



# Hydraulic Component Design and Selection

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This book is the first of eight books comprising the Computerized Fluid Power Series. The book is a heavyweight edition containing 650 pages and is the foundation document for the entire series. Basically all the mathematical models of hydraulic components that are needed in the design and simulation of hydraulic systems are presented. The book is particularly unique in that it is packed full of examples with solutions for nearly every type component known in the industry. Specifically, the book contains nearly 400 figures including 10 nomographs, over 380 equations, 21 tables, and 48 practical examples. For the first time, the book presents the 24 prime laws, theorems, and equations of fluid power. To set the stage for the modeling of hydraulic components, the book devotes an entire chapter to the fundamentals of fluid power engineering. Finally, the book contains a comprehensive glossary of hydraulic terms.

## **1 Introduction**

Component Design Perspective · Hydraulic Power Evolution  
Hydraulic Applications · Component Design Rationale  
Why Computerized Component Design?

## **2 Fundamental Fluid Power Engineering**

Introduction · Engineering System of Units · Behavior of Fluid in a System · Viscosity of Fluids · Pressure · Flow · Conduit Flow Models · Orifice Flow Models · Energy and Power · Design Safety Factors · Hydraulic Laws, Theorems, and Equations

## **3 Linear Actuators**

Function and Configuration · Cylinder Nomographs · Hydraulic Cylinders · Hydraulic Cylinder Cushioning · Hydraulic Cylinder Design Considerations · Hydraulic Cylinder Structural Integrity · Hydraulic Cylinder Dynamics · Hydraulic Cylinder Selection · General Selection Considerations

## **4 Rotary Actuators**

Introduction · Hydraulic Rotary Motors · Hydraulic Motor Selection · Limited Rotation Actuators · Oscillating Motor Applications

## **5 Fluid Distribution**

Fluid Distribution Function · Directional Control Valves · Check Valves · Shuttle Valves · Spool Valve Characteristics · Spool Valve Selection · Valve Design Considerations · Solenoid Valves · Hydraulic Fuses and Circuit Protectors

## **6 Pressure Regulation**

Pressure Regulation Function · Pressure Control Selection Factors · Relief and Safety Valves · Sequence Valves · Counterbalance Valves · Unloading Valves · Reducing Valves · Valve Noise and Cavitation

## **7 Flow Regulation**

Flow Regulation Function · Uncompensated Flow Controls · Deceleration Valve · Compensated Flow Control · Bypass Flow Regulator · Priority Valve · Flow Divider and Combiner Valves · Positive-Displacement-Metering Valve · Flow Control Circuits · Valve Selection and Specification

## **8 Cartridge Valve Technology**

Cartridge Valve Perspective · Poppet-Type Cartridges · Spool-Type Cartridge Valves · Cartridge Valve Models · Sizing of Cartridge Valves · Cartridge Manifold Design · Applications

## **9 Hydraulic Power Sources**

The Energy Question · Prime Mover Considerations · Hydrostatic Power Generation · Pumping Models · Pump Characteristics · Pump Application Factors · Functional Aspects of Pumps · Fixed Displacement Pump Models · Noise in Pump Systems · Environmental Aspects of Pumps · Booster Pumps

## **10 Energy Storage and Transformation**

Introduction · Energy Storage—Accumulators · Gas-loaded Accumulator Sizing Criteria · Accumulator Selection and Application · Accumulator Assessment · Energy Transformation Devices · Intensifier Application Factors · Intensifier Assessment and Selection

## **11 The Conduit System**

The Role and Types of Conduits · Connector Seals · Conduit Connectors · An Overtorqued Connector Case · Rigid Conduit—Piping · Rigid Conduit—Tubing · Flexible Conduit—Hose · Manifolding and Modularizing · Energy Losses in Conduit Systems

## **12 Seals for Hydraulics**

Introduction · Types of Seals · Mechanics of Sealing · Elastomer Technology · Seal Design and Selection Notes · Linear Seal Considerations · Cylinder and Piston O-ring Seal Force Model · Hydraulic Seal Models

## **Appendices**

- Glossary of Hydraulic Terms
- Fluid Power Symbols
- Hydraulic Test Standards
- FPRC/OSU Orifice Flow Nomograph
- Tables of Conversion Factors

The Appendices are very Practical and Useful.