Industrial Maintenance

Vibration Metering

Courseware Sample

39109-F0

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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	**DANGER** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
WARNING	**WARNING** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
CAUTION	**CAUTION** used without the *Caution, risk of danger* 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
3∿	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 Lab-Volt Basic Vibration Analysis for Pumps System, Model 46736, is an add-on to the Lab-Volt Pumps Training System, Model 46106, which faithfully reproduces an industrial environment where students can develop their skills in the installation and maintenance of industrial pumps.

Due to its modular design, the Pumps Training System can be configured to fit various training needs. The following equipment is available to adjust the curriculum to various training levels:

- Centrifugal Pump – Pedestal
- Centrifugal Pump – C-Face
- External Gear Pump
- Vane Pump
- Flexible Impeller Pump
- Progressive Cavity Pump
- Peristaltic Pump
- Pneumatic Diaphragm Pump
- Metering Pump
- Piston Pump
- Centrifugal Pump - Stuffing-Box
- Multi-Stage Centrifugal Pump
- Magnetic-Drive Centrifugal Pump
- Variable Speed Drive
- Upper Reservoir
- Lubrication Kit
- Alignment Kit
- Air Compressor
- Software and configuration software components
- Measuring instruments, including Paddle Wheel Flowmeters, Pressure Gauges, Current Clamp Meter, Pyrometer, Vibration Meter, Tachometer, Stroboscope, and more
- Tools and toolbox
- Hoses and accessories

All of the above components consist of industrial-type equipment and tools for realistic training.

We hope that your learning experience with the Pumps Training System will be the first step of a successful career.

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.

Introduction

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 when necessary, and the main steps of the work to be done.

To obtain further information about the covered topics, consult the reference material or ask your instructor.

Safety Considerations

Make sure that you are wearing appropriate protective equipment before performing any of the work orders in this manual. You should complete the basic safety procedures listed in Appendix B of this manual whenever you begin a work order. Remember that you should never perform a task if you have any reason to think that it could be dangerous to you or your teammates.

Reference Material

- Module 32414, Vibration Analysis – Trainee Guide from the National Center for Construction Education and Research (NCCER).
- User guide of the vibration meter supplied with your system.
- User guide of the data acquisition software supplied with your vibration meter.

Prerequisite

To perform the work orders of this manual, you should have completed the manual Single Pump Systems, Lab-Volt p/n 37894.

The answers to the questions of this manual can be found in the reference material.

System of Units

Both the imperial and SI systems of units are used in this manual. The values associated with the SI systems are shown between parentheses.

Appendices

The appendices included in this manual are:

Appendix A: *Equipment Utilization Chart*, shows in which work order(s) the equipment is used.

Appendix B: *Safety Procedures*, lists the basic safety procedures to perform before beginning any of the work orders.

Appendix C: *Unit Conversion Table*, lists the conversion factors to apply when converting imperial units to SI units and vice versa.

Sample

Extracted from

Work Orders - Student

Introduction to the Lab-Volt Basic Vibration Analysis for Pumps System

System overview

The components of the Lab-Volt Basic Vibration Analysis for Pumps System, Model 46736, are shown in Figure 1-1. The system consists of a vibration meter, and a balancing disk with cover and accessories.

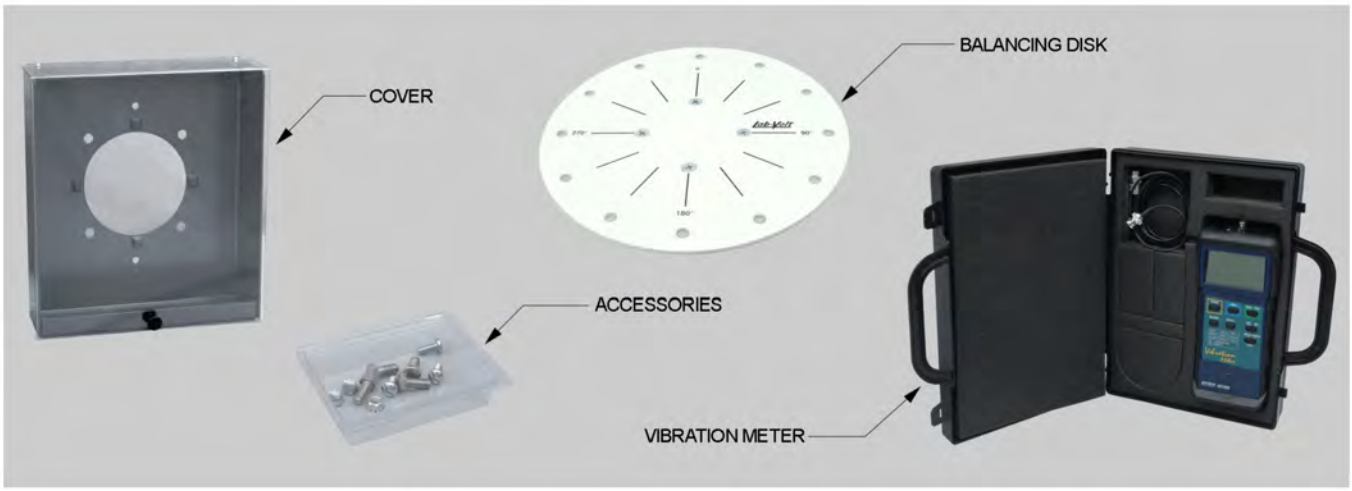

Figure 1-1. Components of the Lab-Volt Basic Vibration Analysis for Pumps System.

Task: To become familiar with vibration measurements.

PROCEDURE

CAUTION!

Before proceeding with this procedure, complete the safety checklist in Appendix B.

☐ 1. Name five causes of vibration in a rotating system.

_____

_____

_____

☐ 2. Name four measurable characteristics that make up the vibration signature.

_____

_____

_____

☐ 3. Which vibration characteristic is the most widely used for measurements in industrial applications?

_____

_____

_____

☐ 4. Which vibration characteristics can be measured with the vibration meter of your training system?

_____

_____

_____

☐ 5. Name the three axes of each point where the vibration should be measured.

_____

_____

_____

Setup

☐ 6. Install the Emergency Stop Station, Variable Speed Drive, Pump Universal Base and Motor on the Pump Bench as shown in Figure 1-2.

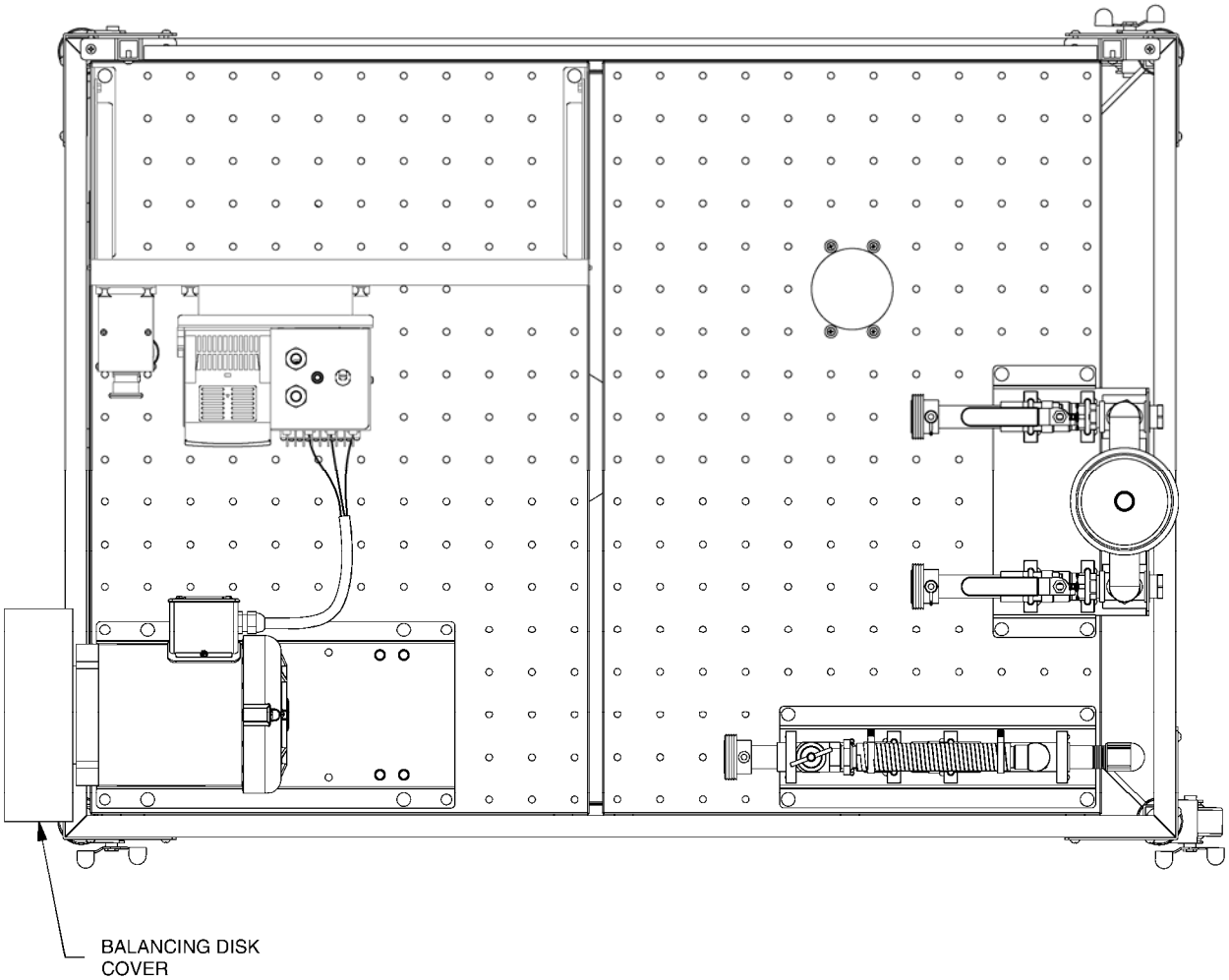

Figure 1-2. Circuit setup.

☐ 7. Complete the setup by performing the following steps:

- Separate the balancing disk from the cover by removing the screws.
- Attach the cover to the Motor by tightening the four screws as shown in Figure 1-3.
- Close the cover.

Note: *Never run the Motor when the cover of the balancing disk is open.*

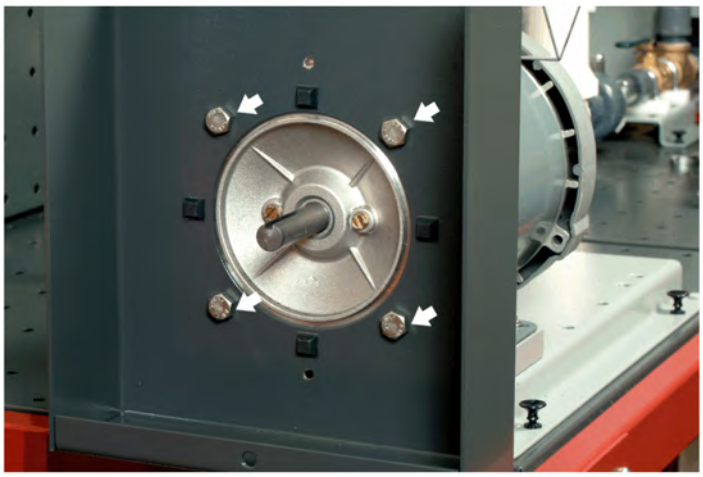

Figure 1-3. Tighten the four screws to attach the cover to the Motor.

☐ 8. Perform the following settings on the Variable Speed Drive:

- Set the maximum output frequency to 30 Hz.
- Display the output frequency.

Note: *Make sure there is no key in the Motor shaft keyseat.*

☐ 9. Start the Motor, and set the output frequency to 30 Hz.

☐ 10. Measure the velocity and acceleration levels at the positions shown in Figure 1-4. Enter your results in the *Without balancing disk* row in Table 1-1.

Note: *Do not forget to indicate the units in Table 1-1.*

Figure 1-4. Location of the measurement points.

VIBRATION MONITORING DATA SHEET					
Date: . . . . . Performed by: . . . . . Instrument: . . . . . System: . . . . . r/min:			system schematic		
OPERATING CONDITION	POINT	POSITION	VELOCITY		ACCELERATION RMS
			PEAK	RMS	
Without balancing disk	1	H			
		V			
		A			
With unbalanced disk	1	H			
		V			
		A			
With balanced disk	1	H			
		V			
		A			

Table 1-1. Vibration monitoring data sheet.

☐ 11. Stop the motor.

☐ 12. Compare the RMS velocity levels you measured to the suggested levels in the severity charts in the user guide of your vibration meter.

Do the measured levels exceed the acceptable levels?

☐ Yes ☐ No

☐ 13. Create an unbalanced condition by performing the following:

- Install the balancing disk on the motor shaft and tighten the setscrew.
- Install a screw and a Keps nut in one of the holes of the balancing disk.
- Close the cover.

Note: *Do not use more than one screw and one Keps nut to create an unbalanced condition.*

☐ 14. Start the Motor.

Note: *Do not let the motor run for long periods with a faulty operating condition that causes vibration.*

☐ 15. Repeat your velocity and acceleration measurements at the positions shown in Figure 1-4. Enter your results in the With unbalanced disk row in Table 1-1.

☐ 16. Stop the Motor.

☐ 17. Compare the RMS velocity levels you measured to the suggested levels in the severity charts in the user guide of your vibration meter.

Do the measured levels exceed the acceptable levels?

☐ Yes ☐ No

Note: *Vibration meters as the one with your training system are not designed to identify the causes of the vibration. They are designed to monitor the general mechanical status of a system in order to generate investigations when the vibration levels exceed those suggested by the manufacturer.*

☐ 18. Balance the disk by installing a screw and a Keps nut in the hole facing the one where a screw and Keps nut were previously installed. See Figure 1-5.

Figure 1-5. Balance the disk by installing a screw and a Keps nut.

☐ 19. Start the Motor.

☐ 20. Repeat your velocity and acceleration measurements at the positions shown in Figure 1-4. Enter your results in the *With balanced disk* row in Table 1-1.

☐ 21. Stop the Motor.

☐ 22. Compare the RMS velocity levels you measured to the suggested levels in the severity charts in the user guide of your vibration meter.

Do the measured levels exceed the acceptable levels? Explain.

_____

☐ 23. Ask the instructor to check your work.

☐ 24. Remove the balancing disk and cover from the Motor.

Fix the balancing disk to the cover as shown in Figure 1-6.

Figure 1-6. Storing the balancing disk in the cover.

☐ 25. Place the remaining screws in the plastic box, and return the equipment to the storage location.

Name: _____ Date: _____

Instructor's approval: _____