodes de
nettoyage des canalisations par curage*



This document is a preview generated by ERS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Principle of flushing	2
5 Flushing lines in a hydraulic system	2
5.1 Initial factors to consider	2
5.2 System layout	3
5.3 Component cleanliness level	3
5.4 Anti-corrosion agents	3
6 Treatment of lines	3
6.1 Preparation of lines during fabrication	3
6.2 Surface treatment	4
6.3 Storage of lines and connectors	4
7 Installation of piping systems	4
8 Flushing requirements	4
8.1 Flushing document	4
8.2 Flushing criteria	4
8.3 Flushing parameters	5
8.4 Filters and separation of particles	6
8.4.1 General requirements	6
8.4.2 Additional external flushing filters	6
8.5 Monitoring the progress of flushing	6
8.5.1 Options for monitoring	6
8.5.2 Sampling procedures	7
8.5.3 Minimum flushing time before oil samples are taken	7
8.6 Flushing procedures	7
8.6.1 General	7
8.6.2 Preliminary stages	7
8.6.3 Stage 1 — Flushing at low pressure	8
8.6.4 Stage 2 — Flushing at higher pressures	8
8.6.5 Verification of final cleanliness level	8
9 Identification statement (reference to this document)	8
Annex A (informative) Guidelines for obtaining the Required Cleanliness Level (RCL) for a system	9
Annex B (informative) Factors influencing the effectiveness and duration of flushing	11
Annex C (informative) Identification and relationship between the main flushing requirements	13
Bibliography	18

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 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 the following URL: www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 23309:2007) which has been technically revised.

The main changes compared to the previous edition are as follows:

- identifies the shortfall of the Reynolds formula when it's used in isolation;
- identifies the importance of flushing oil velocity, temperature, and viscosity;
- identifies to the practitioners who perform flushing procedures that if they only consider the *Re* value the flushing velocity could be much less than the system oil flow within the system and what it will be subjected to in normal service;
- raises awareness and importance of the factors other than the *Re* value that affect the effectiveness, efficiency and reliability of any flushing process.

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.

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, particulate contamination present after manufacturing, assembly, component failure and repair of a system can circulate through the system and cause damage to the system components. To reduce the probability of such damage, the fluid and the internal surfaces of the hydraulic fluid power system needs to be flushed clean to a specified level.

Flushing of lines in a hydraulic system needs to be viewed as one means of removing in-built and residual contamination and should not be the sole method for cleaning such systems unless other methods are impractical.

Hydraulic fluid power systems — Assembled systems — Methods of cleaning lines by flushing

1 Scope

This document specifies the procedures for flushing particulate contamination from the hydraulic lines and components of hydraulic fluid power systems which is:

- residual in the components after manufacture;
- introduced into the system during the assembly of a new system; or
- introduced into the system after system failure, maintenance or modification of an existing system.

The aim of flushing the system is to quickly remove this contamination to reduce the amount of wear and damage that results if these particles are allowed to circulate around the system.

This document is not applicable to:

- the chemical cleaning and pickling of hydraulic tubes;
- the cleaning of major system components (this is covered in ISO/TR 10949).

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

ISO 4406, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 4407, *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/TR 10949, *Hydraulic fluid power — Component cleanliness — Guidelines for achieving and controlling cleanliness of components from manufacture to installation*

ISO 12669, *Hydraulic fluid power — Method for determining the required cleanliness level (RCL) of a system*

ISO 16431, *Hydraulic fluid power — System clean-up procedures and verification of cleanliness of assembled systems*

ISO 16889, *Hydraulic fluid power — Filters — Multi-pass method for evaluating filtration performance of a filter element*

ISO 18413, *Hydraulic fluid power — Cleanliness of components — Inspection document and principles related to contaminant extraction and analysis, and data reporting*

ISO 21018-1, *Hydraulic fluid power — Monitoring the level of particulate contamination of the fluid — Part 1: General principles*