

**Industrial Maintenance
Mechanical Training System**

Alignment and Couplings

Courseware Sample

52540-F0

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By the staff of Festo Didactic

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Safety and Common Symbols

The following safety and common symbols may be used in this manual and on the equipment:

Symbol	Description
	DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	CAUTION used without the <i>Caution, risk of danger</i> sign  , indicates a hazard with a potentially hazardous situation which, if not avoided, may result in property damage.
	Caution, risk of electric shock
	Caution, hot surface
	Caution, risk of danger
	Caution, lifting hazard
	Caution, hand entanglement hazard
	Notice, non-ionizing radiation
	Direct current
	Alternating current
	Both direct and alternating current
	Three-phase alternating current

Safety and Common Symbols










Symbol	Description
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
	On (supply)
	Off (supply)
	Equipment protected throughout by double insulation or reinforced insulation
	In position of a bi-stable push control
	Out position of a bi-stable push control

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Preface

The Mechanical Training System, Model 46101, is a modular program that covers the installation, use, maintenance, and troubleshooting of mechanical drive systems.

The curriculum is divided into five levels, and covers the following topics:

- Introduction to mechanical drive systems
- Belt drives 1 and 2
- Chain drives 1 and 2
- Gear drives 1 and 2
- Lubrication
- Couplings
- Shaft alignment
- Bearings
- Ball screws
- Linear bearings
- Gaskets and seals
- Clutches
- Brakes
- Laser alignment
- Vibration metering

This manual Alignment and Couplings, is one of the four manuals supplied with the Mechanical Training System, level 2. The objective of this manual is to introduce shaft alignment and coupling installation procedures.

We invite readers of this manual to send us their tips, feedback, and suggestions for improving the book.

Please send these to did@de.festo.com.

The authors and Festo Didactic look forward to your comments.

About This Manual

The topics covered in this manual are presented in the form of Work Orders. Each Work Order includes a brief description of the task, a drawing of the equipment setup if necessary, and the main steps of the work to be done.

To obtain a detailed step-by-step procedure of the work to be done, you should refer to the manual titled *Alignment and Couplings*, p/n 52540-20. To obtain further information about the covered topics, consult your textbook or ask your instructor.

Safety considerations

Safety symbols that may be used in this manual and on the equipment are listed in the Safety Symbols table at the beginning of the manual.

Safety procedures related to the tasks that you will be asked to perform are indicated in each exercise.

Make sure that you are wearing appropriate protective equipment when performing the tasks. You should never perform a task if you have any reason to think that a manipulation could be dangerous for you or your teammates.

Reference material

Refer to the manual titled *Industrial Maintenance* written by Michael E. Brumbach and Jeffrey A. Clade as reference textbook.

Prerequisite

As a prerequisite to this manual, you should have read the manual titled *Introduction to Mechanical Drive Systems*, p/n 36737-20.

System of units

Most of the components in the Mechanical Training System are machined using the U.S. customary system of units. For this reason the U.S. customary system of units was preferred in the manual.

In the figures, however, the distances are also indicated in the International System of Units (SI). These values are shown in parentheses.

The distances are estimates and may vary due to the play in the components.

Refer to the Conversion Table in Appendix D if necessary.

To the Instructor

You will find in this Instructor Guide all the elements included in the Student Manual together with the answers to all questions, results of measurements, graphs, explanations, suggestions, and, in some cases, instructions to help you guide the students through their learning process. All the information that applies to you is placed between markers and appears in red.

Accuracy of measurements

The numerical results of the hands-on exercises may differ from one student to another. For this reason, the results and answers given in this manual should be considered as a guide. Students who correctly performed the exercises should expect to demonstrate the principles involved and make observations and measurements similar to those given as answers.

Sample
Extracted from
Work Orders - Instructor

Flange Couplings

OBJECTIVE In this work order, you will align two shafts and install a flange coupling.

PROCEDURE

Equipment required

- Universal Base Assembly, Model 46603
- Motor Package, Model 46609
- Couplings – Shafts Panel, Model 46610
- Pillow Block Bearings Panel, Model 46611
- Alignment and Couplings Package, Model 46615
- Test/Measurement Package 1, Model 46630
- Test/Measurement Package 2, Model 46630-10
- Tool Box Component Package 1, Model 46631
- Tool Box Component Package 2, Model 46631-10

Safety procedure

1. Before proceeding with this work order, complete the following check list.
 - You are wearing safety glasses.
 - You are wearing safety shoes.
 - You are not wearing anything that might get caught such as a tie, jewelry, or loose clothes.
 - If your hair is long, tie it out of the way.
 - The working area is clean and free of oil.
 - The floor is not wet.
 - Your sleeves are rolled up.

Lockout/Tagout procedure

2. Perform the Lockout/Tagout procedure (see Appendix B).



The Universal Base should be already set up from the previous work order. Repeat the Universal base setup section in Work Order 1 if necessary.

Coupling installation

3. Determine whether flange couplings as the one shown in Figure 11 are flexible or rigid?

Type: _____

Type: rigid



Figure 11. Flange coupling.

4. Identify the bushings that are installed in the hubs of the flange coupling of your trainer.

Bushings: _____

Bushings: split taper bushings

5. Perform a rough alignment of the shafts.
6. Install the two hubs of the flange coupling on the shafts.
7. Complete the coupling assembly.
8. Align the shafts using the dial indicator method or the reverse indicator method. Record all measurements and calculations required for the chosen method.
9. Perform the following Start-up procedure.

Start-up procedure

- Connect the motor to an AC outlet.
- Ensure that all screws, setscrews and capscrews are tightened.
- Install the safety panels.
- Ask your instructor to inspect the setup.
- Ask each person to remove their padlock from the lockout device.
- Remove the lockout device.
- Ensure that the output voltage selector is set to FIXED.
- Set the disconnecting switch to ON.
- Start the motor by pressing the Start button on the Start/Stop push-button station.

System operation

- 10.** Check to see whether the drive produces unusual vibrations. If this is the case, perform the following steps:
 - Stop the motor by pressing the Stop button on the Start/Stop push-button station.
 - Set the disconnecting switch to OFF.
 - Perform the Lockout/Tagout procedure.
 - Remove the safety panels.
 - Make sure the alignment is adequate. If not, repeat the alignment procedure.
 - Perform the Start-up procedure.

- 11.** Ask the instructor to check your work.

- 12.** Stop the motor by pressing the Stop button on the Start/Stop push-button station.

- 13.** Set the disconnecting switch to OFF

- 14.** Perform the Lockout/Tagout procedure.

- 15.** Remove the safety panels.

16. Remove the coupling but leave the rest of the setup as shown in Figure 12.

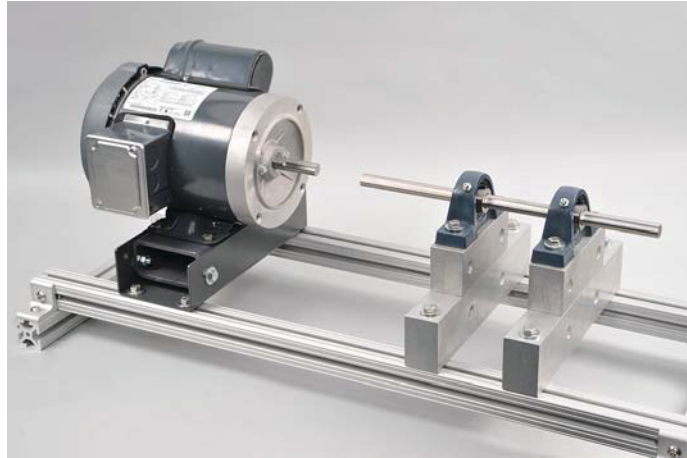


Figure 12. Current setup.

Name: _____ Date: _____

Instructor's approval: _____