



LABORATORY PLANNING GUIDE

L25 Machine Diagnosis Laboratory

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Covered subjects according to the curriculum

Major topics of learning content:

- introduction to vibration measurement methods on rotating machinery systems
 - * fundamentals of measurement of shaft and bearing vibrations
 - * basic variables and parameters
 - * sensors and measuring devices
 - * influences of speed and shaft layout
 - * influence of transducer positioning
- field balancing of rigid shafts
- influence of alignment between motor and flexible coupling
- understanding and interpreting frequency spectra
- use of a computerised vibration analyser
- correct application of FFT analysis
- measurement of rotation speed, vibration displacement, vibration velocity and acceleration
- assessment of the vibration state of a machine
- damage analysis of roller bearings and gears by means of envelope spectra
- detection of cracks in shafts by means of run-up curves and order analysis
- measurement of imbalance vibrations and field balancing of rigid rotors in 1 and 2 planes
- estimating service lives of roller bearings
- influence of the lubricant on the vibration spectrum
- identification of coupling faults from the vibration signal
- load dependency of running behaviour
- influence of gear rim hardness on claw couplings
- comparison of curved teeth, pin, flange and claw couplings
- influence of belt tension and speed on vibration behaviour
- influence of pulleys running untrue, and off-track running
- power split across multiple belt drive
- influence of slip on vibration running spectrum
- comparison between fault-free and damaged belts
- identification of gear damage from vibration behaviour
- influence of gearing type: spur toothed or helical
- experimental modal analysis of mechanical systems
- influence of bearing clearance and shock impact
- inconsistent torque characteristic
- wear measurement on piston rods
- observing and understanding cavitation in a centrifugal pump
 - * visually
 - * stroboscopically (stroboscope available as accessory)
 - * by vibration analysis
- investigation of the operating vibrations of a centrifugal pump
- vibration measurement on fans
- measurement of blade pass frequency
- identification of the vibration induced by the blades from the vibration spectrum
- effect of dynamic imbalance on the fan
- influence of electromagnetic asymmetry on vibration behaviour
- influence of the gap on electromagnetic losses, efficiency and vibration

Main concept

The laboratory is designed for accommodation of 24 students + 2 laboratory staff:

- 2 - 4 students form a team and work together at a workstation / training system
- 6 different workstations
- All workstations are equipped with a PC
- Each workstation is equipped with a manual containing technical information, basic theory, experiment instructions, evaluation help and safety advice.
- Student teams are scheduled to change workstations from lab session to lab session in order to perform the entire range of experiments within the course duration.
- Average time per experiment: 90 to 120 minutes.

2 workstations for laboratory staff (with PC and internet access)

1 printer for common use

1 cupboard for small parts, consumables, tools, paper etc.

Initial training provided for laboratory personnel

Trainer: Specialized engineer of G.U.N.T. Gerätebau GmbH, Germany.

To be conducted immediately after installation and commissioning of the equipment.

General topics to be covered for any of the educational systems:

- Basic familiarization with the system.
- Functions and components.
- Overall system configuration aspects.
- Start-up and operational aspects.
- Conduction experiments, including evaluation and calculation.
- Using the system with and without the software (where applicable).
- Trouble shooting and maintenance aspects.
- Hands-on, practical familiarization aspects.
- Seminar participants with the delivered system.
- Details of the manuals.
- Safe operation and preventive maintenance.

Requirements / Utilities

Power supply:

- 230 V / 50 Hz / 1 phase – at least 24 power sockets distributed according to lab lay-out.

Laboratory computer network:

- 2 internet connections for staff
- 6 internet connections for students

Location:

- Laboratory space min 48 m²
- This laboratory could be installed on any floor (e.g. ground floor or 1st floor)

Schedule of Requirements

Item No.	Description	Quantity
Item 1	Machinery diagnostic system, base unit	6 pcs.
Item 1.1	Laboratory trolley	6 pcs.
Item 1.2	Computerised vibration analyser	6 pcs.
Item 1.3	Elastic shaft kit	2 pcs.
Item 1.4	Crack detection in rotating shaft kit	1 pcs.
Item 1.5	Roller bearing faults kit	1 pcs.
Item 1.6	Couplings kit	1 pcs.
Item 1.7	Belt drive kit	4 pcs.
Item 1.8	Damage to gears kit	2 pcs.
Item 1.9	Crank mechanism kit	1 pcs.
Item 1.20	Cavitation in pumps kit	1 pcs.
Item 1.21	Vibrations in fans kit	1 pcs.
Item 1.22	Electromechanical vibrations kit	1 pcs.
Item 1.23	Brake & load unit	4 pcs.
Item 1.24	Two displacement sensors	1 pcs.

Laboratory drawing

