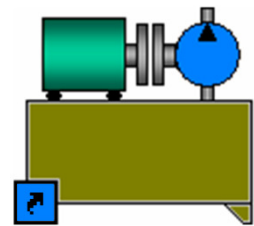


Hydraulic Systems Volume 3

Hydraulic Fluids and Contamination Control

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Hydraulic Fluids and Contamination Control

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Hydraulic Systems Volume 3

Hydraulic Fluids and Contamination Control

PREFACE, 8

ACKNOWLEDGEMENT, 9

ABOUT THE BOOK, 11

ABOUT THE AUTHOR, x

Chapter 1: Introduction, 15

1.1- Hydraulic Fluids Conditioning and Contamination Control

1.2- Cost of Contamination

1.3- Sources for Standard Test Methods

1.3.1- International Organization for Standardization (ISO)

1.3.2- American Society for Testing and Materials (ASTM)

1.3.3- Society of Automotive Engineering (SAE)

1.3.4- American National Standards Institute (ANSI)

1.3.5- German Institute for Standardization (DIN)

1.3.6- Fluid Power Systems and Components Vocabulary (ISO 5598)

Chapter 2: Hydraulic Fluids, 23

2.1- Basic Definition

2.2- Hydraulic Fluid Contribution

2.3- Historical Background

2.4- Properties and Test Methods for Hydraulic Fluids

2.4.1- Fluid Density

2.4.2- Fluid Specific Weight

2.4.3- Fluid Specific Gravity

2.4.4- Fluid Viscosity

2.4.4.1- Definition of Fluid Viscosity

2.4.4.2- Effect of Fluid Viscosity on System Performance

2.4.4.3- Mathematical Expression of Fluid Viscosity

2.4.4.4- Newtonian versus Non-Newtonian Fluids

2.4.4.5- Units of Fluid Viscosity

2.4.4.6- Fluid Viscosity Standard Test Methods

2.4.4.7- Viscosity Standard Grades

2.4.5- Viscosity Index

2.4.5.1- Definition of Viscosity Index

2.4.5.2- Viscosity Index Standard Test Method (ISO 2909 - ASTM D2270-226)

2.4.6- Wear Protection

2.4.6.1- Definition and Importance of Wear Protection

2.4.6.2- Factors Affecting Fluid Wear Protection

2.4.6.3- Anti-Wear Performance Test

2.4.7- Fluid Bulk Modulus

2.4.7.1-	Definition of Fluid Bulk Modulus
2.4.7.2-	Bulk Modulus Standard Test Method (ASTM D6793 – 02(2012))
2.4.7.3-	Mathematical Expression for Fluid Bulk Modulus
2.4.7.4-	Effect of Fluid Bulk Modulus on System Performance
2.4.8-	Pour Point
2.4.8.1-	Pour Point Definition and Standard Test Method (ASTM D-97)
2.4.8.2-	Pour Point Ratings
2.4.9-	Flash Point
2.4.9.1-	Flash Point Definition and Standard Test Method (ASTM D-92)
2.4.9.2-	Flash Point Values
2.4.10-	Fire Point
2.4.11-	Ignition Point
2.4.12-	Specific Heat
2.4.13-	Thermal Conductivity
2.4.14-	Thermal Expansion
2.4.15-	Oxidation Stability
2.4.15.1-	Definition and Factors Affecting Oxidation Stability
2.4.15.2-	Importance of Oxidation Stability
2.4.15.3-	Oxidation Stability Standard Test Method (ASTM D-4636)
2.4.15.4-	Corrosion Standard Test Method (ASTM D-130)
2.4.16-	Anti-Rust Property
2.4.16.1-	Definition and Importance of Anti-Rust Property
2.4.16.2-	Anti-Rust Standard Test Method (ASTM D-665)
2.4.17-	Hydrolytic Stability
2.4.17.1-	Definition and Importance of Hydrolytic Stability
2.4.17.2-	Hydrolytic Stability Standard Test Method (ASTM D2619-09)
2.4.18-	Total Acid Number (TAN)
2.4.18.1-	Definition and Importance of Total Acid Number
2.4.18.2-	Total Acid Number Standard Test Method (ASTM D-664 and D2986)
2.4.19-	Demulsibility (Water Separation)
2.4.19.1-	Definition and Importance of Demulsibility
2.4.19.2-	Demulsibility Standard Tests Method (ASTM D-1401)
2.4.20-	Fluid Compatibility with Seals
2.4.20.1-	Definition and Importance of Fluid Compatibility with Seals
2.4.20.2-	Fluid Compatibility Standard Test Methods (ASTM D6546-15 OR ISO 6072)
2.4.21-	Foam Suppression
2.4.21.1-	Definition and Importance of Foam Suppression
2.4.21.2-	Foam Suppression Standard Test Methods
2.5-	Hydraulic Fluid Additives
2.5.1-	Viscosity Index Improvers (VII)
2.5.2-	Rust and Oxidation (R & O) Inhibitors
2.5.3-	Anti-Wear (AW) Additives
2.5.4-	Pour Point Depressant

2.5.5- Demulsifiers

2.5.6- Foam Suppressors

2.6- Classification of Hydraulic Fluids

2.7-Petroleum-Based Hydraulic Fluids (Mineral Oils)

2.7.1- Main Features of Mineral Oils

2.7.2- Composition of Mineral Oils

2.7.3- Standard Designations of Mineral Oils

2.7.3.1- HH Mineral Oil

2.7.3.2- HL Mineral Oil

2.7.3.3- HM Mineral Oil

2.7.3.4- HV Mineral Oil

2.7.3.5- HR Mineral Oil

2.6.3.6- Special Mineral Oil

2.7.3.7- Military-Grade Mineral Oil (MIL-H-5606 and MIL-H-83282)

2.8-Fire-Resistant Hydraulic Fluids

2.8.1- Definition of Fire-Resistant Hydraulic Fluids

2.8.2- Composition and Standard Designations of Fire-Resistant Hydraulic Fluids

2.8.3- General Properties of Fire-Resistant Hydraulic Fluids

2.8.4- HFA (Water-Based) Fire-Resistant Hydraulic Fluids

2.8.4.1- Composition and Standard Designations for HFA Fluids

2.8.4.2- Main Features of HFA Fire-Resistant Hydraulic Fluids

2.8.5- HFB (Oil-Based) Fire-Resistant Hydraulic Fluids

2.8.5.1- Composition and Standard Designations for HFB Fluids

2.8.5.2- Main Features of HFB Fire-Resistant Hydraulic Fluids

2.8.6- HFC (Polymer-Based) Fire-Resistant Hydraulic Fluids

2.8.7- Application Examples for HFB and HFC Fire-Resistant Fluids

2.8.8- HFD (Chemical-Based) Fire-Resistant Hydraulic Fluids

2.8.8.1- Composition and Standard Designations for HFD Fire-Resistant Hydraulic Fluids

2.8.8.2- Main Features of HFD Fire-Resistant Hydraulic Fluids

2.8.9- Testing of Fire-Resistant Hydraulic Fluids

2.9- Environmental-Friendly Hydraulic Fluids

2.9.1- Definition of Environmental-Friendly Hydraulic Fluids

2.9.2- Composition and Standard Designations for Environmental-Friendly Hydraulic Fluids

2.9.3- Main Features of Environmental-Friendly Hydraulic Fluids

2.10- Best Practices for Hydraulic Fluid Selection

2.10.1- Manufacturer-Based Fluid Selection

2.10.2- Application-Based Fluid Selection

2.10.3- Properties-Based Fluid Selection

2.10.4- Compatibility-Based Fluid Selection

2.10.5- Viscosity-Based Fluid Selection

2.10.6- Additives-Based Fluid Selection

2.10.7- Cost-Based Fluid Selection

2.11- Best Practices for Hydraulic Fluid Replacement

2.12- Best Practices for Hydraulic Fluid Storage

Chapter 3: Energetic Contamination, 108

3.1- Contamination by Heat

3.1.1- Sources of Contamination by Heat

3.1.1.1- Design-Related Heat Sources

3.1.1.2- Operation-Related Heat Sources

3.1.2- Effects of Contamination by Heat

3.1.3- Best Practices to Minimize Contamination by Heat

3.2- Contamination by Magnetic Fields

3.2.1- Sources of Contamination by Magnetic Fields

3.2.2- Effects of Contamination by Magnetic Fields

3.2.3- Best Practices to Minimize Contamination by Magnetic Fields

3.3- Contamination by Electrostatic Charges

3.3.1- Sources of Contamination by Electrostatic Charges

3.3.2- Effects of Contamination by Electrostatic Charges

3.3.3- Best Practices to Minimize Contamination by Electrostatic Charges

3.4- Contamination by Light

Chapter 4: Gaseous Contamination, 117

4.1- Sources of Gaseous Contamination

4.2- Forms of Air in Hydraulic Fluids

4.3- Standard Test Methods for Measuring Air Content in Hydraulic Fluids

4.4- Effects of Gaseous Contamination

4.5- Best Practices to Minimize Gaseous Contamination

4.5.1- Preventive Practices to Minimize Gaseous Contamination

4.5.2- Curative Practices to Remove Gaseous Contamination

Chapter 5: Fluidic Contamination, 125

5.1- Sources of Fluidic Contamination in Hydraulic Fluids

5.2- Forms of Water Contamination in Hydraulic Fluids

5.3- Standard Test Methods for Measuring Water Content in Hydraulic Fluids

5.3.1- Karl-Fischer Method (ISO760 - ASTM D6304 – DIN 51777)

5.3.2- Fourier Transform Infrared (FTIR) (ASTM E2412)

5.3.3- Centrifuge

5.3.4- Crackle Test

5.4- Effects of Fluidic Contaminants

5.5- Best Practices to Minimize Fluidic Contamination

5.5.1- Preventive Practices to Minimize Fluidic Contamination

5.5.2- Curative Practices to Remove Fluidic Contamination

5.5.2.1- Water Removal Techniques for Small Water Contents

5.5.2.2- Water Removal Techniques for Large Water Contents

Chapter 6: Chemical Contamination, 155

6.1- Sources of Chemical Contamination

6.2- Products of Hydraulic Fluid Degradation

6.2.1- Rust

6.2.2- Acids

6.2.3- Sludge

6.2.4- Varnish

6.3- Effects of Chemical Contamination

6.4- Standard Test Methods for Measuring Oil Degradation

6.5- Best Practices to Minimize Chemical Contamination

6.5.1- Preventive Practices to Minimize Chemical Contamination

6.5.2- Curative Practices to Remove Chemical Contamination

Chapter 7: Particulate Contamination, 173

7.1- Forms of Particulate Contamination

7.2- Sources of Particulate Contamination

7.2.1-Built-in Particulate Contamination

7.2.2-Ingested Particulate Contamination

7.2.3-Induced Particulate Contamination

7.2.4-Generated Particulate Contamination

7.2.5- Wear Mechanisms in Hydraulic Components

7.2.5.1- Abrasive Wear Mechanism

7.2.5.2- Adhesive Wear Mechanism

7.2.5.3- Corrosive Wear Mechanism

7.2.5.4- Erosive Wear Mechanism

7.2.5.5- Fatigue Wear Mechanism

7.2.5.6- Cavitation Wear Mechanism

7.3- Contamination Particle Sizes

7.4- Critical Clearances in Hydraulic Components

7.5- Effects of Particulate Contamination

7.5.1- Replication of Particulate Contamination

7.5.2- Factors Affecting Level of Damage due to Particulate Contamination

7.5.2.1- Effect of Particle Size

7.5.2.2- Effect of Particle Shape

7.5.2.3- Effect of Particle Material

7.5.3- Typical Failures due to Particulate Contamination

7.5.4- Examples of Failed Components due to Particulate Contamination

7.5.4.1- Pump Failure due to Particulate Contamination

7.5.4.2- Valve Failure due to Particulate Contamination

7.5.4.3- Cylinder Failure due to Particulate Contamination

7.5.4.4- Bearing Failure due to Particulate Contamination

7.5.4.5- Filter Clogging due to Particulate Contamination

7.6- Best Practices for Controlling Particulate Contamination

7.6.1- Preventive Practices to Control Particulate Contamination

7.6.2- Curative Practices to Remove Particulate Contamination

Chapter 8: Hydraulic Fluid Analysis, 214

8.1- Introduction to Hydraulic Fluid Analysis

8.2- Hydraulic Fluid Sampling

8.2.1- Hydraulic Fluid Sampling Intervals

8.2.2- Hydraulic Fluid Sampling Locations

8.2.2.1- Sampling from Low Pressure Return Line (ISO 4021)

8.2.2.2- Sampling from High Pressure Line

8.2.2.3- Sampling from Reservoir

8.2.3- Hydraulic Fluid Sampling Kit

8.2.4- Hydraulic Fluid Sampling Procedure

8.3- Hydraulic Fluid Material Analysis

8.3.1- Air Content

8.3.2- Water Content

8.3.3- Solids Content

8.4- Hydraulic Fluid Cleanliness Standards

8.4.1- Two-Code ISO Standard 4406-1987

8.4.2- Three-Code ISO Standard 4406-1999

8.4.3- NAS Standard 1638

8.4.4- SAE Standard AS 4059(E)

8.4.5- Contamination Standards Cross-Reference

8.5- Hydraulic Fluid Particle Analysis

8.5.1- Visual Inspection

8.5.2- Silt Index Test

8.5.3- Patch Test

8.5.4- Gravimetric Analysis (ISO 4405)

8.5.5- Microscopic Particle Counting (ISO 4407)

8.5.6- Automatic Particle Counting (ISO 11500:2008)

8.5.6.1- Automatic Particle Counters (APC)

8.5.6.2- Particle Monitors

8.5.6.3- Particle Classifiers

8.5.6.4- Calibration of Automatic Particle Counters

8.6- Interpretation of Fluid Analysis Report

Chapter 9: Hydraulic Filters Performance Ratings, 273

9.1- Porosity

9.1.1- Filter Porosity

9.1.2- Pore Size

9.1.2.1- Thin vs. Thick Fibers of a Filter Medium

9.1.2.2- Fixed vs. Non-Fixed Pore Size.

9.1.2.3- Uniform vs. Graded Pore Size.

9.2- Beta Rating

9.2.1- Multipass Test Performance Test (ISO 16889)

9.2.2- Beta Ratio Calculation

9.2.3- Beta Ratio Stability

9.3- Filter Efficiency

9.4- Nominal and Absolute Ratings

9.5- Filter Dirt Holding Capacity

9.6- Filter Size

9.7- Filter Capacity versus Efficiency

9.8- Filter Pressure

9.8.1- Rated Burst Pressure (RBP) of a Filter Housing

9.8.2- Rated Fatigue Pressure (RFP) of a Filter Housing.

9.8.3- Cyclic Test Pressure (CTP) of a Filter Housing.

9.8.4- Filter Differential Pressure (ISO 3968)

9.8.5- Filter Bypass Pressure

9.8.6- Collapse Pressure of a Filter Element

9.8.7- Fatigue Flow of a Filter Element

Chapter 10: Contamination Control in Hydraulic Transmission Lines, 298

10.1- Contamination in Hydraulic Transmission Lines

10.1.1- Sources of Contamination in Hydraulic Transmission Lines

10.1.2- Methods for Cleaning Hydraulic Transmission Lines

10.2- Projectile Cleaning

10.2.1- Projectile Cleaning Overview

10.2.2- Projectile Cleaning Equipment

10.2.3- Hydraulic Hose Projectile Cleaning

10.2.4- Hydraulic Tubes and Pipes Projectile Cleaning

10.2.5- Clean Seal Capsules

10.2.6- Clean Seal Flange

10.3- Pickling of Hydraulic Transmission Lines

10.3.1- What is Pickling?

10.3.2- Pickling Process

10.4- Flushing of Hydraulic Transmission Lines

10.4.1- What is Flushing?

10.4.2- Reasons to Flush a Hydraulic System

10.4.3- Flushing System Requirements (ISO 23309)

10.4.4- Flushing Process

APPENDIXES, 317

APPENDIX A: LIST OF FIGURES

APPENDIX B: LIST OF TABLES

APPENDIX E: Lists OF STANDARD TEST METHODS

APPENDIX D: LIST OF REFERENCES

INDEX, 337

PREFACE

Contamination control is a crucial for hydraulic systems to survive and to sustain their reliability and performance. Hydraulic fluids are inevitably contaminated by various sources. Hydraulic fluid contamination is not limited to just the particulate contaminants as many people may think. Hydraulic fluid contamination can be broadly defined as any internal or external reason that can change the properties or performance.

Therefore, this textbook focuses on hydraulic fluids and contamination control. The text book discusses thoroughly the different types of hydraulic fluids, their properties and standard methods of testing. The textbook also covers all types of contamination, their sources, effects, and best practices to avoid and control them.

With 30+ years of experience in teaching fluid power for industry professionals, the author had effectively applied his solid understanding to the subject and his post-doctoral level of academic education in developing this book.

The author wants to continue his goal of supporting fluid power and motion control professional education by developing the following series of volumes:

- Hydraulic Systems Volume 1: Introduction to Hydraulics for Industry Professionals.
- Hydraulic Systems Volume 2: Electro-Hydraulic Components and Systems.
- Hydraulic Systems Volume 3: Hydraulic Fluids and Contamination Control.
- Hydraulic Systems Volume 4: Hydraulic Fluids Conditioning.
- Hydraulic Systems Volume 5: Best Practices for Safety and Maintenance.
- Hydraulic Systems Volume 6: Troubleshooting and Failure Analysis.
- Hydraulic Systems Volume 7: Hydraulic Systems Modeling and Simulation for Application Engineers.
- Hydraulic Systems Volume 8: Design Strategies of Hydraulic Systems.
- Hydraulic Systems Volume 9: Design Strategies of Electro-Hydraulic Systems.
- Hydraulic Systems Volume 10: Hydraulic Components Modeling and Simulation.

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All praise is to Allah who granted me the knowledge, resources and health to finish this work.

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- www.aa1car.com

ABOUT THE BOOK

Book Description:

The book is targeting students and professionals who are looking to advance their fluid power careers. The book is colored and has the size of standard A4. The book is associated with a separate colored workbook. The workbook contains printed power point slides, chapter reviews and assignments. This book is the third in a series that the author plans to publish to offer complete and comprehensive teaching references for the fluid power industry. This book is an attempt to fill the gap between the very academic style of fluid power books and the very commercial style of books that are produced by fluid power manufacturers basically to promote their products.

The book presents the different types of hydraulic fluids, their physical properties, and their standard test methods. The book also overviews the various types of contamination including, energetic, gaseous, fluidic, and particulate contamination. This book introduces, comprehensively, methods for hydraulic fluid analysis including the various types of standards for evaluating cleanliness level of hydraulic fluids. This book discusses methods for controlling contamination in hydraulic transmission lines including projectile cleaning and flushing.

The book contains a total of ten chapters distributed over 300 pages with very demonstrative figure and tables. The contents of the book are brand non-biased and intends to introduce the latest technologies related to the subject of the book.

Book Objectives:

Chapter 1: Introduction

This chapter introduces the scope of hydraulic fluids conditioning and contamination control. The chapter also overviews various organizations who are involved in developing standards and set standard test methods for fluid power components and systems.

Chapter 2: Hydraulic Fluids

This chapter provides an overview of the commonly used hydraulic fluids including petroleum-based, water-based, chemical-based, fire-resistant, and environmental-friendly types of hydraulic fluids. The chapter discusses thoroughly 21 various properties and the relevant standard test methods of hydraulic fluids. Fluid properties are categorized as physical, thermal, and chemical properties. The chapter introduces the best practices for hydraulic fluid selection, replacement, and storage.

Chapter 3: Energetic Contamination

This chapter presents the sources hydraulic fluids energetic contamination. For each source, the chapter explains how the system performance will be affected and possible recommendations to minimize such consequences.

Chapter 4: Gaseous Contamination

This chapter presents the sources of hydraulic fluids gaseous contamination. For each source, the chapter explains how the system performance will be affected and recommendations to minimize such consequences.

Chapter 5: Fluidic Contamination

This chapters covers the sources of hydraulic fluids fluidic contamination. For each source, the chapter explains how the system performance will be affected and possible recommendations to minimize such consequences.

Chapter 6: Chemical Contamination

This chapter presents the sources of hydraulic fluids chemical contamination. For each source, the chapter explains how the system performance will be affected and possible recommendations to minimize such consequences.

Chapter 7: Particulate Contamination

This chapters presents the sources of hydraulic fluids particulate contamination. For each source, the chapter explains how the system performance will be affected and possible recommendations to minimize such consequences.

Chapter 8: Hydraulic Fluids Analysis

This chapter discusses standard methods for hydraulic fluid analysis including methods for particle and material analysis. The chapter covers the various standard cleanliness classes used to evaluate the contamination level in hydraulic fluids. The chapter also provides examples for interpretation of hydraulic fluid analysis reports.

Chapter 9: Hydraulic Filters Performance Ratings

This chapters discusses the standard methods for evaluating the performance of a hydraulic filter. The purpose is to make the reader aware of the factors based on which type of filter may be more suitable for a specific application.

Chapter 10-Contamination Control in Hydraulic Transmission Lines

This chapter discusses best practices for controlling contamination in hydraulic transmission lines including projectile cleaning and hydraulic system flushing.

Book Statistics:

The table shown below contains interesting statistical data about the textbook:

Chapter #	Pages	Figures	Animated Circuits	Equations	Tables	Lines	Words	Characters
First Part	14	0		0	0	0	0	0
Chapter 1	8	3	-	0	0	65	1383	7884
Chapter 2	85	65	-	13	26	652	13736	78298
Chapter 3	9	8	-	0	0	59	1250	7126
Chapter 4	8	5	-	0	3	58	1237	7055
Chapter 5	30	22	-	0	3	170	3579	20402
Chapter 6	18	22	-	0	1	97	2050	11691
Chapter 7	41	43	-	0	5	269	5667	32303
Chapter 8	59	57	-	0	18	320	6737	38404
Chapter 9	25	25	-	6	4	152	3210	18303
Chapter 10	19	20	-	1	0	182	3836	21866
Appendices	20	0	-	0	0	0	0	0
Index	6	0	-	0	0	0	0	0
Total	342	270	-	20	60	2,024	42,685	243,332

ABOUT THE AUTHOR



Medhat Khalil, Ph.D., Director of Professional Education & Research Development at the Applied Technology Center, Milwaukee School of Engineering, Milwaukee, WI, USA. Medhat got his bachelor's degree in mechanical engineering from Military Technical College (MTC), Cairo, Egypt. He got his master's degree in Mechanical Engineering from Cairo University, Cairo, Egypt. Medhat has been granted his Ph.D. in Mechanical Engineering and Post-Doctoral Industrial Research Fellowship from Concordia University in Montreal, Quebec, Canada. Medhat, published several fluid power textbooks. He participated in many technical conferences, published several reviewed technical papers, and is in the process of registering a number of patents. Medhat has been certified by the International Fluid Power Society (IFPS) as:

Certified Fluid Power Hydraulic Specialist (CFPHS) and Certified Fluid Power Accredited Instructor (CFPAI). Medhat is a member of many grand institutions such as Center for Compact and Efficient Fluid Power Engineering Research Center (CCEFP), listed Fluid Power Consultant by the National Fluid Power Association (NFPA) and listed professional instructor by the American Society of Mechanical Engineers (ASME) and National American Die Casting Association (NADCA). Medhat has been assigned as the chair of the education committee for the International Fluid Power Exposition (IFPE 2017 and 2020). Medhat developed and taught various courses for industry professionals. He has a balanced academic and industrial experience. Medhat has a deep working experience in the field of Mechanical Engineering; more specifically in fluid power and motion control. Medhat had worked for several world-

wide recognized industrial organizations such as Rexroth in Germany and CAE in Canada. Medhat has designed several hydraulic systems and developed analytical and educational software. Medhat also has vast experience in modeling and simulation of dynamic systems using Matlab-Simulink. Medhat was the designer and founder of the Universal Fluid Power Trainers. Medhat was the recipient of the "Otto Maha Pioneers in Fluid Power" award in 2012.

