



Power Transmission Handbook[®]

*The Definitive Hands-on Resource and Textbook for
the Power Transmission/Motion Control Industry*

Chapter 00 “Table of Contents / Preface”

6th Edition

Power Transmission Handbook[®]

Content compiled by the
Power Transmission Distributors Association

CORE PURPOSE

"The Power Transmission Distributors Association, consisting of distributors and manufacturers who serve customers through distribution and encompassing the mechanical, electrical/electronic, fluid power and related technologies, is committed to advancing distribution and strengthening members to be successful, profitable and competitive in a changing market environment."



POWER TRANSMISSION DISTRIBUTORS ASSOCIATION

230 W. MONROE ST., STE. 1410
CHICAGO, ILLINOIS 60606-4703
(312) 516-2100 FAX (312) 516-2101
E-Mail: ptda@ptda.org
www.ptda.org

All rights reserved.

No part of this book may be reproduced or utilized in any form, or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without permission in writing from the Power Transmission Distributors Association.

This Handbook is intended to provide substantially accurate information regarding the subjects contained herein. Although every effort has been made to ensure its accuracy, PTDA and all other third party providers make no representations or warranties, express or implied, to any user or entity as to the accuracy, timeliness or completeness of the information contained herein. Users are cautioned that the information provided is current, but subject to change based on unforeseen and unforeseeable changes in technology beyond PTDA's control.

Printed in U.S.A.

SIXTH EDITION
Copyright © 2020

ISBN 978-1-7344093-1-4 (Volume 1)
ISBN 978-1-7344093-4-5 (2 Volume Set)

Table of Contents

– Table of Contents

A Note on the Arrangement of Chapters

The Power Transmission Distributors Association has arranged most chapters of the *Power Transmission Handbook*® alphabetically.

These are the exceptions:

- **“Fundamentals,”** Chapter 1, Provides the reader with basic knowledge essential to understanding later chapters.

- **“Adjustable Speed Drives,”** Chapter 12, and **“Controls and Sensors,”** Chapter 13, follow **“Motors,”** Chapter 11, because these chapters are closely interrelated, and information contained in each chapter should be mastered before moving on to the next.
- **“Sealants & Adhesives,”** Chapter 14, **“Accessories,”** Chapter 15, **“Lubrication,”** Chapter 16, **“Vibration Analysis,”** Chapter 17, are positioned last.

FUNDAMENTALS CHAPTER 1

| | |
|------------------------|----|
| Introduction | 9 |
| Force & Friction | 9 |
| Torque | 9 |
| The Circle | 10 |
| Revolutions per Minute | 11 |
| Power | 12 |
| Efficiency | 15 |
| Summary | 15 |

BEARINGS CHAPTER 2

| | |
|---------------------------|----|
| Introduction to Bearings | 19 |
| Plain Bearings | 20 |
| Rolling Element Bearings | 24 |
| Linear Bearings | 34 |
| Mounted Bearings | 36 |
| Bearing Standards | 39 |
| Application and Selection | 40 |
| Additional Information | 42 |

BELT DRIVES CHAPTER 3

| | |
|---------------------------|----|
| Introduction | 45 |
| Concept | 45 |
| Belt Types | 45 |
| Belt Standards | 58 |
| Application and Selection | 59 |
| Key Terms | 59 |
| Summary | 59 |
| Additional Information | 59 |

CHAIN DRIVES CHAPTER 4

| | |
|-------------------------|----|
| Introduction | 63 |
| Characteristics | 63 |
| Types of Chain | 64 |
| Engineering Class Chain | 72 |
| Chain Rating | 77 |
| Load | 77 |
| Environment | 77 |
| Sprockets | 77 |
| FDA & USDA Acceptance | 82 |
| Lubrication | 82 |

| | |
|---------------------------|----|
| Caution | 83 |
| Chain Guards | 84 |
| Application and Selection | 84 |
| Additional Information | 84 |

CLUTCHES & BRAKES CHAPTER 5

| | |
|--|----|
| Introduction: Usage of Clutches and Brakes | 87 |
| Friction Types | 87 |
| Magnetic and Electromagnetic Designs | 90 |
| Mechanical Lock-up Interfaces | 91 |
| Actuation Methods | 94 |
| Common Application Notes | 96 |
| Selection Criteria | 96 |

CONVEYORS AND COMPONENTS CHAPTER 6

| | |
|---|-----|
| Introduction | 99 |
| Unit Handling Equipment | 99 |
| Special Unit Handling Applications | 104 |
| Overhead Conveying Equipment | 106 |
| Bulk Handling Equipment | 110 |
| Special Concentrations of PT Components | 117 |
| Special Considerations | 121 |
| Additional Information | 122 |

COUPLINGS AND U-JOINTS CHAPTER 7

| | |
|--------------------------------|-----|
| Introduction | 125 |
| Rigid Couplings | 125 |
| Flexible Couplings | 126 |
| Coupling and U-Joint Standards | 150 |
| Application and Selection | 150 |
| Additional Information | 154 |

GEARS CHAPTER 8

| | |
|---------------------------|-----|
| Introduction | 157 |
| Open Gears | 157 |
| Enclosed Gears | 167 |
| Lubrication | 171 |
| Gear Rating Standards | 171 |
| Application and Selection | 172 |
| Additional Information | 173 |

Table of Contents –

HYDRAULICS & PNEUMATICS CHAPTER 9

| | |
|------------------------------|-----|
| Introduction | 177 |
| Hydraulic Pumps | 177 |
| Pneumatic Compressors | 180 |
| Valves | 182 |
| Actuators and Motors | 185 |
| Hydrostatic Drives | 188 |
| Fluids and Conductors | 190 |
| Additional Information | 194 |

LINEAR MOTION CHAPTER 10

| | |
|---|-----|
| Introduction | 197 |
| General Selection Criteria | 197 |
| Linear Guidance | 200 |
| Linear Propulsion | 207 |
| Actuators (Electromechanical, Stage, Slide, Table) | 216 |
| Linear Motion Control Systems | 225 |
| Key Terms | 226 |
| Summary | 227 |

MOTORS CHAPTER 11

| | |
|------------------------------------|-----|
| Introduction | 231 |
| Common Factors | 231 |
| AC Motors | 236 |
| DC Motors | 240 |
| Servomotors | 242 |
| Step Motors | 243 |
| Application and Selection | 245 |
| International Standards | 246 |

ADJUSTABLE-SPEED DRIVES CHAPTER 12

| | |
|--|-----|
| Introduction | 249 |
| Why Use Adjustable-Speed Drives? | 249 |
| Mechanical Adjustable-Speed Drives | 250 |
| Eddy-Current Drives | 257 |
| Wound-Rotor Drives | 258 |
| DC Adjustable-Speed Drives | 259 |
| AC Adjustable-Speed Drives | 260 |
| Servo Drives | 268 |
| Key Terms | 268 |
| Drive Performance Summary | 269 |
| Engineered Drive Systems | 269 |

CONTROLS & SENSORS CHAPTER 13

| | |
|---|-----|
| Introduction | 273 |
| Motor Starters | 273 |
| Control Devices | 279 |
| Programmable Controllers and Computers | 280 |
| Operator Displays | 284 |

| | |
|---------------------------|-----|
| Sensors | 285 |
| Control Enclosures | 293 |
| Codes and Standards | 295 |

SEALANTS & ADHESIVES CHAPTER 14

| | |
|---------------------------------------|-----|
| Introduction | 301 |
| Types of Sealants and Adhesives | 301 |
| Key Terms | 304 |
| Additional Information | 304 |

PT ACCESSORIES CHAPTER 15

| | |
|--------------------------------|-----|
| Introduction | 307 |
| Shaft Seals | 307 |
| Drive Tensioners | 309 |
| Retaining Rings | 311 |
| Shaft-Locking Devices | 313 |
| Shaft Collars | 315 |
| Keystock | 316 |
| O-Rings | 317 |
| Locknuts | 317 |
| Single-Point Lubricators | 318 |
| Additional Information | 318 |

LUBRICATION CHAPTER 16

| | |
|------------------------------|-----|
| Introduction | 321 |
| Lubrication | 321 |
| Grease | 328 |
| Solid Lubricants | 329 |
| Selection Criteria | 333 |
| Key Terms | 333 |
| Additional Information | 333 |

VIBRATION ANALYSIS CHAPTER 17

| | |
|--|-----|
| Introduction | 337 |
| Theoretic Basis | 337 |
| Rotating Machine-Fault Diagnostics | 341 |
| Balancing | 346 |
| Vibration Analysis of Structures | 351 |
| Summary | 352 |
| Key Terms | 353 |

APPENDIX

| | |
|---|-----|
| Career Opportunities in the PT/MC Industry | 359 |
| Common Conversion Factors | 361 |
| Common Formulas | 365 |
| Associations that Interface with the PT Industry | 369 |
| Credits | 373 |
| Index | 375 |

Preface

The *Power Transmission Handbook*[®] material has four broad objectives: (1) motivate the learner who is being introduced to new products, technology, and concepts; (2) provide experience in solving problems (using SI and common units) and presenting solutions in a logical manner; (3) introduce the learner to subject areas that are common to most PT/Motion Control practitioners and that require the application of fundamental engineering concepts; and (4) develop a basic knowledge base necessary to effectively solve open-ended problems through an applications process.

The material in the *Power Transmission Handbook*[®] is written in a manner that allows for individual home study or for presentation in an organized classroom setting.

The *Power Transmission Workbook* offers a series of true-false, multiple-choice, and short answer questions for each of the 17 chapters. Requiring learners to complete the answers to these questions increases their potential to understand and retain the information by four times.

Preface –

