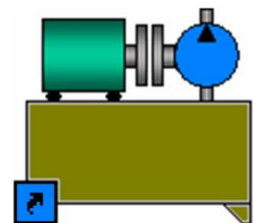


Hydraulic Systems Volume 4

Hydraulic Fluids Conditioning

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Hydraulic Fluids Conditioning

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PREFACE

In addition to hydraulic fluids contamination control, topics for hydraulic fluids conditioning are essential for hydraulic fluids to perform effectively within hydraulic systems. Hydraulic fluids and contamination control are discussed in Volume 3 of this series of textbooks. This textbook focuses only on the topics of hydraulic fluids hosting, transmission, sealing, temperature control, and filtration.

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 has a goal of supporting fluid power 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: 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.

To the soul of my parents who taught me the values of ISLAM

To my family: wife, sons, daughters in law, and grandchildren

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- www.efficientplantmag.com
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- www.compudraulic.com
- www.stauffusa.com
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- www.marinedieselbasics.com
- www.universalhydraulik.com
- www.savree.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 fourth in a series that the author plans to publish to offer a complete and comprehensive educational curriculum for fluid power industry. This book is an attempt to fill the gap between the very academic style and the very commercial style of fluids power textbooks that are produced by fluid power manufacturers basically to promote their products.

The book presents different types of hydraulic reservoirs, transmission lines, sealing elements, and heat exchangers. For each of these elements, the book introduces the methods of operations, construction, sizing, and selection.

The book contains a total of eight chapters distributed over approximately 400 pages with very demonstrative figures 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

In addition to hydraulic fluids contamination control, conditioning of hydraulic fluids is an essential process for a hydraulic system to perform properly and reliably. This chapter introduces the scope of hydraulic fluids conditioning.

Chapter 2: Hydraulic Reservoirs

Unless a hydraulic reservoir is designed, constructed, installed and maintained properly, the reliability of the entire system will be adversely affected. This chapter presents an overview of the different types of hydraulic reservoirs for industrial and mobile machines. This chapter also provides guidelines for design and sizing of hydraulic reservoirs.

Chapter 3: Hydraulic Transmission Lines

This chapter focuses on browsing the construction and the features of the three main hydraulic transmission lines, Pipes, Tubes, and Hoses. For each transmission line, the following topics are presented: sizing, material, construction and pressure rating. This chapter also presents information about fittings and manifolds.

Chapter 4: Hydraulic Sealing Elements

This chapter provides a knowledge base for fluid power users to become familiar with the commonly used seals in hydraulic components. This chapter presents an overview of hydraulic sealing elements including seal functions, classifications, and materials. This chapter also presents 15 various properties of hydraulic seals and the relevant standard test methods. This chapter also presents sealing solutions for cylinders and rotational shafts.

Chapter 5: Hydraulic Heat Exchangers

This chapter overviews various types of heat exchangers including air-type, water-type, and plate-type. Construction, operation, features, applications, and sizing calculations are discussed.

Chapter 6-Introduction to Hydraulic Filters

This chapter presents an overview of hydraulic filters including the contribution of filters in hydraulic systems, ISO1219 symbols, construction and operating principles. The chapter also presents various types of filters based on application in which the filter is used, type of connection to the circuit, body style of the filter, placement in the hydraulic circuit. The chapter also discusses the added accessories to the filter such as bypass valve and clogging indicators. Examples from industry are presented.

Chapter 7-Filter Media and Filtration Mechanisms

This chapter presents an overview of filter elements including the construction and material of the filter media. This chapter discusses surface filters versus depth filters. The chapter discusses also the principles of various filtration mechanisms that are applicable in hydraulic filters such as direct interception, absorption, adsorption, and magnetic separation.

Chapter 8-Filter Selection Criteria

This chapter presents a selection checklist as a guide for selecting proper filters. The chapter also discusses briefly the concepts for cost-effective filtration and selecting a filter cleanliness level based on system requirements. This chapter presents several examples of filtration solution for hydraulic systems.

Note: you may notice that there are some duplications in the figures and body text between chapter 2 and chapter 6. The reason is that the author wants to make each subject is a standalone chapter that can be taught independent from the other chapters.

Book Statistics:

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

Chapter #	Pages	Figures	Tables	Words	Editing Time (Hours)
Chapter 1	4	1	0	626	100
Chapter 2	63	63	2	11450	205
Chapter 3	104	122	15	13159	224
Chapter 4	105	120	11	14279	374
Chapter 5	42	44	2	6764	147
Chapter 6	56	69	0	6897	189
Chapter 7	20	26	0	3160	181
Chapter 8	12	8	2	1247	165
406	406	453	32	57582	1,585 Hour = 66 Days

ABOUT THE AUTHOR



Medhat Khalil, Ph.D. is Director of Professional Education & Research Development at the Applied Technology Center, Milwaukee School of Engineering, Milwaukee, WI, USA. Medhat has consistently been working on his academic development through the years, starting from bachelor's and master's Degrees in Mechanical Engineering in Cairo Egypt and proceeding with his Ph.D. in Mechanical Engineering and Post-Doctoral Industrial Research Fellowship at Concordia University in Montreal, Quebec, Canada. He has been certified and is a member of many institutions such as: Certified

Fluid Power Hydraulic Specialist (CFPHS) by the International Fluid Power Society (IFPS); Certified Fluid Power Accredited Instructor (CFPAI) by the International Fluid Power Society (IFPS); Member of 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). Medhat has balanced academic and industrial experience. Medhat has vast working experience in Fluid Power teaching courses for industry professionals. Being quite aware of the technological developments in the field of fluid power,

Medhat had worked for several world-wide recognized industrial organizations such as Rexroth in Egypt and CAE in Canada. Medhat had designed several hydraulic systems and developed several analytical and educational software. Medhat also has considerable experience in modeling and simulation of dynamic systems using Matlab-Simulink. Medhat has been selected among the inductees for



Pioneers in fluid Power by NFPA (2012) and **Hall of Fame** in fluid Power by IFPS (2021).

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APPENDIX C: LIST OF REFERENCES

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