

# MECH 325 Reading Guide #5

## Fluid Power & Bearings

### 1 Overview

The readings outlined in this guide are intended to prepare a foundation of knowledge and skills that will be used in the MECH 325 classes and tutorials. You will have a short multiple choice Readiness Assurance Process (RAP) Quiz on this material. The quiz will primarily test your ability to recall this material; the emphasis is not to test your ability to apply or use the material (that will come later).

This first reading assignment focuses on gears, gear trains, and power screws. The readings are divided into two categories:

- **Required:** the primary source of material for the Readiness Assurance Process (RAP) Quiz. Each student is expected to complete the required readings.
- **Beneficial:** *additional analyses, derivations, explanations and examples to provide in-depth understanding of the course material. These readings help develop a more complete understanding of course concepts necessary for the tutorials, exercises, exams, and design projects. It up to you whether or not you do the beneficial readings.*

The fluid power readings are drawn from educational material provided by Parker Hannifin Corp. Parker is one of world's largest manufacturer of fluid power equipment. Parker donated a fluid power training module to the UBC several years ago that we are allowed to utilize including the printed training materials.

### 2 Readings

#### 2.1 General Information

The primary texts are Parker Training *Fluid Power Basics* and *Design Engineers Handbook*. The RAP Quiz will only cover material contained in *Fluid Power Basics*. Design lectures will focus on the material found in the *Design Engineers Handbook*. It must be noted that the *Fluid Power Basics* is developed for technologists. It is not an engineering text! It is written for someone with basic high school science. However, the focus for the RAP is the terminology, basic functions, and symbolic representation.

#### 2.2 Force Transmission through a Fluid (Lesson 2)

**Required:** All

Very basic.

#### 2.3 Hydraulic Energy (Lesson 3)

**Required:** All. Be sure to know the fundamentals of a displacement pump.

#### 2.4 Hydraulic Control (Lesson 4)

**Required:** All. Fundamentals of pressure valves, flow control valves, and directional (spool) valves

## 2.5 Pumps and Compressors (Lesson 7)

**Required:** Pages 7-1 to 7-5. Know the difference between vane, gear, and piston pumps.

## 2.6 Check Valves, Cylinders, and Motors (Lesson 8)

**Required:** Pages 8-1 to 8-6. Check valves and cylinders sections. The motor section is basically a repeat of Lesson 7 except that the pump now acts as a motor.

## 2.7 Flow Control (Lesson 9)

**Required:** Pages 9-1 to 9-4. The circuits (page 9-8) will be highlighted in the tutorial. It is not necessary to memorize them at this point.

## 2.8 Directional Control Valves (Lesson 10)

**Required:** Pages 10-1 to 10-3, and 10-5 (Center Conditions)

*Beneficial: The rest of the section*

## 2.9 Pressure Control (Lesson 11)

**Required:** Pages 11-1 to 11-5.

## 2.10 Pilot Control (Lesson 12)

**Required:** All (Concepts are similar to Lesson 11).

## 2.11 Fluid Conductors (Lesson 15)

*Beneficial: All*

## 2.12 Graphic Symbols (Various Lessons)

**Required:** Be sure to know the basic hydraulic symbols. Section 4 (Page 4-4), Section 7 (Pages 7-1 and 7-3), Section 8 (Pages 8-1, 2 and 6), Section 9 (Pages 9-1, 2, and 4), Section 10 (Pages 10-1, 2, 3 and 5), Section 11 (Pages 11-1, and 11-8).

*Beneficial: You can also refer to the ANSI Y32-10 Graphic Symbols Chart found on the website. It covers all the symbols.*

## 2.13 Introduction to Fluid Power (MECH 30X Lab)

*Beneficial: The material is a summary of all the previous material. Please review it prior to the tutorial demonstration.*

## 2.14 Additional Information on Bearings (now part of the final RAP quiz)

This portion of the readings was all beneficial for RAP quiz 4. For this next RAP quiz, some of the material is now required. For this section, review the *SKF Bearing and Installation Guide* found on the Canvas website (Papers Related to MECH 325 Folder). This manual has some good practical information related to roller bearings.

*Beneficial: First section highlighting the different bearings types (pp. 3-7). Illustrations showcase the variety of bearing types. Pay attention to the difference between the Self Aligning Ball Bearings (Fig. 7&8) and the Spherical Roller Bearings which also allow for self-alignment (Fig. 25&26).*

**Required:** Section on Shaft and Housing Fits (pp. 51-4). This section highlights the importance of the interference and clearance fits. The Tables following the discussion are the ones that you would follow when applying tolerances to your drawings. Review the first page of Table 8 in order to understand how the “Resultant Fit” values are calculated.

**Required:** Lubrication Section (pp. 87-8). This portion discusses several important considerations when it comes to lubrications.

*Beneficial:* Read the discussion on how Figures 1, 2 and 3 are used in the selection of a bearing lubricant (pp. 88-90). It is not required that you memorize the procedure but have a basic understanding of its use.

**Required:** Review the methods of oil lubrication (pp 91-2). Several of these methods also relate to chain drive lubrication (oil spray, etc.)

**Required:** The final section discusses lubrication using grease (pp. 93-4). Grease is a common bearing lubricant for slower speed and high load applications.

*Beneficial:* Read the discussion on Operational Damage Mode Analysis due to inadequate lubrication (pp. 128-132). This section reviews the consequences of improper lubrication.