



## LABORATORY PLANNING GUIDE

# L22 Assembling and Maintenance Laboratory

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Covered subjects according to the curriculum

Major topics of learning content:

- design and function of valves and fittings, piping elements and system components
- planning of piping and system installations according to specification
- selection of components and drafting of requirement lists
- technically correct preparation and execution of system assembly
- reading and understanding engineering drawings and technical documentation
- operational testing of a constructed systems
- connecting and aligning motor and pump
- alignment of drives, shafts and gears
- familiarisation with various alignment methods: straight edge, dial gauges
- electrical installation of motor and switching elements
- detail installation on a standard centrifugal pump
- familiarisation with maintenance procedures
- planning assembly and maintenance steps
- behaviour during operation and function of
  - \* ball valve
  - \* butterfly valve
  - \* gate valve
  - \* wedge gate valve
  - \* control valve
  - \* safety valve
  - \* dirt trap
- determining valve characteristic and the Kvs value of the control valve
- pressure losses at the dirt trap depending on the filter and its load
- determining the pump efficiency
- determining the system characteristics and the operating point of the pump
- checking the required NPSH value of the pump
- experiments with a
  - \* lobe pump
  - \* multistage centrifugal pump
  - \* standard centrifugal pump
- assembly exercises:
  - \* spur wheel / worm gear mechanism
  - \* piston compressor
  - \* spur gear
  - \* shut-off valve
  - \* wedge gate valve and angle seat valve
  - \* centrifugal pump
  - \* multi-stage centrifugal pump
  - \* screw pump
  - \* diaphragm pump
  - \* piston pump
  - \* in-line centrifugal pump
  - \* gear pump
- vibrational spectrum of the running noise of roller bearings
- influence of damage to outer race, inner race or roller body, on the spectrum
- estimating service lives of roller bearings

- influence of the lubricant on the vibration spectrum
- detection of faulty roller bearings
- understanding and interpreting frequency spectra
- use of a computerised vibration analyser

### 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
- 22 workstations with 19 different experiment units
- Large assembling stations on one side of the laboratory and laboratory tables with assembling exercises on the other side
- 5 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 exercise cases, 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 15 power sockets
- 400 V / 50 Hz / 3 phase – at least 2 power sockets

Distributed according to lab lay-out.

Water supply

- 5 x Cold water and drain

Compressed air:

- 1 connection required

Laboratory computer network:

- 2 internet connections for staff
- 3 internet connections for students

Location:

- Laboratory space min 120 m<sup>2</sup>
- This laboratory should be installed on the ground floor

## Schedule of requirements

Item No.	Description	Quantity
Item 1	Assembly station: pipes and valves and fittings	3 pcs.
Item 1.1	Assembly and alignment of pumps and drives	1 pcs.
Item 2	Pump and valves and fittings test stand	1 pcs.
Item 3	Universal drive and brake unit	1 pcs.
Item 4	Supply unit for water pumps	1 pcs.
Item 4.1	Lobe pump	1 pcs.
Item 4.2	Centrifugal pump, multistage	1 pcs.
Item 4.3	Centrifugal pump, standard design	1 pcs.
Item 5	Assembly spur wheel / worm gear mechanism	1 pcs.
Item 6	Cutaway model worm gear	1 pcs.
Item 7	Assembly exercise: piston compressor	1 pcs.
Item 7.1	Cutaway model piston compressor	1 pcs.
Item 7.2	Multimedia learning software: piston compressor	1 pcs.
Item 8	Assembly spur gear	1 pcs.
Item 9	Assembly exercise: shut-off valve	1 pcs.
Item 10	Assembly exercise: wedge gate valve and angle seat valve	1 pcs.
Item 11	Alignment of drives, shafts and gears	1 pcs.
Item 12	Assembly & maintenance exercise: centrifugal pump	1 pcs.
Item 13	Assembly & maintenance exercise: multi-stage centrifugal pump	1 pcs.
Item 14	Assembly & maintenance exercise: screw pump	1 pcs.
Item 15	Assembly & maintenance exercise: diaphragm pump	1 pcs.
Item 16	Assembly & maintenance exercise: piston pump	1 pcs.
Item 17	Assembly & maintenance exercise: in-line centrifugal pump	1 pcs.
Item 18	Assembly & maintenance exercise: gear pump	1 pcs.
Item 19	Roller bearing faults	2 pcs.